



Implementation of Android-Based Salon Booking Application for Customer Service Optimization

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Abstract: Most beauty salons are still using manual system to manage booking and customer, which made queue long, record incorrect and customer frustrated. Purpose of this research is to create an Android based Salon booking application for IKA Salon (which fulfill operational needs) and thus increase service quality and enhance the customer satisfaction. This study is done by use of Research and Development (R&D) model which consists needs analysis followed by design development system testing. We built it using Flutter (the framework) and Firebase for real-time storage and management of data. It offers user registration, login, service scheduling(booking), customer data management etc Key findings show that application can resolve some manual problems like also queuing, scheduling improvement and recording errorless operation. Additionally, the app brings major improvements in operations and client happiness. Serving mobile service booking and management of schedule, customer data in real-time makes the application play an optimising role for a salon and help its growth of business.

Keywords: Information System; Salon Booking; Firebase; Mobile Application; Real-time Data Management; Customer Relationship Management.

1. Introduction

The beauty industry plays a vital role in the service sector, yet many beauty salons still rely on outdated manual systems to book appointments and manage customer interactions. These systems are often riddled with inefficiencies such as long wait times, scheduling conflicts, and inaccuracies in customer data management. These challenges not only hamper operational efficiency but also contribute to customer dissatisfaction, as highlighted by Alavi *et al.* (2020), who found that manual booking methods significantly limited service delivery and degraded customer experience [3]. Addressing these challenges is becoming increasingly important, especially in the ever-evolving and competitive beauty industry landscape. The rapid advancement of mobile technology presents an unprecedented opportunity for salons to modernize their operations and transition to digital platforms. Mobile applications, which combine convenience with functionality, have been recognized as powerful tools to streamline processes and enhance user experiences. Studies such as those by Lee *et al.* (2021) and Zhang & Wang (2022) emphasize the potential of digital booking systems in improving operational efficiency and customer satisfaction [1][2]. However, most of these studies focus on web-based platforms, leaving a gap in research on mobile app solutions tailored specifically to the beauty industry.

Flutter, a cross-platform development framework, and Firebase, a cloud-based backend service, have emerged as leading technologies for building intuitive and efficient mobile applications. Flutter's versatility enables developers to create applications with seamless user interfaces and robust functionality across multiple operating systems. Firebase complements this by providing real-time data synchronization, secure authentication, and reliable storage solutions, making it an ideal backend for salon management systems [9][10]. Together, these technologies empower businesses to integrate innovative features such as real-time booking updates, customer data management, and scheduling tools, thus transforming traditional salon operations into a more streamlined and customer-focused experience. This study focuses on the development of an Android-based salon booking application tailored to the operational needs of IKA Salon, a beauty salon seeking to address the limitations of its manual systems. The application aims to provide essential features, including user registration, secure login, service booking, scheduling, and customer data management. By integrating real-time updates through Firebase and leveraging Flutter's cross-platform capabilities, the application seeks to improve operational efficiency, reduce human errors, and enhance customer satisfaction.

Digital transformation is no longer an option but a necessity for businesses across industries, including beauty salons. Kim *et al.* (2023) argue that the adoption of digital solutions can significantly enhance operational efficiency and customer reach, particularly for small and medium-sized enterprises (SMEs) like beauty salons [4]. Moreover, Singh & Kaur (2022) highlight the potential of location-based booking systems to further improve user experiences by offering personalized and convenient services [5]. For beauty salons, integrating these technologies can bridge the gap between traditional operations and modern customer expectations, thereby fostering loyalty and repeat business. Despite these advantages, the transition to digital platforms comes with its own set of challenges. Lopez *et al.* (2023) identify resistance to change, lack of technical expertise, and the high cost of implementation as some of the barriers faced by SMEs during digital transformation [13]. For beauty salons like IKA Salon, overcoming these challenges requires tailored solutions that are cost-effective, user-friendly, and aligned with their specific operational needs.

Mobile applications have become indispensable in the service industry, enabling businesses to enhance efficiency, improve accessibility, and deliver personalized customer experiences. Guzsvinecz *et al.* (2020) emphasize that mobile technology can increase user engagement and streamline processes in diverse, including customer service management [6]. Furthermore, Wang & Li (2022) found that ease of use is a critical factor in the adoption of mobile applications, making user-centric design an essential consideration for developers [14]. Mobile applications offer several advantages. They eliminate the need for manual booking processes, allowing customers to book appointments, view service options, and select their preferred stylists directly from their smartphones. This reduces waiting times and scheduling conflicts, thereby improving overall customer satisfaction. Additionally, mobile applications provide salon owners with tools to manage schedules, track customer preferences, and analyze data for targeted marketing efforts. Such features align with the findings of Chen *et al.* (2022), who noted that digital solutions can significantly improve the performance of small businesses in the beauty industry [12].

The primary objective of this study is to develop a mobile application that addresses the specific needs of IKA Salon, enhancing both customer experiences and operational efficiency. By leveraging Flutter for cross-platform development and Firebase for real-time data management, the application aims to provide a seamless and reliable solution for booking and customer management. The inclusion of features such as secure login, real-time notifications, and detailed customer data tracking ensures that the application meets the demands

of modern salon operations. Moreover, the implementation of this application is expected to yield several tangible benefits. These include reduced waiting times, improved scheduling accuracy, enhanced customer satisfaction, and increased operational control for salon owners. The study also aims to demonstrate the scalability of such solutions, providing a model that can be adapted for other salons and service-based SMEs. Kumar *et al.* (2022) suggest that integrating advanced technologies like blockchain and biometric authentication could further enhance the security and reliability of similar applications in the future [8][7].

The beauty industry stands at the cusp of a digital transformation, driven by the growing demand for convenience and efficiency among customers. This study seeks to contribute to this transformation by developing an Android-based salon booking application tailored to the operational needs of IKA Salon. By addressing the limitations of manual systems and leveraging cutting-edge technologies, the application has the potential to set new standards in salon management. The findings of this study are expected to provide valuable insights for future research and development in the domain of digital solutions for small businesses, particularly in the beauty and personal care sectors.

2. Research Method

This research adopted a Research and Development (R&D) methodology inspired by the Design Science Research Methodology (DSRM) to develop and evaluate an Android-based salon booking application that addresses operational challenges at IKA Salon. The research began with a thorough problem identification phase, where interviews and observations were conducted with stakeholders from IKA Salon to uncover limitations in their manual booking system. Common issues identified included long queues, scheduling conflicts, and inaccurate customer data management, which significantly hindered operational efficiency and customer satisfaction [3][4]. Based on the findings from the needs analysis, specific objectives were established, and system requirements were defined. To visualize the application's architecture, interfaces, and database, Unified Modeling Language (UML) diagrams were employed, including use case diagrams, class diagrams, and sequence diagrams. These visual tools ensured a structured design approach, improving communication and clarity among the development team. The system design emphasized the integration of Flutter for front-end development and Firebase for back-end real-time database management and secure user authentication [9][10]. In the development phase, Flutter was utilized as the primary framework due to its capability to create responsive, cross-platform applications. The modular approach to development ensured scalability and facilitated the management of key features such as user registration, secure login, service booking, schedule management, and customer data handling. Firebase Realtime Database enabled real-time updates of booking and scheduling data, eliminating the delays and errors associated with manual systems. Additionally, Firebase Authentication provided robust security measures, including encryption and role-based access control, safeguarding sensitive user data [10].

Testing and evaluation were critical to the project's success. Functional and non-functional tests were conducted to ensure that all application features worked seamlessly under varying conditions. Functional testing verified the correct operation of the booking process, schedule management, and login system, while non-functional testing focused on performance metrics such as speed, load handling, and data security. User Acceptance Testing (UAT) involved surveys and interviews with salon staff and customers to gather feedback on the application's usability and impact. Insights gained from these tests informed iterative improvements, ensuring that the application met user needs effectively.

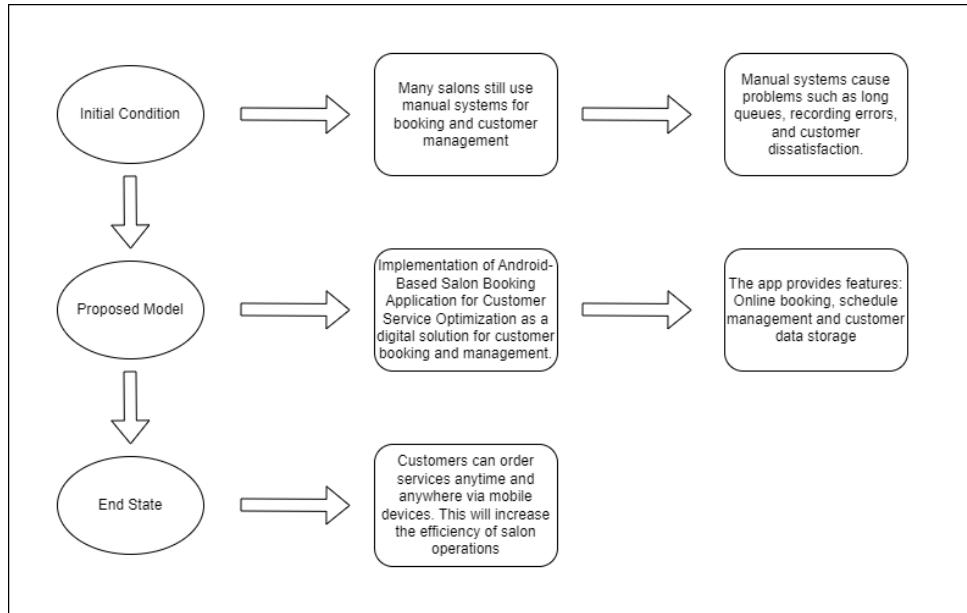


Figure 1. Research Framework

The research framework for the development of the Android-based salon booking application is illustrated in Figure 1. This framework depicts the transformation process from a manual booking system to a digital, application-based solution. It encompasses stages such as data collection through interviews and observations, system design with UML, application development using Flutter and Firebase, and comprehensive testing to validate functionality and user satisfaction. The methodology employed successfully bridged the gap between IKA Salon's traditional manual processes and the modern digital solution. The integration of Flutter and Firebase proved instrumental in delivering a scalable, user-friendly application tailored to the salon's needs. This structured approach not only addressed the salon's immediate operational challenges but also provided a foundation for future enhancements, such as advanced analytics and additional customer-centric features [1][3][4].

3. Result and Discussion

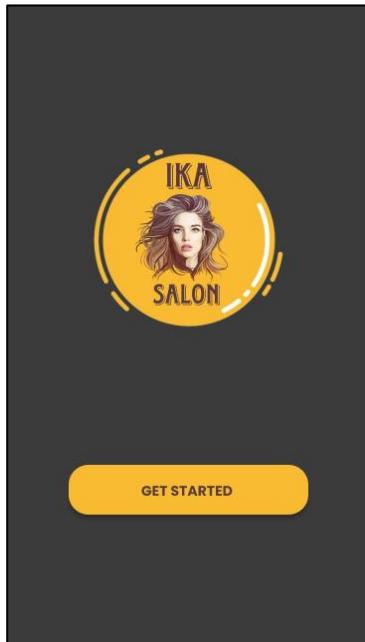
3.1 Results

The Android-based salon booking application has been successfully developed and implemented at IKA Salon, providing a comprehensive solution for managing appointments, customer data, and salon operations. The application boasts a user-friendly interface and efficient functionalities, including an integrated booking system that allows customers to easily browse available services, select desired treatments, choose preferred stylists, and book appointments seamlessly. This system efficiently manages appointment schedules, preventing conflicts and optimizing salon capacity. To ensure real-time data updates, the application utilizes Firebase Realtime Database, enabling salon staff to instantly access the latest schedules and customer information, thus eliminating delays and potential errors associated with manual systems. Furthermore, the application facilitates efficient customer data management, service history, and preferences, which allows for personalized services, targeted promotions, and improved customer relationship management. Firebase Authentication provides robust security measures, ensuring user data protection through end-to-end encryption and role-based access control, safeguarding customer privacy and maintaining data integrity. Additionally, the application incorporates a notification system to keep customers informed about booking confirmations.

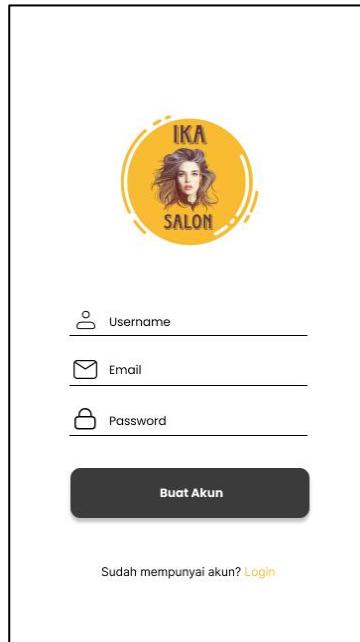
3.1.1 Program Implementation

The implementation of the Android-based salon booking application at IKA Salon has yielded significant improvements in operational efficiency and customer satisfaction. The streamlined booking process, real-time synchronization of data, and efficient customer management have resulted in reduced waiting times, minimized scheduling conflicts, and enhanced customer experience. The application has also enabled IKA

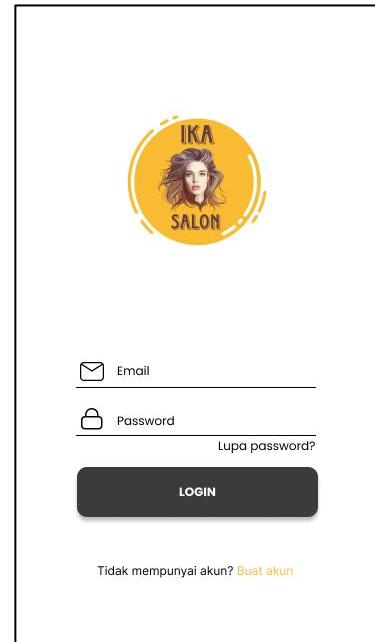
Salon to gather valuable customer data, providing insights into customer preferences and behavior, which can be leveraged for targeted marketing and service improvement initiatives.



(a) Splash Screen Page



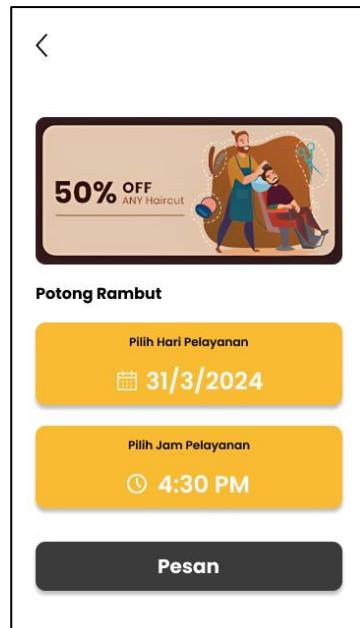
(b) Registration Page



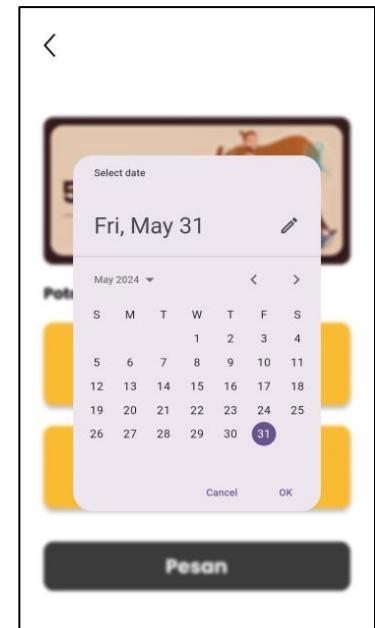
(c) Login Page



(d) Home Page



(e) Booking Page



(f) Date Selection Display

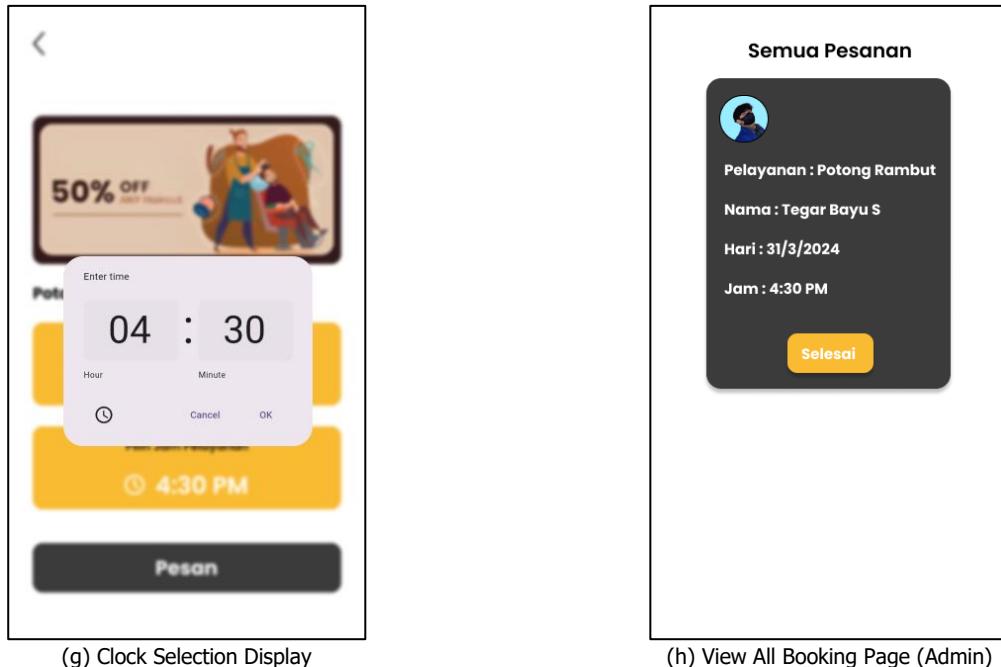


Figure 2. Program Implementation

Figure 2 illustrates the implementation of the Android-based salon booking application at IKA Salon, showcasing the primary interfaces that significantly improve operational efficiency and customer satisfaction. The application begins with the Splash Screen Page (a), which serves as the entry point, creating a professional and visually appealing introduction to the system. Users can proceed to the Registration Page (b), where new customers can securely create accounts, ensuring their data is stored efficiently within the database. Returning users access the system via the Login Page (c), which incorporates Firebase Authentication for secure and role-based access. The Home Page (d) acts as the central hub, providing users with an organized layout of services, promotions, and easy navigation to other features. The Booking Page (e) enables customers to select services, stylists, and preferred schedules seamlessly, supported by the Date Selection Display (f) and Clock Selection Display (g). These interfaces ensure accurate and conflict-free scheduling while improving user convenience. For administrative staff, the View All Booking Page (h) offers a comprehensive view of all customer appointments, facilitating efficient schedule management, quick updates, and conflict resolution. The components depicted in Figure 2 demonstrate the application's contribution to modernizing IKA Salon's operations. By integrating these features, the system streamlines the booking process, synchronizes data in real time, and enhances both customer experience and operational control. This implementation provides a robust foundation for further innovation and scalability.

3.1.2 Testing

Testing of the Android-based salon booking application was conducted through a series of functional tests covering all the main features of the application. Table 1 summarizes the test results, showing that all application functions are successfully implemented and run as expected.

Table 1. Application Function Testing

Function	Expected	Observation	Result
Register	Create account	Account created	Accepted
Login (Valid)	Access granted	User authenticated	Accepted
Login (Invalid)	Access denied	Error displayed	Accepted
View Services	Display list	Services shown	Accepted
Book Service	Create booking	Booking confirmed	Accepted
View All Bookings (Admin)	Display all user bookings	Displayed correctly	Accepted
Delete Booking (Admin)	Booking is deleted	Booking is successfully deleted	Accepted
Logout	Return to login screen	Successfully logged out	Accepted

Table 2. Application Testing on Various Smartphones

Smartphone	Specifications	Remarks
Google Pixel 7	RAM 8GB, Android 14, Google Tensor G2	Passed
Xiaomi Redmi Note 12	RAM 8GB, Android 12, Snapdragon 685	Passed
Vivo V21	RAM 8GB, Android 11, MediaTek Dimensity 800U	Passed
Poco X3 Pro	RAM 8GB, Android 11, Snapdragon 860	Passed

3.2 Discussion

The implementation of the Android-based salon booking application at IKA Salon has delivered measurable improvements in both operational efficiency and customer satisfaction. By streamlining the booking process and synchronizing data in real time, the application has significantly reduced waiting times and minimized scheduling conflicts. The user-friendly interface simplifies the process for customers to view available services, select their preferred stylists, and book appointments, thereby enhancing the overall customer experience. One of the standout benefits of the application is its ability to manage customer data effectively. It allows IKA Salon to maintain detailed records of customer preferences and service history, enabling personalized services and targeted marketing efforts. These capabilities align with the findings of Kim *et al.* (2021), who emphasized that personalization is a key factor in fostering customer loyalty within the beauty industry [11].

Additionally, the app's secure registration and login features have bolstered customer trust, ensuring that sensitive data is protected. The direct access provided for booking and browsing services has further improved the accessibility of salon offerings. This observation is consistent with Wang and Li (2022) research, which highlighted the critical role of user-friendly design in mobile app adoption within the beauty industry [14]. From an administrative standpoint, the application empowers salon staff with enhanced control and flexibility. The ability for administrators to view all bookings and delete or modify them when necessary has streamlined salon management. This feature mirrors findings from Chen *et al.* (2022), who identified digital solutions as vital tools for increasing efficiency in small businesses [12]. Despite these successes, some challenges have arisen during the implementation process, particularly with user adaptation. Older customers and staff who are less familiar with mobile technology have required additional support to fully utilize the application. This underlines the importance of providing adequate training and support, as suggested by Lopez *et al.* (2023), who highlighted similar issues in their study on digital transformation in small businesses [13]. While the Android-based salon booking application has demonstrated its value in improving operational workflows and customer interactions at IKA Salon, ongoing efforts are needed to address adaptation challenges and further optimize the system's impact. This implementation serves as a foundation for future advancements in digital transformation within the beauty industry.

4. Related Work

The development of digital booking systems and management applications for the beauty industry has been widely studied, forming a robust foundation for advancing technology adoption in this sector. These studies emphasize the potential of digital platforms to improve operational efficiency and customer satisfaction, which are crucial for service-based businesses. However, existing research often highlights certain limitations, such as a focus on web-based systems or the lack of integration with advanced mobile application functionalities and cloud-based technologies. Lee *et al.* (2021) developed a web-based booking system for beauty salons, demonstrating significant improvements in operational workflows and customer satisfaction. However, their research was constrained to web platforms and failed to consider the enhanced accessibility and real-time service delivery offered by mobile applications [1]. Similarly, Zhang & Wang (2022) emphasized the importance of user-friendly interfaces and real-time data management in Android applications for salon management. Despite their valuable insights, the integration of cloud storage systems, such as Firebase, which are critical for scalability and real-time updates, was not addressed [2]. Mobile applications have been recognized as transformative tools for enhancing engagement and operational processes. Guzsvinecz *et al.* (2020) demonstrated the effectiveness of mobile applications in improving user interactions and operational efficiency across various sectors, including consumer services [6]. Alavi *et al.* (2020) further highlighted the importance of integrating real-time databases into mobile applications, emphasizing their role in efficient service delivery and data accuracy [3].

Research into the digitalization of small businesses, including beauty salons, underscores its transformative potential. Kim *et al.* (2023) found that digital technology adoption enhances operational

efficiency and expands customer reach. However, their study lacked a specific focus on mobile applications tailored for salon operations [4]. Similarly, Singh & Kaur (2022) explored location-based booking systems, noting their ability to improve user experiences. However, their application within the beauty industry remains limited [5]. Emerging technologies, such as biometric authentication and blockchain, offer innovative approaches to enhancing salon applications. Putri *et al.* (2023) demonstrated how biometric systems can enhance customer authentication and service personalization [7]. Kumar *et al.* (2022) discussed the potential of blockchain to secure customer data and ensure data integrity, proposing its adoption in management systems [8]. Payne *et al.* (2023) further elaborated on privacy considerations in biometric systems, emphasizing the balance between security and user convenience [22]. Additionally, Elangovan *et al.* (2022) reviewed blockchain applications in healthcare, which can serve as a foundation for integrating similar technologies into salon management for secure data handling [23].

Recent advancements in artificial intelligence (AI) and data-rich technologies offer new opportunities for salon applications. Kim (2023) analyzed AI adoption in beauty applications, identifying its potential to improve service delivery and customer engagement [16]. Georgievskaya (2023) explored how AI could inadvertently adopt human biases in the cosmetic skincare industry, underlining the importance of ethical considerations in its integration [21]. Sridhar & Fang (2019) emphasized the role of data-driven environments in shaping digital marketing strategies, which can be adapted for enhancing beauty salon operations [19]. Roy *et al.* (2016) examined the interplay between convenience and satisfaction in service delivery, emphasizing the importance of seamless and accessible applications for enhancing customer experiences [20]. Pambudi & Dwinata (2023) further validated the increasing consumer intent to adopt AI technologies in the beauty sector, reflecting a growing acceptance of these tools among users [17]. Priya *et al.* (2019) highlighted that convenience and satisfaction remain critical drivers of customer engagement in beauty services [18].

Despite these advancements, significant gaps remain in the development of mobile applications specifically designed for beauty salon management. Notably, the integration of Firebase with Android-based applications has not been adequately explored. Firebase offers robust features, including real-time data synchronization, secure user authentication, and scalability, making it an ideal solution for managing complex salon operations. This study aims to address these gaps by developing an Android-based salon booking application tailored to the operational and customer management requirements of IKA Salon. By incorporating Firebase and leveraging advanced technologies, such as biometric authentication and blockchain, the proposed solution seeks to enhance operational workflows and improve customer satisfaction. This research contributes by bridging gaps in existing literature and offering a practical, scalable solution optimized for modern salon operations.

5. Conclusion

The development and implementation of an Android-based salon booking application have effectively addressed operational challenges at IKA Salon. Transitioning from a manual booking system to a digital platform has significantly improved service efficiency, customer management, and overall business operations. The application has streamlined the booking process, reduced waiting times and scheduling conflicts, and enhanced customer data management to provide personalized services. Additionally, real-time notifications have improved communication with customers, enhancing operational efficiency and optimizing resource utilization. The success of the application demonstrates the capability of mobile technology to transform small business operations, particularly in the beauty and personal care sector. Tailored digital solutions effectively address specific business needs, improving both operational efficiency and customer satisfaction. Future enhancements could include the integration of loyalty programs to boost customer retention, the use of data analytics tools to generate insights into business performance and customer trends, and the addition of an inventory management module to streamline stock control. These features would further expand the application's functionality and support business growth. The implementation at IKA Salon underscores the potential for adaptation to other salons and service-based businesses. Customizing the application to meet diverse operational requirements can drive modernization across similar industries, supporting efficiency and customer satisfaction on a broader scale.

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