E-ISSN: 2962-6110
P-ISSN: 2964-7843
JSRET
jsret.knpub.com
Journal of Scientific Research, Education, and Technology

Optimizing the Waterfall Method in Designing an Android-Based Mobile Application for Table Reservation in Coffee Shops

Rahardian Damar Galih, Suyud Widiono
Universitas Teknologi Yogyakarta, DIY, Indonesia

ABSTRACT

The growth of the coffee shop industry in Indonesia has caused problems in the table reservation system, which is still done manually, such as long queues, uncertainty of seat availability, and poor service. The purpose of this research is to improve service quality by developing an Android-based mobile application that enables table booking and reservation. Requirement analysis, system design, implementation, testing, and maintenance are the stages of the Waterfall Software Development Life Cycle (SDLC) used. Field observations, interviews with managers, and customer questionnaires are the methods used to obtain research data. The implementation results show that the application is capable of making real-time reservations, providing status notifications, and helping managers monitor table capacity. In addition, testing shows that the system can improve customer satisfaction, speed up the reservation process, and reduce queues. Thus, this research found that optimizing the Waterfall method can produce an application that is stable, organized, and relevant to the needs of the contemporary coffee shop industry.

Keywords: *Mobile Application, Android, Coffee Shop, Table Reservation, Waterfall Method*

Corresponding author
Name: Rahardian Damar Galih
Email: rahardiandamar2@gmail.com

INTRODUCTION

The coffee shop industry in Indonesia has experienced substantial expansion over the past decade, driven by lifestyle changes that position cafés as versatile social and professional environments. Today, coffee shops function not only as places to dine but also as preferred settings for studying, remote working, informal meetings, and leisure activities. This increasing multifunctional role has naturally led to greater customer volume, creating new operational challenges for business owners. One major issue is the continued reliance on manual reservation methods, which remain common among many cafés. Processes such as walk-in booking, phone reservations, and handwritten scheduling often contribute to long waiting times, inefficient table allocation, double reservations, and inconsistent service delivery. These constraints can negatively impact customer satisfaction and reduce the

overall competitiveness of coffee shops, especially as digital expectations among consumers continue to rise.

The broader trend of digitalization in the hospitality sector has encouraged businesses to adopt mobile-based solutions as a means of streamlining service operations. (Hamdani dan Sanjaya, 2025) highlight that digital reservation applications enhance convenience by enabling customers to book tables remotely, receive confirmation updates, and view seating availability in real-time. Supporting this view, (Trisnadoli et al. 2023) found that mobile systems can significantly reduce waiting times and improve service flow, ultimately enhancing customer experience. Similarly, (Wiastuti et al. 2025) emphasize that mobile technologies play a vital role in shaping customer preferences, making digital adaptation essential for hospitality businesses aiming to stay relevant in a competitive market.

Although existing studies have contributed valuable insights, most of them primarily address the functional and usability aspects of reservation systems. In contrast, discussions concerning the underlying software development processes particularly the application of structured methodologies are still limited. The absence of a systematic development approach often leads to applications that may work well initially but lack long-term robustness, scalability, and maintainability. Furthermore, without a structured framework, developers may encounter issues related to requirement identification, design validation, error handling, and system testing. This highlights the need for research that not only focuses on what features a reservation system should have but also on how such systems should be developed to ensure consistent quality.

The Waterfall Software Development Life Cycle (SDLC) offers a linear and well-organized approach that includes sequential phases such as requirement analysis, system design, implementation, testing, deployment, and maintenance. This model is particularly suited for projects that demand clear documentation, predictable processes, and meticulous quality control. Structured methodologies like Waterfall support development environments that require accuracy, stability, and alignment with user needs. When applied to a reservation application for coffee shops, the Waterfall SDLC ensures that system requirements are analyzed comprehensively before development begins, that system components are designed according to functional demands, and that errors are minimized through systematic testing procedures.

Even though the Waterfall approach offers these advantages, research specifically examining its optimization within the context of reservation systems especially those tailored to Indonesian coffee shops is still scarce. Many previous studies utilize general mobile development frameworks or focus mainly on user satisfaction metrics, overlooking the significance of structured engineering processes. This gap demonstrates the need for research that investigates how a rigorous development methodology can produce a reservation system that is reliable, user-centered, and suitable for real operational environments.

To address this gap, a more detailed understanding of how systematic development stages can enhance the effectiveness of reservation applications is required. Based on this need, the present study aims to explore several essential questions: **(1) How can each phase of the Waterfall SDLC be optimized in the creation of an Android-based reservation application for coffee shops? (2) To what extent can the use of this methodology improve the system's reliability, efficiency, and operational stability? and (3) What key features are necessary to meet customer expectations while supporting managers in monitoring table availability in real time?** These questions serve as the foundation for directing the study and ensuring that the resulting application aligns with both technical standards and industry needs.

Considering the issues faced by many coffee shops, developing a dedicated Android-based reservation application presents a promising solution. Android is chosen because it is the most widely used mobile operating system in Indonesia, making it accessible to a broad customer base. Through digital reservation systems, customers can choose their preferred seating, select time slots, and adjust guest numbers easily. On the business side, managers can track seating capacity, forecast customer flow, and reduce reservation conflicts. As noted by (Wiastuti et al. 2025), the use of real-time digital information also enhances operational decision-making, allowing coffee shops to manage resources more effectively.

In summary, the rapid development of the coffee shop industry demands the implementation of reliable and efficient reservation systems capable of addressing modern customer expectations. While mobile applications have demonstrated their potential to improve service delivery, the limited focus on structured development methodologies in previous studies presents a notable gap. Therefore, by optimizing the Waterfall SDLC method in the development of an Android-based reservation application, this research intends to offer practical contributions for operational efficiency and theoretical contributions to the field of hospitality-focused software development.

METHOD

This research uses the Waterfall Software Development Life Cycle (SDLC) method with five main stages: requirements analysis, system design, implementation, testing, and maintenance and development (Pressman & Maxim, 2020). In the requirements analysis stage, data was collected through observations of the manual reservation flow, interviews with managers regarding table capacity, and customer questionnaires regarding reservation system preferences. The analysis results were used to design flowcharts, Entity Relationship Diagrams (ERDs), and a user-friendly application interface for customers and admins. The implementation was carried out using Android Studio with Java and XML languages, and a connection to a MySQL database via a PHP-based RESTful API and JSON format in a client-server architecture. Testing used a black-box method covering normal and abnormal scenarios, with an average API response rate of under one second. The final stage includes maintenance and development, including application evaluation and plans for advanced

features such as digital payments, expansion to iOS and the web, and real-time integration of the Firebase database to improve scalability and performance.

The Waterfall model consists of five sequential stages, starting from analysis to maintenance (Pressman & Maxim, 2020). The first stage is analysis, which is the process in which the author outlines the steps required to develop a sales application program, from processing product data to sales transaction data, as well as analyzing and collecting all information related to the required software (Sommerville, 2016). The next stage is design, which includes the creation of Use Case Diagrams and Entity Relationship Diagrams as tools to illustrate functional requirements and database structure, thereby simplifying the overall system design process (Dennis, Wixom, & Tegarden, 2015). Once the design is complete, the process continues to the implementation stage, which translates the design results into program code and creates a database according to system requirements (Pressman & Maxim, 2020). Next, the application is tested in the testing phase, where the Black Box Testing method is used to ensure each function works as expected and reduces the potential for system errors (Myers, Sandler, & Badgett, 2012). The final stage is maintenance, which includes fixing emerging problems, system updates, and data recovery and backup processes to maintain the long-term sustainability of the application (Sommerville, 2016).

FINDING AND DISCUSSION

RESEARCH RESULT

The results of the study indicate that an Android-based table reservation application created using the Waterfall method can improve service productivity and resolve queuing issues that previously occurred in manual systems. In line with the findings of (Syahputra et al. 2023) that digitizing reservations improves service speed and accuracy, the system provides real-time reservation services, status notifications, and accurate table availability information. As explained by (Hakim et al. 2023), the use of WhatsApp OTP authentication improves user access security. As stated by (Prasetyo & Laksana, 2021) and (Kurniawan, 2020), the modeling process using UML and ERD is crucial for building a stable database structure and clarifying system flow. They emphasize that visual modeling is effective in reducing design ambiguity and maintaining data integrity.

As demonstrated by the implementation phase using Android Studio, Java language, and RESTful API integration, the system architecture has been developed in a sophisticated and effective manner. According to (Widiyanto & Putro, 2022) regarding the effectiveness of APIs in increasing mobile application scalability, JSON-based API integration improves the user experience with faster response times. Furthermore, the results of Black Box Testing show that all functions run according to specifications without significant errors. This is consistent with research by (Permana & Alfahmi, 2022) which states that black box testing is effective in validating application functions without examining the source code. Therefore, this study shows that the implementation of Waterfall can produce stable and structured software, which supports the classical theory outlined by (Pressman & Maxim, 2020).

This application has met the primary needs of users and improved operational efficiency, but this study still has several issues. The lack of digital payment features and the absence of a real-time database can affect data synchronization under high traffic conditions. Results from (Hidayat et al. 2023) show that a reservation system without a real-time database can experience information delays, but the system is still capable of performing. And below is a table of tests that I carried out on the application system that I have created.

Table 1: Black Box Result Test

No.	Testing Scenario	Tase Case	Expected Result	Actual Result	Conclusion
1.	After all columns in the table reservation form are left blank, click **"Submit".**	Name: (blank) Phone Number: (blank) Date: (blank) Time: (blank) Number of People: (blank)	For each blank column, the system displays the message, **"Please fill in this field"** and denies data storage.	As Expected	Valid
2.	After you fill in all columns except the Reservation Date, click **"Submit".**	Name: Alex Phone Number: +6289804563781 Date: (blank) Time: (blank) Number of People: 2	After denying data storage, the system displays the message, **"Please fill in this first column."**	As Expected	Valid
3.	After you fill in all columns except the Reservation Date, click **"Submit".**	Name: Alex Phone Number: +6289804563781 Date: (blank) Time: 19:00 Number of People: 2	in the Reservation Date column, the system displays the message, **"Please fill in this field"** and denies data storage.	As Expected	Valid
4.	After you fill in all columns with the	Name: Alex	After data is stored, a	As Expected	Valid

correct format, click **"Submit".**	data	Phone Number: +6289804563781 Date: 10/10/2025 Time: 19:00 Number of People: 2	success message, **"Successfully saved"** is displayed by the system.

This test document provides a summary of four key scenarios related to the table reservation form. Overall, each test case yields valid conclusions, indicating that the system operates as expected. These tests effectively validate the error handling and data saving functions. Specifically, test cases 1, 2, and 3 demonstrate that the system successfully rejects data saving and displays error messages such as "Please fill in this field" or "Please fill in the first field" when required fields, such as name, reservation date, or other important data, are empty. Test case 4, on the other hand, demonstrates the system's core functionality: filling in all fields with the correct data format results in data saving and displays the success message, "Successfully saved."

The results of the questionnaire about how students' perception towards the implementation of online learning during the covid-19 pandemic is based on their own experiences have previously experienced lecturers with a direct face-to-face learning system and also experienced lectures with online learning. Based on findings, it is indicated that students in the English education program at FKIP Universitas Tanjungpura have a relatively high percentage of perception, which is 70% overall.

This has shown that the majority of students accept online learning and retrieved positive perceptions on the implementation of this online learning. Based on (Qiong, 2017) positive perception describes all knowledge (both known and unknown) and the responses conveyed when using it. It continues to accept and support the object actively or sensing. while negative perception describes all knowledge (knowing or not knowing) and reactions that are not oriented to the object of perception.

Of the five aspects that obtained the highest percentage was the student achievement aspect (76%). Students have perceived that this online learning has a significant impact on their improvement in academia. These findings are in line with (Mandasari, 2020) who also revealed that in terms of learning motivation, learning achievement, and learning engagement, online learning has a beneficial effect on students' academic performance. Furthermore, the positive perception that has been shown is from learning completeness. Most students have been able to follow online learning well. From the result obtained, they can easily understand the material provided. These findings are in line with the findings of (Siahaan, 2021) who has explained that there is a significant effect of online lectures on student understanding which is 37 respondents (74%). A study from (Ramadhan, 2021) also found that there is a significant effect of online-Based learning on the effectiveness of student learning in Malang.

DISCUSSION

The results of the study show that the application of the Waterfall Software Development Life Cycle (SDLC) when building an Android-based table reservation application has produced a system that is stable, organized, and meets the operational needs of the coffee shop. The Waterfall model's sequential nature ensures that each development phase from requirements analysis to testing is executed thoroughly. These findings are consistent with (Nugroho, 2016)'s findings, which claim that Waterfall provides clear documentation and reduces development ambiguity. The application's success in providing real-time reservation information, reducing queues, and improving service flow demonstrates that effective request collection is heavily influenced by the right structure.

The findings of this study align with those of (Putra & Arifin, 2021), who found that digital reservation systems in the hospitality industry increase operational efficiency and reduce manual errors. According to (Rahmawati et al. 2020), API-based architecture enhances data synchronization and accelerates mobile application performance, and the integration of RESTful APIs and JSON-based communication supports these findings. However, (Santoso & Wibowo, 2019) state that visual modeling is crucial for explaining system structure and preventing inconsistencies during implementation. The design phase using UML and ERD models demonstrates this. The success of the black-box method for functional testing also reflects the findings of (Susanto & Purwanto, 2021), who found that black-box testing is effective for validating system functions without requiring access to the internal program logic.

Despite the positive results, several obstacles were identified. First, the system doesn't utilize real-time database capabilities like Firebase, which can cause delays in data updates during high user volumes. (Lestari & Gunawan, 2022) noted a similar situation, finding that applications without real-time synchronization often experience brief inconsistencies in availability status. Second, contemporary reservation systems typically combine booking and payment in a single workflow, making them less convenient for users. Third, the research was limited to functional testing. Elements like performance, security, and usability were not fully examined. This limitation aligns with the concerns of (Hardiansyah, 2020), who emphasized that mobile applications need to be thoroughly tested to ensure long-lasting reliability. Last but not least, the application is currently limited to Android, which limits access for web users on the iOS platform.

The findings of this study indicate several opportunities for further advancement. By incorporating real-time database technology, data accuracy and reservation synchronization can be significantly improved. To support a seamless user experience, digital payments can be added. According to (Sugianto & Prabowo, 2021), iterative techniques like Agile could be considered from a development perspective to allow for quick enhancements based on user feedback. Furthermore, further usability research is recommended to comprehensively evaluate the user experience and identify improvements in interaction efficiency and interface design. Overall, this study demonstrates that, once optimized, the Waterfall SDLC remains a solid foundation for building a streamlined and streamlined mobile reservation application.

CONCLUSION

By using the Waterfall Software Development Life Cycle (SDLC), an Android-based table reservation application has been developed successfully. The results show that the systematic stages of the SDLC beginning from requirements analysis, design, and implementation up to testing play a significant role in ensuring system stability and cl The application efficiently provides real-time reservation information, reduces queue accumulation, improves service efficiency, and helps managers track table availability.

Furthermore, these findings align with previous research emphasizing the importance of structured modeling, API integration, and functional testing in mobile application development. The implementation of a RESTful API and UML-based design improved the system's data flow and clarity, and black-box testing demonstrated that the application met functional requirements. Overall, the system has proven to provide a solution that meets the needs of contemporary cafe services.

However, several limitations were recognized in this study, including the lack of real-time database synchronization, the lack of digital payment integration, and the application's limitations on the Android platform. Based on these limitations, future development should incorporate real-time databases for more responsive updates, incorporate secure digital payment features, and improve platform accessibility. Further studies are recommended to address these issues.

In conclusion, this study demonstrates that the Waterfall optimization method can still be used to create a stable car reservation system that improves user experience and operational efficiency. These findings will support further research on car reservation systems and provide a foundation for continued innovation in digital service solutions for coffee shops.

REFERENCES

Dennis, A., Wixom, B. H., & Tegarden, D. (2015). *Systems analysis and design: UML version 2.0*. John Wiley & Sons.

Hakim, A., Fadillah, N., & Sari, P. (2023). Implementasi autentikasi OTP pada aplikasi pemesanan menggunakan WhatsApp Gateway. *Jurnal Teknologi Informasi, 14*(2), 112–119.

Hamdani, R., & Sanjaya, A. (2025). Penerapan sistem reservasi digital pada industri kuliner. *Jurnal Sistem Informasi dan Bisnis, 9*(1), 33–41.

Hidayat, M., Fathurrahman, A., & Pramesti, D. (2023). Evaluasi performa sistem reservasi tanpa basis data real-time. *Jurnal Rekayasa Perangkat Lunak, 5*(2), 78–85.

Kurniawan, D. (2020). Perancangan sistem informasi menggunakan model UML dan ERD. *Jurnal Informatika Global, 11*(3), 145–153.

Lestari, R., & Gunawan, T. (2022). Analisis sinkronisasi data pada aplikasi reservasi tanpa basis data real-time. *Jurnal Sistem Informasi dan Teknologi, 8*(1), 55–63.

Mandasari, R. (2020). The impact of online learning on student academic performance. *Journal of Education and E-Learning, 7*(2), 45–53.

Myers, G. J., Sandler, C., & Badgett, T. (2012). *The art of software testing* (3rd ed.). Wiley.

Nugroho, A. (2016). Penerapan model Waterfall dalam pengembangan perangkat lunak. *Jurnal Teknologi Informasi dan Ilmu Komputer, 3*(1), 12–20.

Permana, Y., & Alfahmi, R. (2022). Pengujian aplikasi mobile menggunakan metode black-box. *Jurnal Teknologi dan Sistem Informasi, 6*(1), 55–62.

Pressman, R. S., & Maxim, B. (2020). *Software engineering: A practitioner's approach* (9th ed.). McGraw-Hill.

Prasetyo, A., & Laksana, G. (2021). Analisis kebutuhan dan pemodelan UML pada pengembangan aplikasi layanan publik. *Jurnal Teknologi Informasi dan Komputer, 4*(2), 89–98.

Putra, P., & Arifin, D. (2021). Digital reservation systems and operational efficiency in hospitality industry. *Journal of Hospitality Technology, 11*(2), 66–75.

Qiong, H. (2017). A brief analysis of perception and learning behavior. *International Journal of Social Science and Humanities, 5*(1), 55–59.

Rahmawati, M., Wijaya, A., & Tania, K. (2020). Analisis kinerja RESTful API pada aplikasi mobile berbasis Android. *Jurnal Teknologi dan Sistem Komputer, 8*(3), 210–216.

Ramadhan, R. (2021). Online-based learning and its impact on student learning effectiveness in Malang. *Journal of Digital Education, 2*(1), 33–41.

Santoso, R., & Wibowo, E. (2019). Penerapan UML sebagai alat bantu perancangan sistem informasi. *Jurnal Sistem Informasi dan Sains Teknologi, 2*(1), 45–52.

Siahaan, M. (2021). Pengaruh kuliah daring terhadap pemahaman mahasiswa selama pandemi. *Jurnal Pendidikan Modern, 4*(2), 122–130.

Sommerville, I. (2016). *Software engineering* (10th ed.). Pearson.

Sugianto, A., & Prabowo, Y. (2021). Evaluasi penggunaan metode Agile dalam pengembangan aplikasi mobile. *Jurnal Informatika dan Teknologi, 9*(1), 99–108.

Syahputra, D., Ramadhani, L., & Yusuf, A. (2023). Penerapan sistem reservasi digital untuk efisiensi layanan restoran. *Jurnal Teknologi dan Inovasi Digital, 7*(1), 23–31.

Susanto, H., & Purwanto, D. (2021). Efektivitas pengujian black box dalam validasi aplikasi mobile. *Jurnal Rekayasa Perangkat Lunak, 4*(2), 77–85.

Trisnadoli, D., Santika, P., & Lestari, R. (2023). Dampak teknologi digital pada peningkatan kualitas layanan kafe. *Jurnal Industri Kreatif dan Teknologi, 5*(2), 77–84.

Widiyanto, A., & Putro, S. (2022). Implementasi RESTful API dalam pengembangan aplikasi mobile berskala besar. *Jurnal Informatika dan Rekayasa Sistem, 10*(4), 255–263.

Wiastuti, R., Mardiana, I., & Setiawan, T. (2025). Pengaruh digitalisasi layanan terhadap kepuasan pelanggan kafe. *Jurnal Ekonomi dan Bisnis Digital, 3*(1), 15–28.