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A SECURE DIGITAL TRADING PLATFORM FOR ONLINE GAME ACCOUNTS USING DUAL AUTHENTICATION AND SMART PAYMENT INTEGRATION

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Abstract

The rapid growth of online gaming has increased the economic value of game accounts, leading to the emergence of online game account trading. However, most transactions are still conducted through informal channels, such as social media and online forums, which lack security, transparency, and reliable transaction records. This study aims to design and implement a web-based information system for online game account buying and selling by integrating OTP-based dual authentication and a payment gateway to improve security and transaction efficiency. The system was developed using the Waterfall method, consisting of requirement analysis, system design, implementation, testing, and maintenance stages. UML diagrams and an Entity Relationship Diagram were used to model system functionality and database structure. The system was implemented using PHP and MySQL and supports key features such as user management, game account management, secure login with OTP, transaction processing, payment gateway integration, reviews, and complaints. Black-box testing results indicate that all system functions operate according to the defined requirements. The implementation of OTP-based authentication improves access security by reducing the risk of unauthorized account use, while payment gateway integration ensures accurate and automated payment verification. The system also enhances transaction transparency through digital transaction records and purchase history. The results show that the proposed system provides a secure, efficient, and practical solution for online game account trading in a local business environment, supporting digital transformation and service professionalism for small-scale enterprises.

Keywords: dual authentication; OTP; payment gateway; web-based information system; online game accounts.

1. INTRODUCTION

The rapid advancement of digital technology has significantly transformed various aspects of daily life, including the entertainment sector and the online gaming industry. Online games have evolved beyond mere entertainment into a lifestyle and a source of economic opportunity, particularly for younger generations. This transformation has led to the emergence of online game account trading, involving accounts with high levels, rare virtual items, or specific in-game achievements that possess considerable economic value.

Despite its growing popularity, the buying and selling of online game accounts is still largely conducted through informal channels such as social media platforms and online forums. This practice often lacks an integrated information system, resulting in several critical issues, including weak security mechanisms, potential misuse of account credentials, lack of transaction transparency, and a high risk of fraud. Without proper system support, transaction recording errors and disputes between sellers and buyers are also more likely to occur [1], [2], [3].

Several previous studies have explored the development of web-based transaction systems to support digital business processes and improve transaction management [2], [3]. Other studies have demonstrated that the implementation of Two-Factor Authentication (2FA), particularly using One-Time Password (OTP) mechanisms, can significantly enhance system security by preventing unauthorized access [4], [5], [6]. In addition, payment gateway integration has been widely applied to improve transaction efficiency, accuracy, and security in various e-commerce and digital service platforms [7], [8], [9]. Although these studies provide valuable insights, they generally focus on authentication mechanisms and payment systems separately and are primarily applied to general e-commerce platforms rather than online game account trading systems.

Furthermore, existing research rarely addresses the application of integrated security and payment mechanisms in small-scale or local business environments. Local counters that expand their services into digital trading, such as online game account buying and selling, often continue to rely on manual processes that are vulnerable to security threats and operational inefficiencies. This indicates a clear research gap in the development of integrated information systems tailored to local counter-based online game account trading.

Therefore, this study differs from previous research by proposing and implementing a web-based online game account buying and selling information system that integrates OTP-based dual authentication and payment gateway mechanisms within a local counter context. This research takes Doel Celluler as a case study, a local counter that has expanded its services from mobile credit top-ups to online game account trading but still relies on manual transaction processes.

The main objective of this study is to design and implement a secure and efficient web-based information system for online game account trading. Specifically, this study aims to: enhance system access security through dual authentication, improve transaction efficiency and accuracy through payment gateway integration, and increase service professionalism and transaction transparency. By integrating security and payment features into a single system, this research is expected to provide a practical digital solution for local counters and serve as a reference model for similar small-scale businesses undergoing digital transformation.

2. RESEARCH METHODS

This study develops a web-based information system for online game account buying and selling by integrating OTP-based dual authentication and a payment gateway to improve security and transaction efficiency. The system is developed using the Waterfall method because the system requirements are clearly defined and relatively stable, as identified through observation and interviews conducted at Doel Celluler. The Waterfall model is selected over Agile or other iterative development models because the system does not require frequent changes in functionality or continuous iteration during development. As stated by Fitriyanto and Fitrani [10], the Waterfall method is suitable for web-based information systems with stable requirements and structured development stages. Furthermore, Sommerville [11], emphasizes that the Waterfall model supports comprehensive documentation and systematic evaluation, which are important in academic research. The stages of the Waterfall development process applied in this study – requirement analysis, system design, implementation, testing, and maintenance – are illustrated in Figure 1.

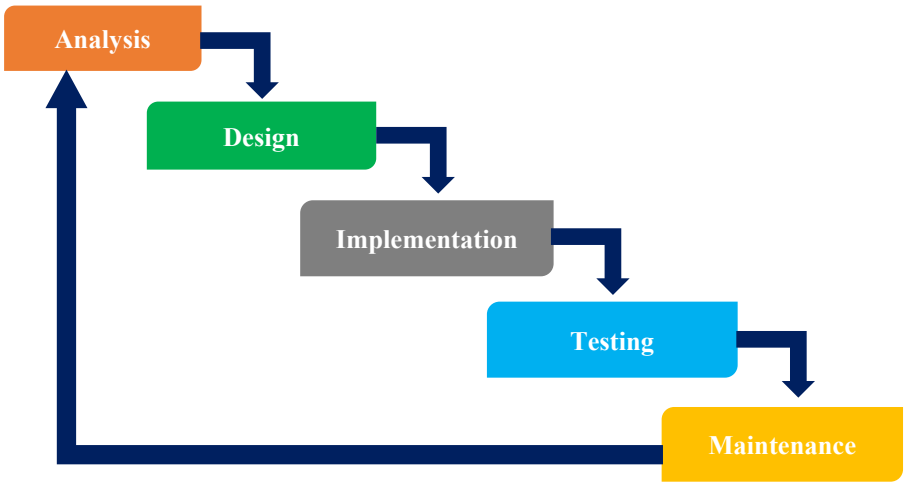

Figure 1. Waterfall Method

1. Analysis
   This stage identifies system requirements through observation and interviews conducted at Doel Celluler to understand the existing online game account buying and selling process. The analysis defines functional requirements, including user management, dual authentication, transaction processing, and payment gateway integration, as well as non-functional requirements related to system security and usability.
2. Design
   The design stage focuses on defining the system architecture, database structure, and user interface. System modeling is performed using Unified Modeling Language (UML) diagrams, such as use case diagrams, activity diagrams, and class diagrams, to describe system functionality and user interactions.
3. Implementation

At this stage, the system is developed as a web-based application using PHP and MySQL. Dual authentication is implemented using a One-Time Password (OTP) mechanism to enhance access security, while a payment gateway is integrated to support secure and automated digital transaction processing.

4. Testing
   System testing is conducted using the black-box testing method to verify that all system functions operate according to the defined requirements. Testing focuses on authentication processes, transaction workflows, and payment gateway integration.
5. Maintenance
   The maintenance stage is carried out after system deployment to fix identified errors and perform necessary adjustments in response to changes in user needs or operational conditions.

3. RESULTS AND DISCUSSION

3.1. System Design Results

The system design results are represented using Unified Modeling Language (UML) diagrams to describe system functionality and data structure. The interaction between users and the system is illustrated through the Use Case Diagram shown in Figure 2, which models user roles and system access boundaries. The use of UML diagrams helps ensure that system requirements are clearly translated into functional components and user interactions [12]. Previous studies indicate that UML-based modeling in web-based transaction systems improves system clarity, requirement validation, and maintainability, particularly in service-oriented applications [13].

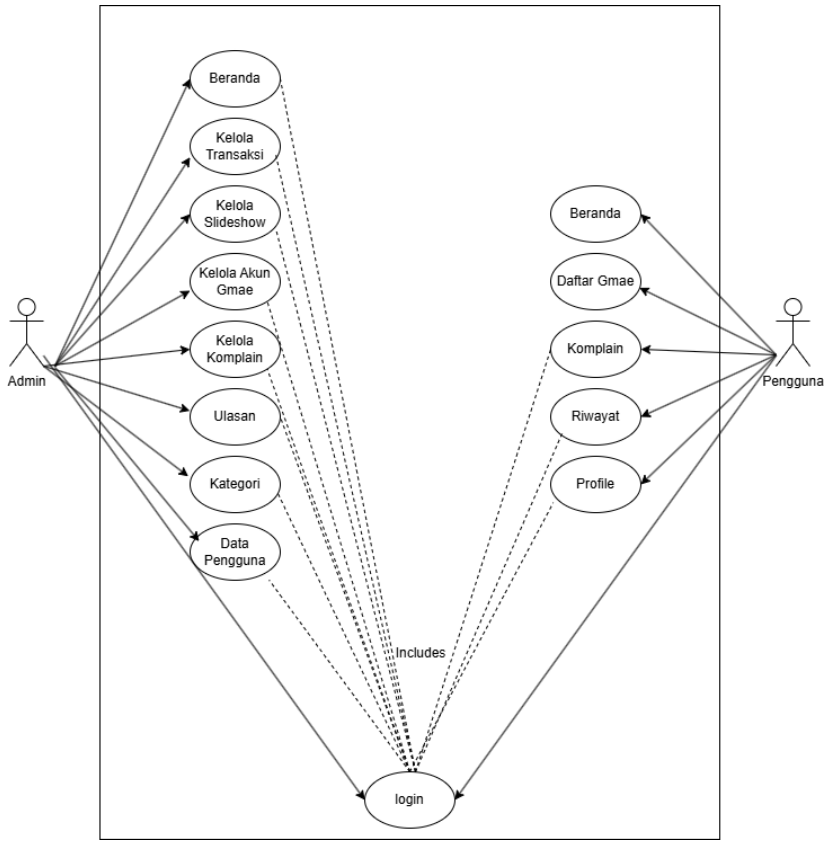

Figure 2. Usecase Diagram

The database structure of the system is modeled using an Entity Relationship Diagram (ERD), as presented in Figure 3. The ERD illustrates the relationships among key entities, including users, game_accounts, categories, transactions, reviews, complaints, account_images, and slideshows. This structure supports data integrity and efficient transaction processing by maintaining clear relationships between users and transaction records. Similar database modeling approaches have been shown to improve data consistency and system scalability in web-based information systems [14].

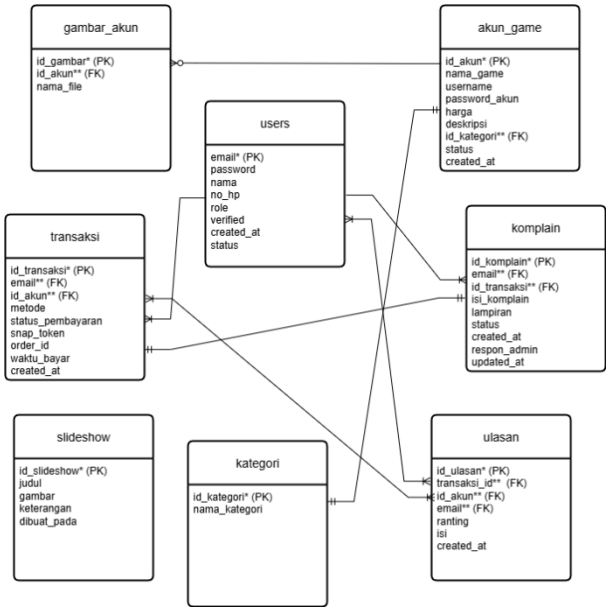

Figure 3. Entity Relationship Diagram (ERD)

3.2. System Implementation Results

The implementation results are demonstrated through several user interface screens corresponding to system functionalities. The login interface shown in Figure 4 functions as the main access point for both admins and users. This interface supports the authentication process, which is strengthened by the implementation of OTP-based dual authentication. Previous studies have shown that OTP mechanisms significantly enhance system security by reducing the risk of unauthorized access compared to single-factor authentication [4], [5], [6]. The implementation of OTP as an additional authentication layer is particularly effective in web-based systems that involve sensitive transactions, as it limits unauthorized access even when primary credentials are compromised [15].

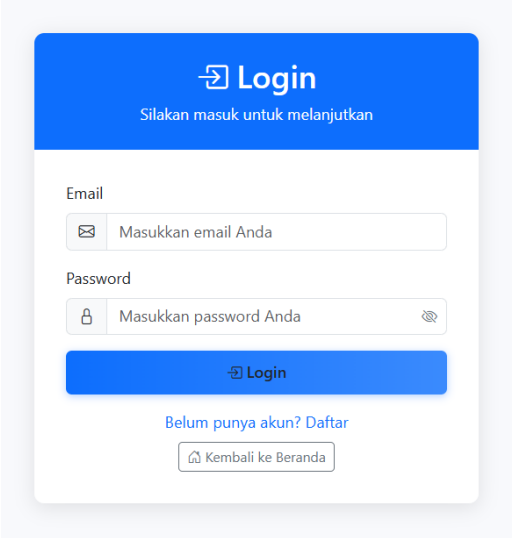

Figure 4. Login Page

The admin dashboard, presented in Figure 5, provides a summary of system data, including users, transactions, complaints, and available game accounts. This dashboard supports efficient monitoring and system management. The game account management feature, as shown in Figure 6, allows administrators to manage game account data, ensuring that all listed accounts are accurate and ready for transaction.

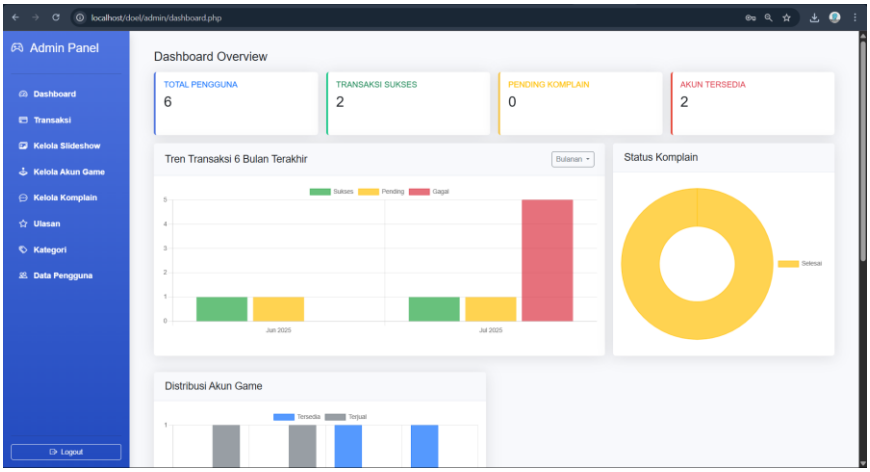

Figure 5. Admin Dashboard Page

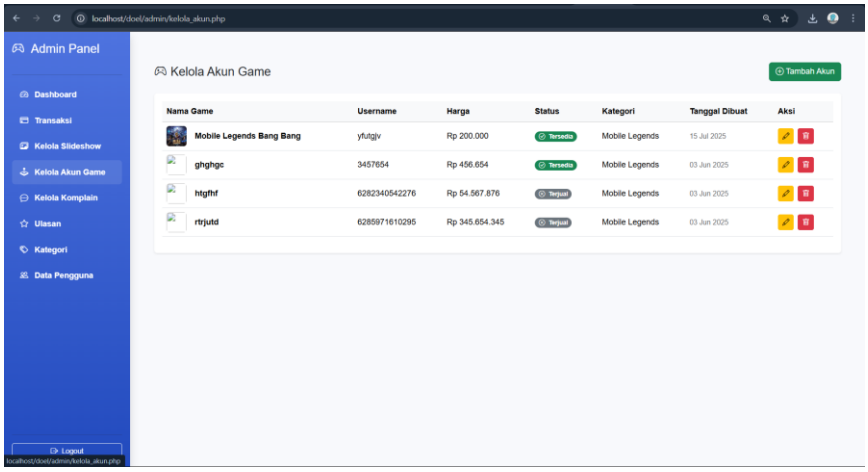

Figure 6. Manage Account Page

From the user perspective, the home page displayed in Figure 7 enables users to browse available game accounts and access core system features. The purchase history interface shown in Figure 8 allows users to view transaction details and provide reviews for completed transactions. This feature increases transaction transparency and user trust, which aligns with findings from previous studies on digital transaction systems and user experience [7], [8]. Furthermore, payment gateway integration plays a crucial role in ensuring transaction reliability and traceability by providing automated payment verification and transaction records that can be audited when disputes occur [9], [16].

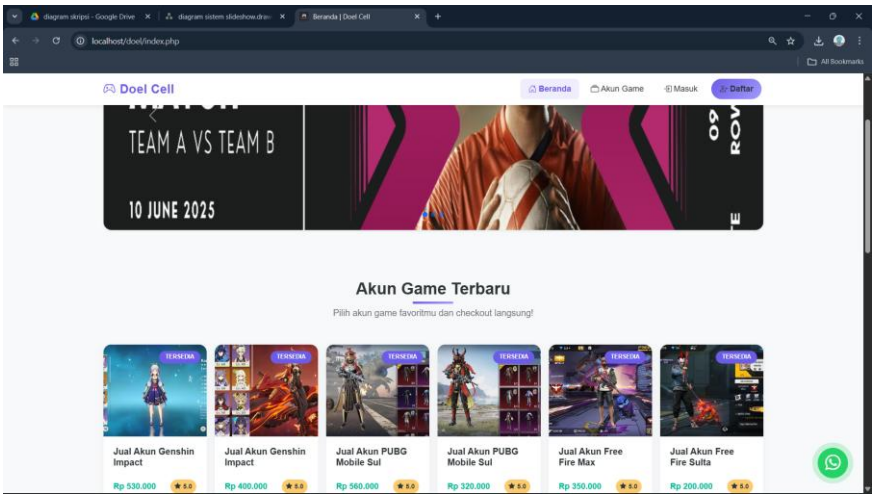

Figure 7. Home Page

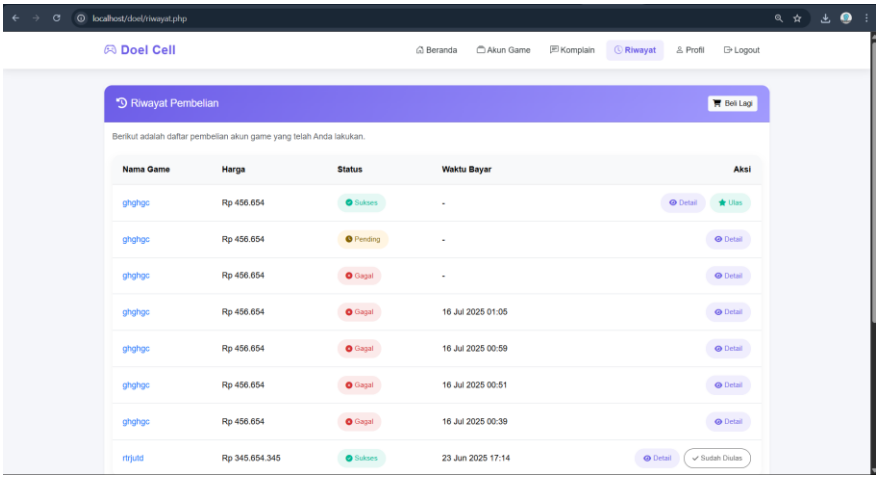

Figure 8. Purchase History Page

3.3. Discussion

This study shows that the integration of OTP-based dual authentication and a payment gateway in a web-based online game account trading system significantly improves both system security and transaction reliability, particularly in a local business environment such as Doel Celluler. Compared to the previous manual transaction process, the proposed system provides a more structured, transparent, and secure digital trading mechanism.

From a security perspective, the use of One-Time Password (OTP) as a second layer of authentication strengthens access control and reduces the risk of unauthorized access. In conventional systems that rely only on usernames and passwords, accounts are vulnerable to password leakage and credential theft. The addition of OTP ensures that even if a user's login credentials are compromised, unauthorized parties cannot access the system without the verification code sent to the registered device. This is especially important in online game account trading, where digital assets and account ownership have high economic value.

The integration of a payment gateway also plays a crucial role in improving transaction management. All payments are automatically verified and recorded by the system, eliminating the need for manual confirmation and reducing the potential for errors and fraud. This automated payment process increases transaction accuracy, provides clear payment status, and creates a reliable transaction history that can be used for tracking and dispute resolution. As a result, both buyers and sellers benefit from a more transparent and trustworthy transaction environment.

In addition, the use of structured system modeling through UML and ERD contributes to the stability and scalability of the system. Clearly defined entities such as users, game accounts, transactions, reviews, and complaints ensure that data relationships are well organized and that information is stored consistently. This structured design supports efficient system maintenance and allows future system development, such as the addition of new features or increased transaction volume, without major architectural changes.

Another important aspect highlighted in this study is the applicability of the proposed system to small-scale local businesses. Many local counters that offer online game account trading still rely on informal communication channels and manual record keeping, which are prone to errors and security risks. By implementing a web-based system with integrated security and payment features, Doel Celluler can provide more professional services, improve customer trust, and compete more effectively in the digital marketplace.

Overall, the developed system successfully addresses the main problems found in manual online game account trading, including weak security, lack of transaction transparency, and operational inefficiency. The combination of OTP-based authentication and payment gateway integration within a single web-based platform provides a practical and effective solution for secure and efficient online game account trading in a local business context.

4. CONCLUSION

This study has successfully designed and implemented a web-based information system for online game account buying and selling by integrating OTP-based dual authentication and a payment gateway at Doel Celluler. The developed system addresses the main problems found in manual transaction processes, including weak security, lack of transaction transparency, and high risk of errors and fraud. The implementation of OTP-based dual authentication has proven effective in improving access security by ensuring that only authorized users can log into the system. This additional security layer is particularly important in online game account trading, where account ownership and virtual assets have significant economic value. By reducing the risk of unauthorized access, the system provides better protection for both users and administrators.

Furthermore, the integration of a payment gateway improves transaction efficiency, accuracy, and reliability. Automated payment verification and transaction recording eliminate manual confirmation processes and reduce

human error. This also enhances transaction transparency, as users can view detailed transaction histories and payment statuses through the system interface.

From an operational perspective, the system supports Doel Celluler in managing game account data, user information, transactions, reviews, and complaints in a structured and centralized manner. This improves service professionalism and enables better monitoring and reporting of business activities.

Overall, the proposed system demonstrates that combining dual authentication and payment gateway mechanisms in a single web-based platform provides a practical and effective solution for online game account trading in a local business environment. This system can serve as a reference model for other small-scale businesses seeking to adopt secure and efficient digital transaction systems.

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