

Android-Based Online ATM Machine Swallowed Bank ATM Card Service Information System

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Abstract

ATM cards remain a primary means of banking transactions, despite the continued development of digital services. However, operational issues such as ATM cards being swallowed by the machine remain common and are generally handled through inefficient manual procedures that require customers to visit the bank in person. This study aims to develop an Android-based information system for reporting ATM card swappings to improve the efficiency, accessibility, and quality of banking services. The system development method used is the Waterfall model, which includes the stages of needs analysis, system design, implementation, and testing. The resulting system is designed to enable customers to report online, enabling faster handling by customer service without face-to-face interaction. Test results from the black-box testing method indicate that all system features operate according to established specifications and remain stable and functional. The implementation of this system has been proven to increase service response speed, simplify the reporting process, and reduce dependence on conventional procedures. This research contributes to the development of an integrated, real-time, mobile-based complaint service model for banking information systems. In addition, this research also strengthens the role of mobile technology as an enabler in the digital transformation of public services. Thus, the proposed system has the potential to be an effective and adaptive solution in improving service quality and customer satisfaction in the digital era.

Keywords: Service Information System; ATM Card; Banking Services; Customer Complaints; Android.

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Introduction

In today's digital era, ATM card use remains a primary means of financial transaction, despite the continued development of e-banking services, with the conveniences offered (Malempati, 2023). This preference stems from users' trust in ATM systems, which are considered safer, simpler, and more accessible to a wide range of users (ENORUWA et al., 2019). Furthermore, the physical presence of an ATM card provides users with a sense of control and certainty, as it allows for direct interaction without complete dependence on digital devices. Therefore, despite the rapid development of digital transformation in the banking sector, ATM usage patterns still demonstrate a high degree of continuity in consumer transaction behaviour (Azevedo et al., 2019).

ATMs also play a strategic role in supporting basic financial services, such as cash withdrawals, fund transfers, and efficient storage (Riski & Santoso, n.d.). Limited access to stable internet access and unequal ownership of smart devices make ATMs a solution that remains relevant and inclusive (Alramadan et al., 2025). Furthermore, the availability of physical transaction evidence, such as receipts, contributes to increased user trust by providing direct validation of transaction activity (Rani et al., 2025). This demonstrates that, despite the continued growth of digital banking services, the role of ATMs has not been completely replaced in the modern financial system (Chauhan et al., 2022).

Along with technological advancements, the functionality of ATMs has also undergone significant improvements (Alsmadi et al., 2023). While previously used solely for withdrawals and fund transfers, ATMs are now equipped with additional features such as cash deposits and touchscreen-based interfaces, enhancing user interaction (El Feky & Ghantous, 2022). However, various operational challenges still frequently occur, including ATM cards being swallowed by the machine. This problem not only inconveniences customers but also affects the efficiency of banking services.

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The process for handling swallowed ATM cards is still generally manual (Alarfaj & Shahzadi, 2024), requiring customers to visit a bank branch to report the incident. This procedure often takes considerable time due to queues and cannot always be completed in a single visit because replacement card availability is limited. This situation highlights the gap between the need for fast and efficient service and the current conventional service system.

Several previous studies have shown that implementing an online service system can improve the efficiency, speed, and quality of service to users (Di Sutam et al., 2024). Based on this, the study proposes developing an Android-based ATM Card Swallowing Service Information System to address these issues. This system allows customers to submit online reports anytime, anywhere, and facilitates customer service in receiving and processing them in real time. The developed system has several key features, including reporting of ATM card-swallowing incidents, customer data management, and bank selection based on the account-opening and incident locations. With the implementation of this Android-based application, it is hoped that the service process will be more efficient, responsive, and integrated, thereby improving the quality of banking services and overall customer satisfaction.

Method

The Waterfall method is used to build an Android-based ATM card service system for Swallowed Bank cards. The Waterfall method is a software engineering model used to develop systems or applications in a structured and sequential manner. (Ali & Yahaya, 2023; Mustapa et al., 2023; Pargaonkar, 2023; Popa et al., 2021) It is called a waterfall because the process is described as a stream of water flowing from top to bottom, with each stage completed before proceeding to the next. (Borecky et al., 2016; Goudie, 2020; Haerani et al., 2023) The main stages in the waterfall method are: Analysis, Design, Implementation, Testing, Maintenance (Al Fajar et al., 2022; Saravanas & Curinga, 2023). To build an ATM card information system application for a bank card swiped at an ATM, the Waterfall method is used. The stages of the Waterfall method are as follows: At this stage, an analysis is carried out on the problems that occur, based on the analysis of the ATM card service.

The analysis indicates that it is necessary to design an Android-based Swallowed ATM Card Service Information System Application to facilitate the service for swallowed ATM cards. For the design stage, a system design is carried out based on the analysis results, in the form of an application design and a structure to accommodate the application's operation. The first step in the application design is to determine the entities included in the swallowed ATM card service. The related entities are customers, who experience the problem of a swallowed ATM and input data into the system, and the Bank's Customer Service, which is tasked with providing services to customers experiencing the problem. Next, a database is designed to determine the related entities and can be implemented in the application.

The implementation and testing, where the design is realised into an Android-based application by thoroughly integrating the user interface and database (Milojković et al., 2024). At this stage, the program is coded according to the established design specifications. After implementation, the system is tested using black-box methods to ensure each function meets user requirements and to identify potential errors. The final stage is maintenance, which includes fixing errors discovered during use and continuously developing additional features to improve system performance, security, and reliability. At this stage, the developed system is expected to provide stable, responsive services that meet user needs for handling swallowed ATM card issues. The application of the Waterfall model in this study provides a systematic framework for developing the Android-based ATM card incident reporting system, ensuring that each development phase is executed in a well-defined and sequential manner. This structured approach enables clear documentation of system requirements, reduces ambiguity during development, and improves traceability between the design and implementation stages.

Furthermore, integrating user interface components with a centralised database enhances data consistency and operational reliability. The use of black-box testing as a validation mechanism ensures that all functional requirements are fulfilled from the user's perspective, thereby improving system usability and performance. In addition, the maintenance phase plays a crucial role in sustaining system quality through continuous improvements and adaptation to evolving user needs (Aslam & Jawaid, 2023). Overall, the adoption of the Waterfall method not only facilitates disciplined system development but also helps create a stable, scalable, and user-oriented digital service solution in the banking sector.

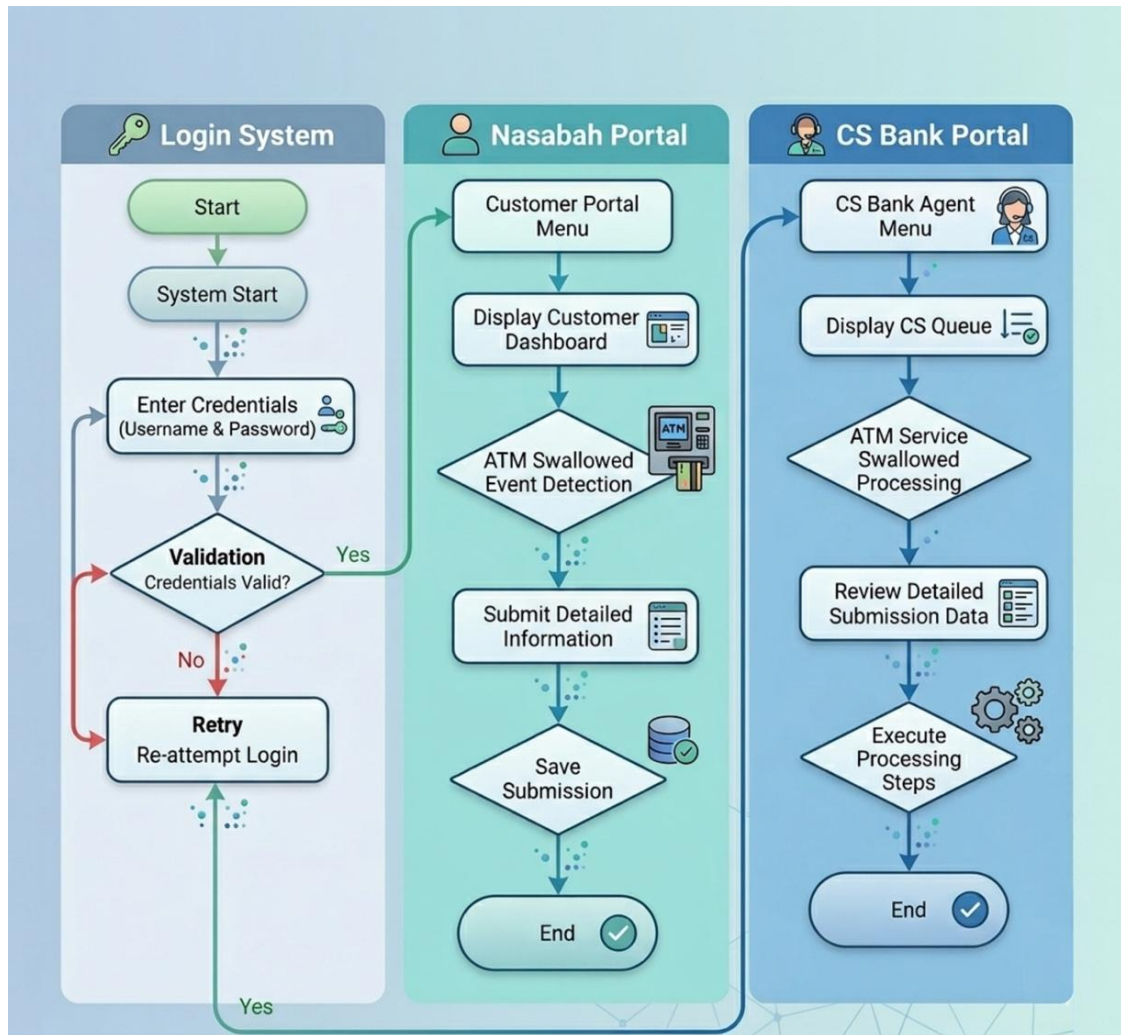


Figure 1. System flowchart

Figure 1 presents a flowchart of the ATM Card Swallowing Information System, illustrating the process for handling ATM card-swallowing incidents. The process begins with user authentication via a login mechanism that requires a username and password. After successful validation, customers are directed to the service menu to select the appropriate complaint type for the ATM card-swallowing incident. In the next step, customers are asked to complete the report data, which will serve as the basis for further processing by the system. The input data is then stored in an integrated system database. The bank's customer service team can then access the report information through the admin portal for verification, review, and processing. This flow is designed to ensure the reporting and handling process is systematic and efficient, and to accelerate service response to customer issues.

Furthermore, the system flowchart design integrates the principles of process efficiency and data security, with each stage designed to minimise redundancy and ensure the validity of the processed information. Centralised authentication and data storage mechanisms enable more controlled and accurate information management. Customer service engagement through the admin portal also supports real-time verification and follow-up processes. Therefore, the designed system flow focuses not only on ease of reporting but also on improving service quality through a structured, responsive, and integrated process.

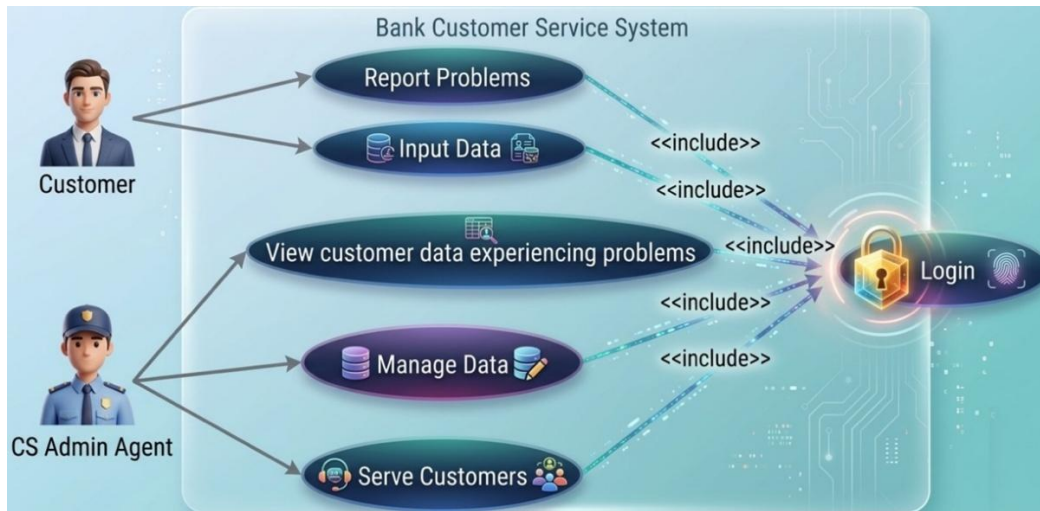


Figure 2. System use case

Figure 2 shows a use case diagram for a banking customer service information system, specifically for handling cases of swallowed ATM cards. This diagram depicts two main actors: the customer and the bank's customer service administrator. The customer plays a role in reporting problems and inputting data as the initial step in the handling process. In this system, the reporting process is integrated with the data entry required for validation and service follow-up. On the other hand, bank customer service administrators have the authority to manage incoming report data, verify information, and provide customer service. The <<include>> notation indicates that each process in the system is interconnected and integral to problem solving, thereby supporting overall service effectiveness.

The implementation phase occurs after the system design process is complete. At this stage, the system is built using an appropriate programming language and integrated with a database to support structured information management. Next, a testing phase is conducted to ensure the system operates in accordance with the predetermined requirements. Testing is conducted to identify errors or deficiencies in the system so they can be corrected before widespread use. The final stage is maintenance, the ongoing process that follows system implementation. This stage involves fixing errors discovered during use and continuously developing additional features to improve the system's performance and quality.

Results and Discussion

Result

This section describes the results of the system evaluation conducted using the black-box testing approach. The purpose of this testing is to verify that each functional component of the developed system meets the specified requirements. Black-box testing focuses on validating system outputs based on given inputs without analysing the internal code structure. Each feature of the ATM card retrieval service application was systematically tested to ensure functionality, reliability, and correctness of system responses. The detailed results of the testing process are summarised in Table 1.

Table 1. System Testing Using the Black-Box Method

No	Testing	Which are expected	Conclusion
1.	Login	The login page can be accessed	Success
2.	List	The list page can be accessed	Success
3.	Dashboard	The dashboard page can be accessed	Success
4.	Customer	The Customer Page can be accessed	Success
5.	CS Bank	The CS Bank page can be accessed	Success

The test results shown in Table 1 indicate that all major features of the system functioned in accordance with the design specifications. Every module from the user authentication process to access to the dashboard, client, and customer service pages operated without any functional errors. This indicates that the system possesses a high level of reliability

in supporting digital service processes. Furthermore, the success of these tests also reflects that the integration between the user interface and the database has been optimised. Thus, the system not only meets users' functional needs but is also ready for implementation in a real operational environment to enhance the efficiency and quality of banking services.

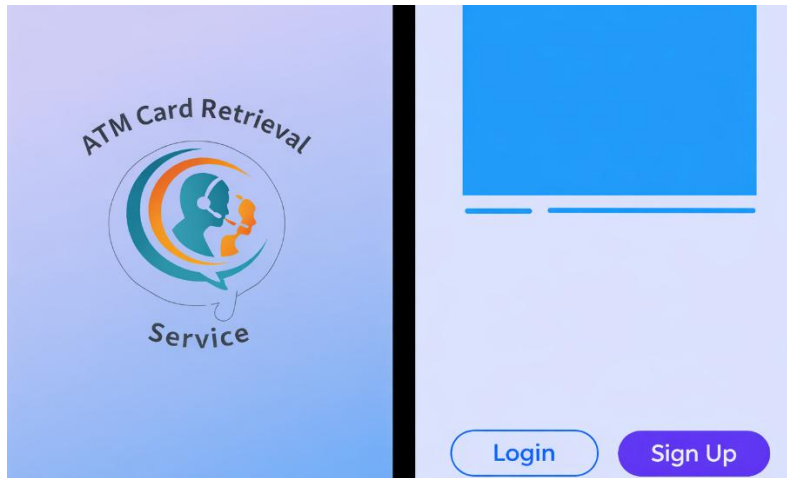


Figure 3. Splash screen and registration page

Figure 3 shows the initial application interface, consisting of a splash screen and a registration page, for the Android-based Swallowed ATM Card Service Information System. The splash screen serves as the application's opening screen, presenting the system's identity through a logo that represents customer service activities. This display also serves as an introduction before users enter the application's main features. Next, users are directed to an authentication page that provides options to log in or register a new account. This page is designed to provide users with easy access to manage their accounts before accessing the application's main menu. With this feature, the system can ensure that every user accessing the service has been verified, thereby enhancing the service's security and reliability. In addition, the interface design at this initial stage considers user experience (UX) and usability, so that users can intuitively understand the application's usage flow from the first time they access the system. This approach aims to minimise obstacles in application use and increase user adoption rates. Thus, the initial interface design serves not only as a visual element but also as a strategic component that enhances the effectiveness of user-system interactions.

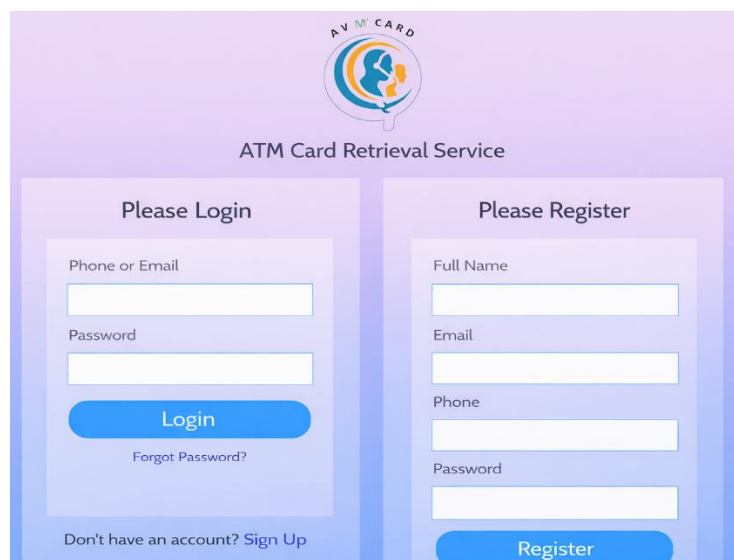


Figure 4. Login and register page

Figure 4 displays the login and registration interfaces for the Android-based Swallowed ATM Card Service Information System. These two pages serve as user authentication mechanisms before accessing the application's main features, for both customers and customer service officers. The login page is used by users who already have an account, who enter their email address or username and password in the provided fields. Meanwhile, the registration page is available for new users to complete, requiring only the required data, such as full name, email address, and password. This authentication feature is designed to ensure the security of system access and ensure that each registered user can access services according to their rights and role in the system.

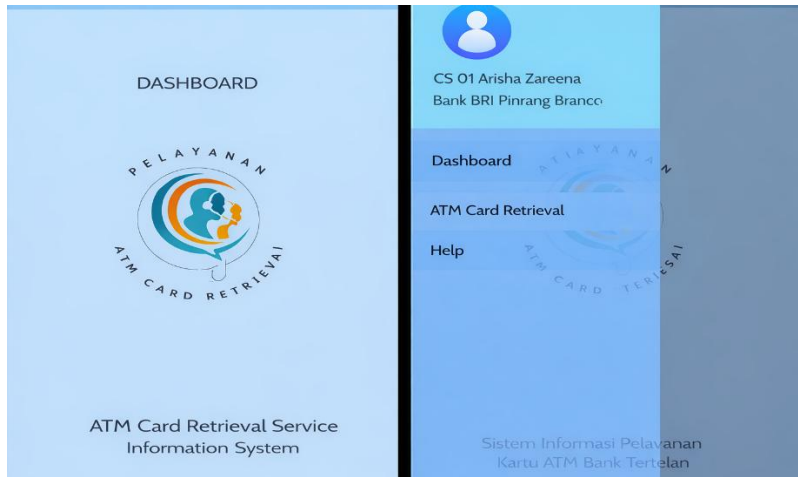


Figure 5. Dashboard page, customer menu and CS Bank admin

In Figure 5, the dashboard page shows three lines in the upper-left corner, representing the menus for both the Customer and the Bank's Customer Support teams. The Customer and Bank Customer Support team menus allow you to access the form to report problems with ATM cards being stuck in the ATM. The Bank Customer Support team menu allows you to access the Bank's Customer Support team's service page, which handles issues with ATM cards that are stuck in the ATM. Furthermore, the dashboard design adopts the concept of role-based access, ensuring that each user, both customers and customer service representatives, has access to features tailored to their needs and functions. This approach aims to enhance system security and minimise errors in application operation. With simple, structured navigation, users can easily access relevant menus without confusion. This demonstrates that the dashboard design serves not only as a navigation centre but also as a crucial component in improving interaction effectiveness and overall service quality.

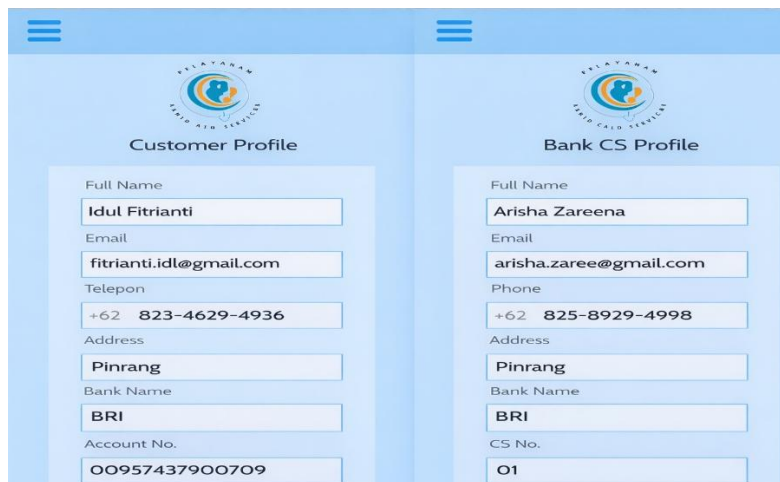


Figure 6. Customer profile page and CS Bank admin profile

Figure 6 shows the profile page interface for customers and bank customer service administrators in the Swallowed ATM Card Service Information System. This page displays user identity information, such as full name, email address, telephone number, and account and bank details. The data displayed on the profile page is read-only, meaning it cannot be changed or deleted by the user. This is because all data is automatically retrieved from the bank's database, which is integrated with the system. This approach aims to maintain the accuracy, consistency, and security of user data throughout the service process. Furthermore, implementing a read-only concept on the profile page is part of an access control strategy to maintain data integrity within the system. By restricting user rights to certain data changes, the system can prevent information manipulation that could potentially lead to errors in the service process. Centralised data management through integration with the bank's database also enables consistent, real-time information synchronisation. Thus, the profile page design serves not only as a medium for presenting information but also as a supporting mechanism for overall system security and reliability.

Full Name	Action
Arisha Zareena	Process
Anneesa Nur	Process
Ellenati Siti	Process
Kamila Sari	Process
Angelina Putri	Process
Ayisha Indah	Process
Melati Purnama	Process
Karisma Hana	Process
Ahmad Agus	Process
Liodra Nita	Process
Dara Nabila	Process

Figure 7. Customer reporting form page and report list

Figure 7 displays the customer reporting form and report list interfaces in the Swallowed ATM Card Service Information System. On the report form page, customers can enter the necessary data for the swallowed ATM card incident, including user identity, account information, and the incident location and time. The input data is then stored in the system as the basis for processing. Meanwhile, the report list page is used by customer service officers to monitor and manage incoming reports. Through this page, officers can review report details and take action by selecting the available process menus. The design of these two pages aims to support an integrated service flow, enabling the reporting and handling processes to proceed effectively and efficiently.

Overall, the interface series shown in Figures 3 through 7 demonstrates that the developed system has been designed with a structured, user-centred approach. Each page has integrated functions, ranging from authentication and dashboard navigation to profile management, reporting, and case handling. The simple, consistent, and easy-to-understand interface design enables users to interact with the system without a steep learning curve. Furthermore, the implementation of security concepts such as user authentication and data access restrictions (read-only) demonstrates that the system emphasises not only functionality but also data protection and service reliability. Furthermore, the integration between customer reporting and customer service report management reflects an efficient and responsive workflow within the system. This allows for faster handling of ATM card issues after swallowing, is well-documented, and minimises errors that may occur in manual processes. Thus, the overall interface design not only supports ease of use but also significantly improves the quality of digital banking services. In addition, design consistency across pages strengthens the user experience, making it more intuitive and directed, thereby minimising errors during interaction.

Discussion

This study shows that the development of an Android-based information system for handling swallowed ATM cards significantly contributes to improving the efficiency and effectiveness of banking services, particularly in the reporting and handling of customer issues (Moon et al., 2022). The developed system reduces reliance on conventional procedures that currently require customers to visit the bank office, often resulting in long wait times and repetitive administrative processes. With the application-based reporting mechanism, the communication process between customers and the bank becomes faster, more structured, and digitally documented (Aydemir & Başçiftçi, 2022).

These findings indicate that digital transformation in banking services plays a role not only as a technological innovation but also as a strategic solution to address the need for more responsive and user-oriented services (Tsindeliani et al., 2022). In this context, the proposed system not only replaces manual processes but also reconstructs service flows to be more efficient through data integration and process automation. This aligns with the concept of digital service transformation, which emphasises increasing service value through optimal use of information technology. From a user experience perspective, this system provides significant ease of access for customers. The ability to report incidents anytime and anywhere is a crucial factor in increasing user satisfaction. Furthermore, the simple, user-centred interface design contributes to the app's ease of use. These findings support previous research that suggests ease of use and accessibility are key factors in the successful implementation of mobile-based systems (Ebadi & Raygan, 2023). Therefore, the success of this system is determined not only by technical aspects but also by the design's suitability to user characteristics.

When compared with previous research, the results of this study are consistent with the findings of (Latupeirissa et al., 2024), which stated that online service systems can improve service efficiency and accelerate information delivery. However, this study has the advantage of being more specific in its implementation context, namely, the handling of swallowed ATM cards, which has not previously been explored in depth. Therefore, this study makes an additional contribution to the literature on the digitalisation of banking services, particularly regarding the handling of operational incidents that are specific and directly impact customers.

From a banking operational perspective (Aslam & Jawaid, 2023) This system has the potential to increase customer service productivity. With an integrated system, officers can access report data in real time without manual recording. This not only speeds up the verification and handling process but also minimises the risk of data recording errors. In the long term, implementing such a system can support data-driven decision-making, as all information is stored in a database for further analysis. This research also contributes to the development of an integrated, real-time, mobile-based service information system model. The proposed model combines the concept of digital service with a user-centred design approach, resulting in a system that is not only functional but also easy to use (Barua & Rahman, 2023). Furthermore, this research reinforces the concept that digitalisation of public services, including in the banking sector, can increase transparency, accountability, and service efficiency (Agostino et al., 2022). Therefore, this research can serve as a reference in the development of similar systems in other public service contexts.

The use of the Android platform as the basis for system development demonstrates high flexibility and scalability (Musa et al., 2023). Android, as the operating system used, allows this application to be accessed by various segments of society, thus supporting service inclusivity. This is especially important in developing countries, where the penetration rate of Android-based smartphones is relatively high compared with other platforms. Therefore, selecting the Android platform for this study is the right decision to support widespread technology adoption.

This study also has several limitations that require attention. First, the developed system has not been directly integrated with the core banking system, so the further verification process still requires manual intervention from the bank. Second, system testing remains limited to a functional level, relying on black-box testing methods and thus failing to provide a quantitative evaluation of the user experience. Third, this study has not comprehensively considered data security and privacy aspects, which are crucial factors in the development of financial services-based applications. Therefore, further research is recommended to develop system integration with core banking to create a more automated and seamless service flow. Furthermore, user-based evaluations involving a larger number of respondents are needed to more objectively measure levels of satisfaction, ease of use, and technology acceptance. Security aspects also need to be a primary focus in further development, including implementing data encryption, multi-layered authentication, and compliance with information security standards.

Overall, this study confirms that the use of mobile-based technology in banking services has significant potential to improve service quality and user experience. The developed system not only provides solutions to specific problems but also opens up opportunities for broader digital service development in the future. With the right approach, integrating technology into banking services can be a key factor in enhancing the competitiveness and sustainability of financial institutions in the digital era.

Conclusions and Suggestions

Conclusions

This research has successfully developed an Android-based information system for handling swallowed ATM cards, designed to improve the efficiency and effectiveness of banks' reporting and problem-solving processes. The proposed system allows customers to report online without visiting a bank office, thereby reducing wait times and improving service convenience. The application of the Waterfall method in the development process and the black-box testing indicate that all system functions operate according to predetermined specifications and are readily accessible to users. These results indicate that the system has an adequate level of reliability to support digital-based service operations. The findings of this research confirm that mobile application-based technology can improve the speed, accuracy, and quality of service in handling cases involving swallowed ATM cards. In addition to providing a practical contribution to improving banking services, this research also strengthens the role of digitalisation as a strategy to increase customer satisfaction and trust.

However, this research still has limitations, particularly in its scope of implementation, which does not include direct integration with the core banking system, and it has not been tested on a wider user base. Therefore, further research is recommended to develop more comprehensive system integration and conduct in-depth user experience evaluations to improve the system's quality and sustainability. Therefore, this system can be implemented as a relevant and practical digital solution to improve services in the banking sector.

Suggestions

Several recommendations are proposed for further development. First, future improvements should focus on enhancing user interaction by integrating automated notifications and real-time status tracking to provide clearer information. Second, data security needs to be strengthened through the implementation of advanced encryption methods and comprehensive security testing to protect sensitive information. Third, the system can be expanded to support other public service domains, such as emergency reporting or government service systems, where rapid response and accurate information handling are essential.

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Contributions

All authors contributed equally to this research. Muh. Riyaldi Pratama was responsible for system design and manuscript preparation. Kamaruddin handled the research methodology and data analysis. John James conducted system testing and performed the final manuscript review. All authors have approved the final version of the manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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