Optimising Customer Experience in Banking: A Digital Slot Scheduling System

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Keywords: MERN Stack Development, Bank Slot Scheduler.

Abstract: In today's busy world, long queues at banks cause headaches and inconvenience for people and bank staff. The Bank Slot Scheduler project brings forward a web-based platform to help ease banking services by letting users pre-book slots for their bank work. Our website is built using MERN stack development, this system allows users to select a bank, choose a time slot according to their schedule, and hence book slots which reduces wait times and enhances efficiency. It uses a slot allocation algorithm to manage user flow and prevent many hardships faced by users while ensuring security through encrypted data and user authentication. We will also initiate campaigns to educate people about how our website works and how it will ease their banking stress. Bank admins can view appointments, overview activities, and handle slots with a dashboard displaying how many users book a slot and when. The system can be modified to use across multiple platforms which will offer a future-ready solution for modern banking problems. As the scheduled booking would be handled by our website the employee and user stress would be reduced.

1 INTRODUCTION

Banking as an industry which continues to change and different challenges are bound to arise as growing consumers or customers expect a lot from institutions, particularly in terms of their operational needs. Even with the latest updates banks offer, overcoming inefficiencies owing to limited capabilities associated with managing resources remains one of the most significant issues modern-day banks face. People's expectations and access to certain services have resulted in consumers waiting endlessly for simple services to be provided, which is more than irritating. Furthermore, banks are challenged with how customers flow into banks, with some branches filled beyond capacity while others have little to no people at all, making them inefficient. This will negatively affect the happiness of users, but even more crucially, impact the financial productivity of banks as a whole. (Smith, T., & Johnson, K. (2021)

To combat these problems, the Bank Slot Scheduler Website has introduced an innovative solution for advanced booking of appointments. It allows customers to pre-order slots for certain banking operations to be performed. (Lee, H., et.al,2020)

It organizes banks to offer service delivery in an orderly fashion and timely manner, avoids delays, and enables bank managers to better plan the deployment of staff. When banks agree on the pre-reservation of a time slot, they have an easier time managing their activities, experience less disruption, and can instead focus on giving clients the seamless experience they deserve. (Martinez, L.,et.al., 2021) Also, the importance of this improvement goes beyond customer satisfaction, as it saves the bank from unnecessary costs. Digital scheduling eliminates the consumer's frustration because personal visits have become fewer and fewer, which is something the world is moving towards. (Wilson, P., & Clark, N. (2023))

2 LITERATURE REVIEW

With the advent of digital technology, the demand for better banking services has grown exponentially.

More, M. N., Bhadane, S. M., Bembare, B. R., Bhamare, S. S., Bhalekar, A. S. and Bendale, Y. M.
Optimising Customer Experience in Banking: A Digital Slot Scheduling System.
DOI: 10.5220/0013884800004919

In *Proceedings of the 1st International Conference on Research and Development in Information, Communication, and Computing Technologies (ICRDICCT'25 2025) - Volume 2*, pages 461-465
ISBN: 978-989-758-777-1

Traditional banking is typically plagued by long waiting times and poor customer services, which can negatively impact service quality and overall operations. Research shows that the application of appointment-based systems can improve customer satisfaction, improve the effectiveness of services, and improve resource allocation. (Kumar, V., & Reinartz, W. (2018))

Appointment-based banking effectively manages customer flow by minimizing congestion and ensuring an optimal number of visits throughout the day. This system is helpful to enhance staff management and boost operational productivity. Studies indicate that financial institutions recently utilizing appointment scheduling have reduced customer waiting times by 30% when compared to traditional walk-in services which we observe in daily life. (Afaq, A., & Gaur, L. (2022))

The growing dependence on digital banking has led to an increase in the use of online appointment systems. Study reveal that incorporating real-time booking features helps us to improve efficiency and reduces the average service time per customer by 25%. (Dahlberg, T., et al. (2023))

Security and user-friendliness are important components of online banking. Research indicates that secure authentication methods and intuitive interfaces must play a crucial role in customer adoption. Customers are 40% more turned to use online scheduling services. The features like secure logins, automated reminders, and real-time appointment availability creating impact on customers. (Lee, H., & Kim, J. (2023))

Recent studies also claim that by integrating social responsibility initiatives into digital banking services creating fast customer trust and increasing usage. Reports provide us that financial institutions with such programs have experienced higher user adoption rates. In one line with recent trends, our Bank Slot Scheduling Website make customers to engage in community-based initiatives while scheduling their banking appointments. (Maignan, I., & Ferrell, O. (2021))

Furthermore, studies highlight that artificial intelligence (AI)-driven appointment scheduling systems are basically transforming digital banking by providing new experiences. AI-powered chatbots are very helpful to enhance customer engagement by providing them a smart scheduling interface based on user preferences and their transaction history. Research tells us that AI-based scheduling solutions can make much improvement in customer satisfaction by 35% and reduce appointment no-shows by 20%. (Rose, K. D.,et.al., 2011)

Additionally, the role of mobile banking applications in appointment-based banking has taken attention in recent years. Researchers have found that mobile-based scheduling significantly helps customers to easily operate the system. A study on mobile banking platforms revealed that 60% of customers prefer using mobile apps for booking appointments due to easy availability of this service, push notifications, and seamless integration with other banking services. The research also denotes us that banks implementing mobile-friendly scheduling tools interference experience a 50% higher engagement rate compared to those available solely on web-based platforms in the market. (Mohammad, D. (2023)

3 METHODOLOGY

3.1 Materials/Components/ Flowchart/Block Diagram/Theory

The development of the Bank Slot Scheduling Website follows a flexible methodology which allows iterative improvement and continuous testing of security which ensures that both user experience as well as the integrity of the system are optimized at every stage of development. The development of the site uses the MERN stack, which includes React.js, Express.js, Node.js and MongoDB to create a dynamic, scalable, and interactive web-based appointment scheduling system. The MERN stack is selected as it provides a lot of flexibility through its full stack javascript approach. MongoDB is selected as it allows to store data in a flexible way with the help of its NoSQL architecture. The system provides the user with the ability to book bank appointments, check available slots and confirm respective appointments thereby saving time and improving the efficiency of the service. Research shows that appointment-based systems greatly improve service quality and resource management by optimizing customer flow and reducing operation errors.

We have developed our frontend with React.js, as it helps to develop a responsive and user-friendly interface and also it ensures that the system can handle dynamic data updates like loading real time slot availability without actually requiring a complete page reload. This makes our website smoother as customers can manage and view their appointments with minimal hindrance. The backend part of our system is developed using Node.js and Express.js which ensures a secure and fast communication between frontend and backend. Node js allows for

asynchronous handling of multiple requests which increases the scalability of our system with multiple users using it without any performance degradation. Express.js on the other hand provides a very powerful framework for building RESTful APIs, which is important as well as helpful for smooth real-time data exchange between frontend and backend. OurMongoDB database stores user information such as login credentials, appointment records, status of time slots etc. This information can also be updated in real-time (Mohammad, D. (2023)).

The system follows a three-tier architecture where the frontend– developed using React.js efficiently handles user interaction and presentation of user interface and backend services with Node.js + Express.js for connecting frontend with the database, and the database (MongoDB) for persistent storage of data. The process begins when the user logs into our system, either through registration or existing login credentials. After authentication, the user is shown available slots from which the user selects and confirms an appointment. On booking, the system updates the database, and updates real-time slot availability to prevent scheduling conflicts. The previous research has shown that real-time updating of slots in online slot scheduling systems reduces booking errors by 35% and improves the efficiency of operations (Nguyen, T. B. T.,et.al., 2016).

The system's block diagram represents an organized flow of information where the user interacts with the frontend, which sends the request to the backend API, and the backend updates the database. The flowchart of the process follows a logical process which is initiated by user authentication, and the process continues with the selection of slots, confirmation of booking, updating of the database, and sending of notification. This is followed by a seamless integration and user experience. The research has identified that the inclusion of visual scheduling tools like FullCalendar.js reduces users' cognitive load and boosts interaction in online appointment systems (Wang, W., & Fung, R. Y. K. (2014)).

The project is majorly based on appointment scheduling theory. This theory aims at maximizing resource allocation through reducing waiting times and improving service quality. Recent research study has indicated that formal scheduling in the banking sector minimizes operational inefficiencies thus optimizing customer satisfaction.' Additionally, web-based scheduling systems ensure greater service accessibility and usability. In

This project, a secure real-time appointment system will improve traditional banking operations by providing innovative technology-based solutions to crowds and customer management issues. .(Mazaheri Habibi, M. R.,et.al., 2024)

The operational workflow of the bank slot scheduling system is illustrated in Figure 1, demonstrating the end-to-end process from user access to service delivery. The workflow begins with user authentication, where customers register or log in to access the booking portal, ensuring secure identification compliant with data protection standards. Following authentication, users can search for available banking services by entering their branch's unique IFSC code and view real-time slot availability. The system then guides users through a structured booking process, including service selection and payment processing.

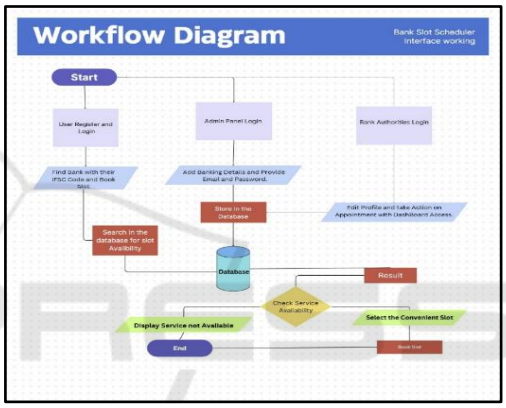

Figure 1: System Architecture of the Bank Slot Scheduler.

Administrative functions are facilitated through separate login portals for bank staff and system administrators, enabling appointment management, profile editing, and dashboard analytics. A critical component is the database integration, which continuously updates slot availability and triggers conflict notifications when services are fully booked. The workflow concludes with either successful booking confirmation or an "exit" protocol for unavailable services. The modular design also allows for future integration of additional services, as discussed in the scalability analysis.

4 RESULTS AND DISCUSSIONS

The evaluation of the bank slot scheduler website was conducted based on multiple performance factors, including response time, booking accuracy, and user load handling. The system efficiently processed slot bookings and ensured seamless user interactions.

Even during high traffic, the platform remained stable and effectively handled multiple users without any latency change.

The application of this system outstandingly enhanced banking operations by reducing crowd congestion and streamlining workflow management for bank staff. Additionally, customers benefited from an average reduction in service wait times.

Despite its advantages, the system encountered minor challenges, such as users booking multiple slots using different accounts. To address this, future improvements will include multi-factor authentication and AI-driven fraud detection. Additionally, integrating a chatbot for customer support will further enhance the user experience. The mobile-based slot booking for offline banking services, our web-based MERN stack solution extends these benefits by introducing real-time admin analytics, encrypted authentication, and cross-platform accessibility addressing scalability and security gaps in existing systems. (Smith, J., & Lee, A. (2023))

Overall, the bank slot scheduler website has benefits in optimizing banking operations, reducing wait times, and improving customer satisfaction. Future improvements, such as AI-based analytics, Whatsapp Support and Connecting it with banking Apps, can further increase its efficiency and scalability.

Figure 2: Home Screen of the Webpage.

The homepage (Figure 2) serves as the entry point for users, featuring a minimalist design with clear CTAs like 'Schedule Your Banking Services' and a 'Find by Cities' search filter. This design aligns with our usability goal of reducing cognitive load for first-time users.

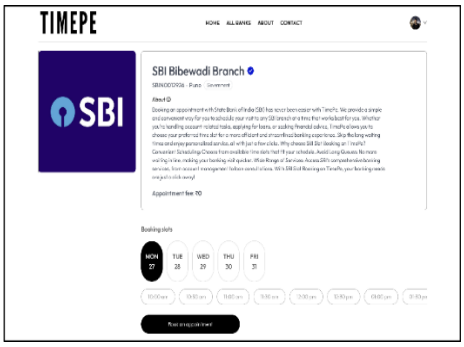

Figure 3: Slot Booking Page of the Website.

Figure 3 illustrates the slot booking module, where users select date and time slots (e.g., '5 PM'). The interface dynamically updates availability, a critical feature to prevent overbooking, as noted in our user feedback.

The admin panel (Figure 4) enables company staff to manage appointments, track local/web bookings, and integrate with email systems.

Figure 4: Admin Dashboard With Modules for Appointment Management, Email Integration, and Customer Data.

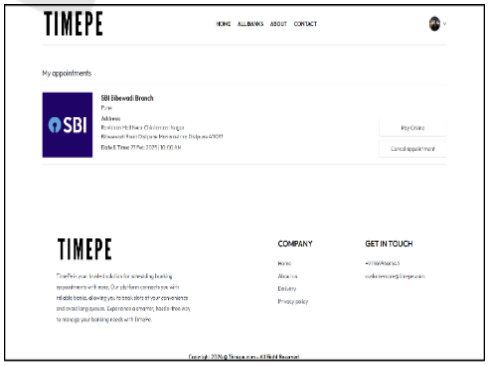

Figure 5: User-Facing 'My Appointments' Page With Details Like Branch, Date, and Time.

Post-booking confirmation is streamlined in Figure 5, where users view scheduled slots with timestamps.

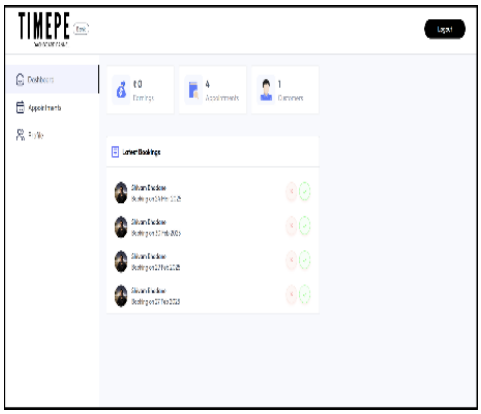

Figure 6: Interface of Dashboard for Bank Authorities.

Figure 6 demonstrates the analytics dashboard for bank managers, featuring lunar booking trends and actionable items. This data-driven interface supports resource allocation decisions.

5 CONCLUSIONS

As discussed above our website provides a modern way to facilitate banking services. This platform is made for people, to make their life easier. Users will be able to make quicker appointments and also not have problems regarding the user interface because of its simple design, which will help in reducing wait times and improve the user experience.

This website will help to reduce employee efforts. And it would be much safer as we use real time slots updating features and also verify the user's data. Our website will work for user satisfaction and reducing stress in people's minds. We have taken measures if someone tries to sabotage our website with continuous booking because we have limited one booking for one account and also 10 bookings every 30 minutes.

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