Wisdom Dental: A Digital Booking and E-Commerce Platform to Enhance Operational Efficiency, Predictive Analytics & Time Series Forecasting at Wisdom Dental Clinic in Pinagbuhatan, Pasig City

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ABSTRACT

The study titled "Wisdom Dental: A Digital Booking and E-Commerce Platform" aims to improve the daily operations and management system of Wisdom Dental Clinic. The website uses predictive analytics and time series forecasting to analyze past booking and sales data, helping the clinic predict future demand, manage schedules, and track product inventory. It combines online booking, product purchasing, and report generation into one user-friendly system that supports both patients and administrators in managing clinic transactions efficiently. Wisdom Dental Clinic is located in the community of Pinagbuhatan, Pasig, and is known for offering quality dental care but still depends on manual and offline processes, which the system aims to improve through a digital platform for online appointments and dental product purchases. The system was created using PHP, MySQL, HTML, CSS, and JavaScript to ensure functionality, usability, and security in every feature and infinityfree website for online hosting. The study used a quantitative research method to evaluate the performance and user satisfaction of the system. The project followed the Waterfall Model, which includes planning, design, development, testing, and implementation stages. The evaluation was based on the ISO 25010 Software Quality Model, measuring functionality, reliability, usability, efficiency, and security. The study involved both user and technical respondents, who evaluated the system using a four-point Likert scale, with results analyzed through frequency, percentage, and weighted mean. The findings showed that the system achieved a high level of acceptance from respondents. It effectively improved appointment booking, product transactions, and report generation, making operations more accurate and organized. The researchers concluded that the system met its objectives and helped improve service quality and record management. It is recommended to include mobile responsiveness, automatic appointment reminders, and secure online payment options for future enhancement.

Keywords: Wisdom Dental, Predictive Analytics, Time Series Forecasting, Online Booking, E-Commerce Platform, Waterfall Model, ISO 25010, PHP, MySQL, User Satisfaction.

INTRODUCTION

Developing a digital platform for Wisdom Dental Clinic to enhance its operations is the main goal of this project. The platform would make it simple for patients to browse offered treatments, schedule appointments online, and buy dental supplies. In order to simplify patient care, the system has functions like automatic scheduling, reminders, and payment processing. The technology improves patient involvement, lower mistakes, and streamline administrative activities by tackling present issues including scheduling conflicts and ineffective workflows. The ultimate objective is to demonstrate how digital technology can boost the clinic's competitiveness and efficiency while enabling it to deliver better, more convenient treatment in a technologically advanced healthcare environment.

Digital technologies are being used more and more by dental clinics to manage patient data. Electronic patient records, or EPRs, are growing in popularity as technology develops. They contribute to enhancing patient care and treatment safety. (Cerna, J.D. et al., 2022). In addition to improving patient care, the management system

may increase revenue for the clinic. It makes things simpler and more effective for dentists by giving them more control over day-to-day operations (Cerna, J.D. et al., 2022). Nowadays, it's not only technology that needs to advance, but also modern marketing, in order to keep up with the developments in various industries and sectors. Modern marketing should employ digital technologies to interact with clients in a more clear and effective manner. Dental clinics must be active online to attract a larger audience. They may improve their online presence for prospective patients to locate them on social media and websites by implementing intelligent digital marketing (Wahyudi, A. et al., 2023).

Wisdom Dental Clinic is located in the community of Pinagbuhatan, Pasig. It has developed a reputation for offering high-quality dental care. The clinic's current operational strategy, however, mostly relies on offline and conventional technology. Numerous issues have resulted from this, such as ineffective patient management, scheduling conflicts, and a lack of an integrated platform that allows clients to pursue dental services and make online purchases. The clinic intends to create a digital booking and e-commerce platform in order to solve this. Patients will be able to conveniently see services, schedule appointments, and even buy dental items online using this platform. The clinic may increase productivity and improve patient satisfaction by automating reminders, simplifying scheduling, and allowing online payments. In the end, this platform will improve clinic operations and enhance patient convenience.

A study is undertaken with the aim to develop a digital platform for Wisdom Dental Clinic to improve appointment scheduling, patient management, and online sales of dental products, providing a more efficient and convenient service experience for both the clinic and its patients.

The study is to design and implement an integrated digital booking and e-commerce platform. Additionally, the platform incorporates predictive analytics and time series forecasting to support smarter resource planning and decision-making. Specific objectives are to design and develop the following:

- a comprehensive digital booking and e-commerce platform.
- a platform to enhance operational efficiency by streamlining appointment scheduling processes.
- optimize patient management by integrating digital tools for tracking records, communications, and follow-ups.
- ensure compliance with ISO 25010 standards for software quality, focusing on usability, reliability, and performance of the system.

Scope

The study centers on the development and implementation of a digital booking and e-commerce platform for clinical operations. It encompasses several key components aimed at enhancing the clinic’s operational efficiency and patient experience. The system includes an Online Appointment Booking System that allows patients to schedule, reschedule, or cancel appointments for a day and for incoming day, weeks, month and year, through a web or mobile interface.

It also includes features such as a Patient Loyalty Program, Patient Program, Treatment Phase monitoring, and Waiting List Notification to further enhance patient management and clinic operations.

LIMITATION

The platform is limited to a single-branch setup, with no current support for multi-branch functionality unless further development is undertaken. It is also dependent on a stable internet connection, as offline capabilities are not included in this phase. Payment gateway integration is not supported and advanced features like installment payments or international transactions and other online payments are not available initially, like credit/debit cards. The e-commerce module is also limited to basic inventory management, offering simple stock tracking without advanced forecasting or supply chain features. Lastly, while the platform includes essential data protection mechanisms, full compliance with complex health data privacy regulations such as HIPAA may require additional future enhancements to meet comprehensive legal and industry standards.

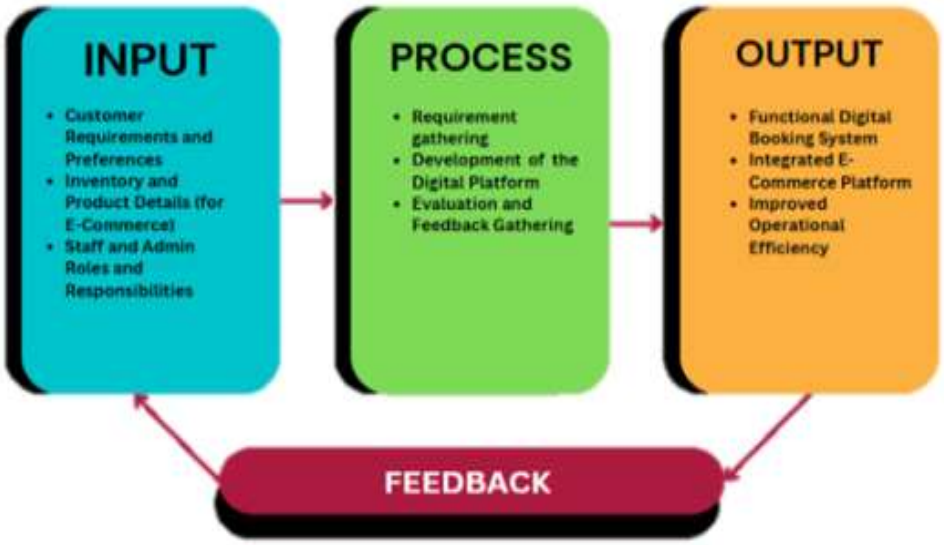
THEORETICAL FRAMEWORK

This study is anchored on predictive analytics, time series forecasting, and the ISO 25010 Software Quality Model. Predictive analytics and time series forecasting help the system analyze past booking and sales data to identify patterns and predict future trends in appointments and product demand. These tools allow the clinic to plan resources, manage inventory, and monitor performance effectively. The ISO 25010 model serves as the standard for assessing the website's overall quality, focusing on functionality, reliability, usability, efficiency, and security. It ensures that the system works properly, is easy to use, performs efficiently, and protects user data. Together, these frameworks support the development of a reliable, accurate, and user-friendly platform for Wisdom Dental Clinic.

CONCEPTUAL FRAMEWORK

The researchers define the study's framework as utilizing the IPO Model. This diagram's primary focus is on the input processing that yields the outcomes. It includes the output or desired result, the processes or procedures, the feedback, and the required input or requirements.

Figure 1: Input-Process-Output Model



Input

- The input includes customer preferences and feedback, product and inventory information, and staff roles that provide essential data for creating the system.

Process

- The process involves system analysis, design, development, and continuous monitoring to ensure the effective function of the online booking and e-commerce modules.

Output

- The output delivers a digital appointment booking system, an e-commerce platform for dental products, and improved operational efficiency for Wisdom Dental Clinic.

Review Of Related Literature

The dentistry field is changing dramatically, going beyond conventional local marketing and word-of-mouth recommendations. The competition is intense since there are more than 300,000 dental clinics worldwide, and the industry is expected to be worth $36.3 billion by 2023. Dental offices need to embrace digital change, especially with regard to online scheduling systems, in order to remain competitive. For dental offices hoping to

succeed in a cutthroat industry, using online scheduling is not only convenient but also essential. Dental clinics may set themselves up for long-term success by boosting patient satisfaction, increasing operational effectiveness, and bolstering their internet image (Saini, K., 2025).

Digital Health Platforms and Their Effect on Clinic Workflow in Urban Settings found that digitizing appointment systems, patient records, and payment processes significantly reduced administrative workload and wait times in urban health clinics. Their findings align with the current research's objective of improving operational efficiency through digital transformation at a local dental clinic (Lim et al. 2019).

Synthesis

The reviewed literature highlights the increasing adoption of digital platforms in dental clinics to enhance efficiency and patient satisfaction. International studies emphasize the importance of online scheduling, calendar syncing, and patient self-service portals in improving clinic operations. Researchers such as Saini (2025) and Vandenberghe (2020) note that digital tools and innovations help clinics stay competitive by improving accuracy and service speed. Similarly, Liu (2024) discusses how data-driven systems and AI contribute to better decision-making and customer experience in dental practices.

Local studies, including those by Desoyo (n.d.) and Urot et al. (n.d.), support the benefits of digital appointment systems in the Philippines by reducing no-shows and streamlining clinic workflows. While current systems like My Dental Clinic App and PIMSPlus help manage basic scheduling and records, they lack advanced analytics and visual reporting. The proposed Wisdom Dental Clinic System addresses these gaps by offering visual dashboards, activity logs, and predictive insights for better operational planning. Overall, both local and international research agree that adopting digital appointment systems enhances clinic performance, patient engagement, and overall service quality.

METHODOLOGY OF THE STUDY

The design of the study is quantitative in nature. The process of gathering and evaluating numerical data is known as quantitative research. The study employed an Applied Research Design with the goal of creating a realistic digital solution to enhance clinical operations.

Direct measurements of variables and information collected are accomplished using data collection methods. Primary data for the study is gathered using an assessment procedure. A rating scale is used to quantify, characterize, and interpret the assessment outcomes in order to measure the effectiveness, performance, and quality of the study output. Similarly, secondary data is acquired through library resources and online research into related literature and studies.

An information system or software product can be efficiently outlined, designed, developed, tested, and ultimately deployed using the System Development Life Cycle (SDLC) project management approach.

Figure 2: SDLC Waterfall Model

In this study, the Waterfall Model is employed because it follows a precise, step-by-step procedure that facilitates system planning, development, and completion. This approach enables the team to concentrate on one stage at

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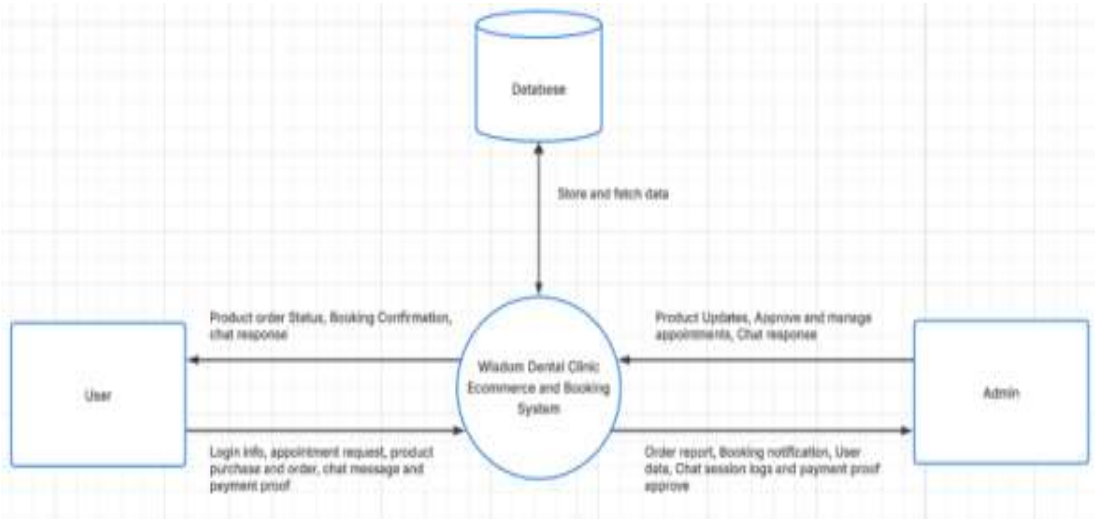
a time, including requirements analysis, system design, implementation, testing, development, and maintenance, because the project goals such as online booking, e-commerce, and data analysis are already well-defined. Additionally, it keeps the project structured and helps to prevent misinterpretation.

A data management system is created, implemented, and maintained with the aid of database design. Creating logical and physical representations of the proposed database system is the main goal of database design.

A context diagram is a high-level visual depiction of the relationships between a system and its external entities such as users, other systems, or processes. Without delving into specifics, it gives a general picture of how the system interacts with its surroundings.

Figure 3: Context Diagram



The context diagram illustrates the high-level interaction between key external entities Users and Admins—and the core component of the platform. At the center of the system is a dynamic interface that allows both users and administrators to perform essential operations, all of which are supported by a centralized MySQL database.

Users interact with the system to perform tasks such as account registration and login, booking dental appointments, purchasing oral care products, and engaging in consultation chat sessions. Meanwhile, the admin is responsible for managing bookings, updating inventory, processing orders, approving consultation sessions, and overseeing the overall operation of the platform.

All data processed through the system—such as appointment schedules, user profiles, orders, chat messages, and notifications—are stored and retrieved from the database in real-time. This ensures that both user and admin actions are synchronized and accurately recorded

Respondents Of The Study

The study involved two groups of respondents: (a) user and (b) technical respondents.

The user respondents consisted of thirty (30) participants. This group is composed of dentists and staff from Wisdom Dental Clinic, and selected patients of the clinic. They are selected considering each one has an impact on the day-to-day activities and offerings of the clinic. They assessed the system from the viewpoint of users, emphasizing usability, functionality, convenience of use, and general contentment with the way the platform facilitates clinical services.

The technical respondents included twenty (20) technical experts. They are made up of system developers, IT consultants, and system analysts with technical backgrounds and experience in software development and evaluation. They evaluated the platform's performance, security, dependability, maintainability, and scalability from a technical standpoint, making sure the system satisfies industry standards and can be maintained over time.

A total of fifty (50) respondents composed of male and female genders are involved in the evaluation activities. Purposive sampling is used to select respondents. Slovin's Formula is used to calculate the sample size to guarantee proper representation.

Development And Evaluation Procedure

The development of the Wisdom Dental System used several tools such as PHP, MySQL, Visual Studio Code, XAMPP, infinity. Free and Google Chrome to design, develop, test, and deploy the system efficiently. These tools worked together to ensure that all modules, including booking, payment, and report generation, function properly and that the system is fully operational, reliable, and user-friendly

Data Analysis Plan

The evaluation of the developed system followed the ISO 25010 Software Quality Model, which served as the main framework for assessing the quality and performance of the software. This model is used to measure whether the system met its objectives in providing reliable, secure, and user-friendly services. The following quality characteristics are considered:

1. Functional Suitability – Determines how effectively the system performs its intended tasks, such as managing bookings, product purchases, and report generation.
2. Reliability – Evaluates the stability and consistency of the system during continuous operation.
3. Usability – Measures how easily users, both patients and administrators, can understand and navigate the system.
4. Effectiveness – Assesses the system's success in improving the clinic's efficiency and supporting decision-making.
5. Security – Checks how well the system protects sensitive information and allows access only to authorized users.

To analyze the evaluation results, the researchers used appropriate statistical tools. The weighted mean is used to determine the average responses for each software quality criterion, while frequency percentage is applied to summarize the distribution of participants' answers.

A four-point Likert Scale is also used to interpret the feedback of respondents. The scale ranged from "1" (Strongly Disagree) to "4" (Strongly Agree), allowing respondents to rate their level of agreement with each statement related to the system's performance and quality.

The System

"Wisdom Dental: A Digital Booking and E-Commerce Platform" is a web-based system developed to enhance the operations and services of Wisdom Dental Clinic in Pinagbuhatan, Pasig City. It integrates appointment scheduling, product sales, and report generation into a single, accessible platform. Through this system, patients can book appointments and make payments online, while administrators can manage bookings, monitor sales, and generate detailed reports. The main goal of the project is to make the clinic's workflow more organized, efficient, and convenient for both patients and staff. Some of the user interfaces are shown as follows:

Figure 4: E-Commerce Report Generation

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Figure 5: Pop up Modal of Actual Income and Predicted Income

The E-Commerce Report Generation Page (Figure: E-Commerce Report Generation) gives administrators a summary of product sales and inventory updates. This reporting tool allows the clinic to monitor sales performance, identify high-demand products, and make informed decisions regarding restocking and promotions. It also helps evaluate overall business performance and supports efficient inventory and financial management.

The system integrates predictive analytics and time series forecasting (figure pop up modal of actual income and predicted income within this module to enhance business insight. Using the Exponential Smoothing algorithm, the system predicts the clinic's expected income for the next seven days based on filter of historical data

A visualization chart labeled "Predicted Income (Next 7 Days)" is displayed on the report page, and when clicked, it opens a pop-up modal showing the forecasted values alongside actual income data. All charts in this module include interactive pop-up modals, allowing users to view detailed results and analyses directly from the visual reports.

Figure 6: Appointment Report Generation

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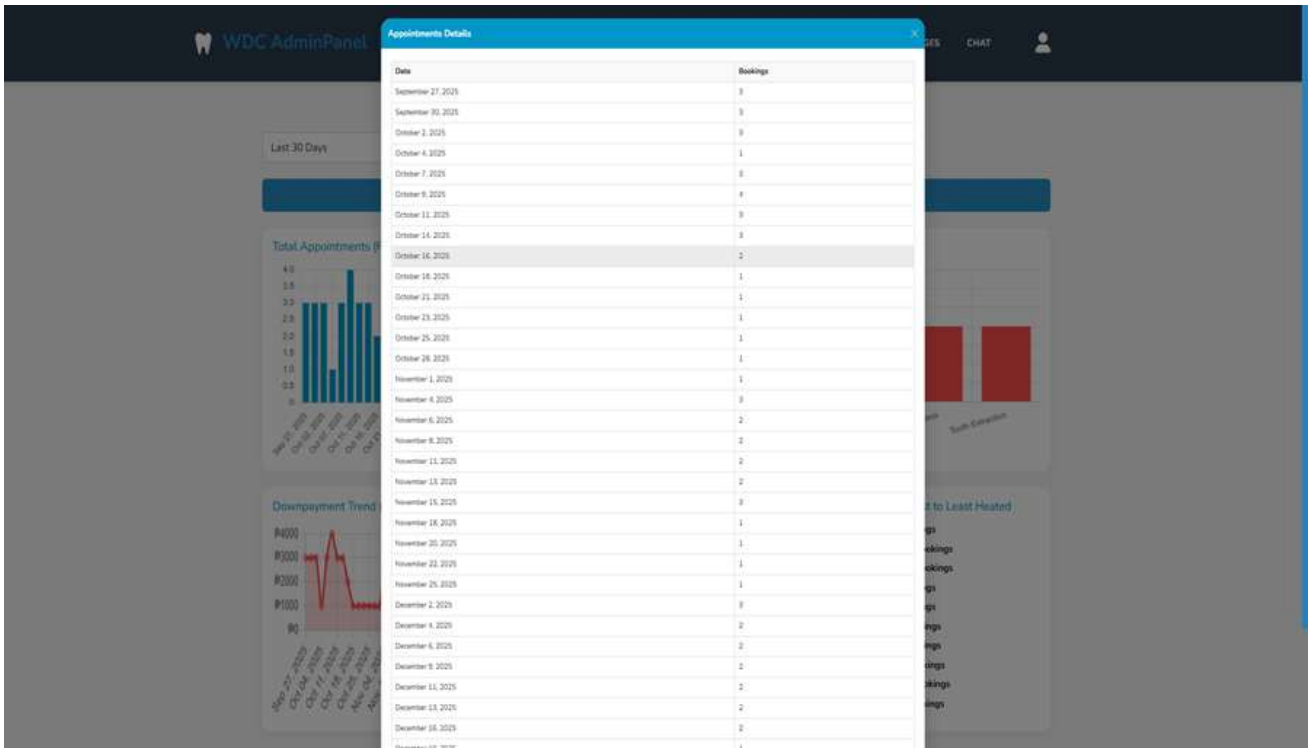
Figure 7: Pop up Modal Example: Total Appointment Chart



The Appointment Report Generation Page (Figure 6: Appointment Report Generation, Figure 7: pop up modal example: total appointment chart), provides a summary of appointment data, showing daily, weekly, and monthly booking trends. It helps the clinic identify peak hours, track patient attendance, and plan staff schedules more efficiently. The report also displays details of the downpayment per appointment, allowing the clinic to maintain an accurate record of confirmed bookings and collected payments. This feature ensures transparency in transactions and assists management in tracking the clinic's service performance over time.

All charts within this module also include pop-up modals that appear when clicked, presenting detailed summaries such as downpayment trends, top treatments, smart summary, most to least appointment administrators analyze results more effectively.

Figure 8: Appointment Scheduling

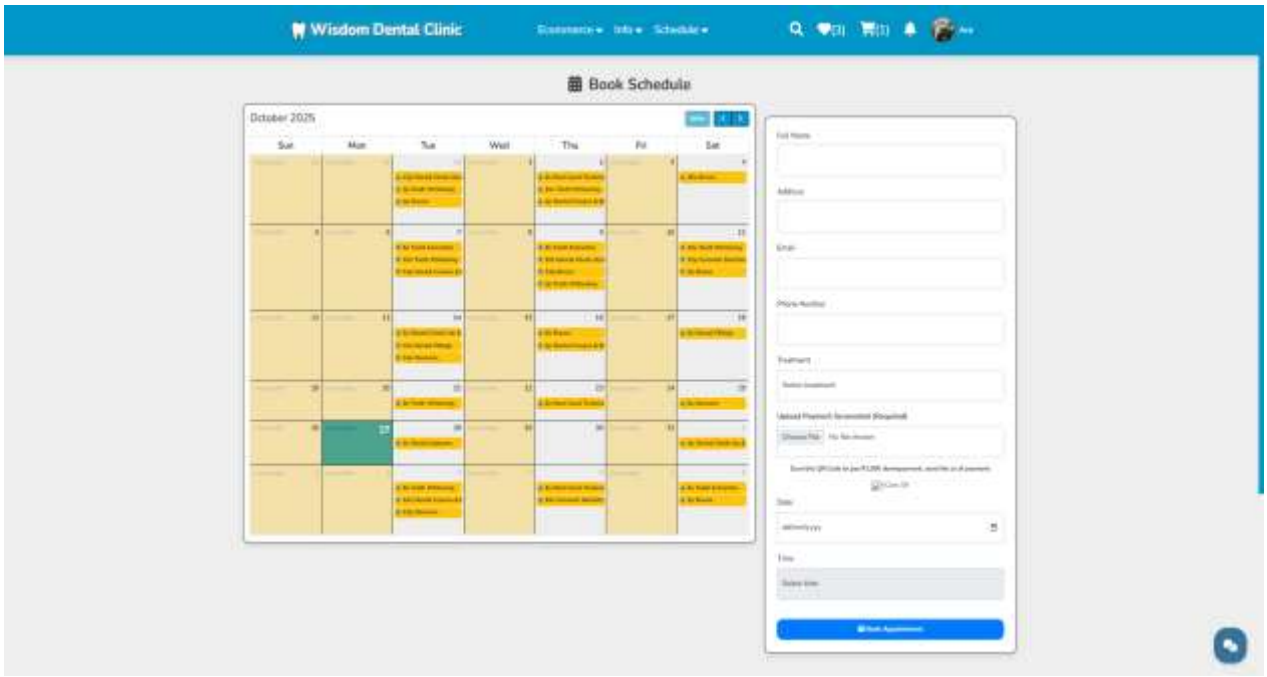


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Figure 9: Ecommerce platform

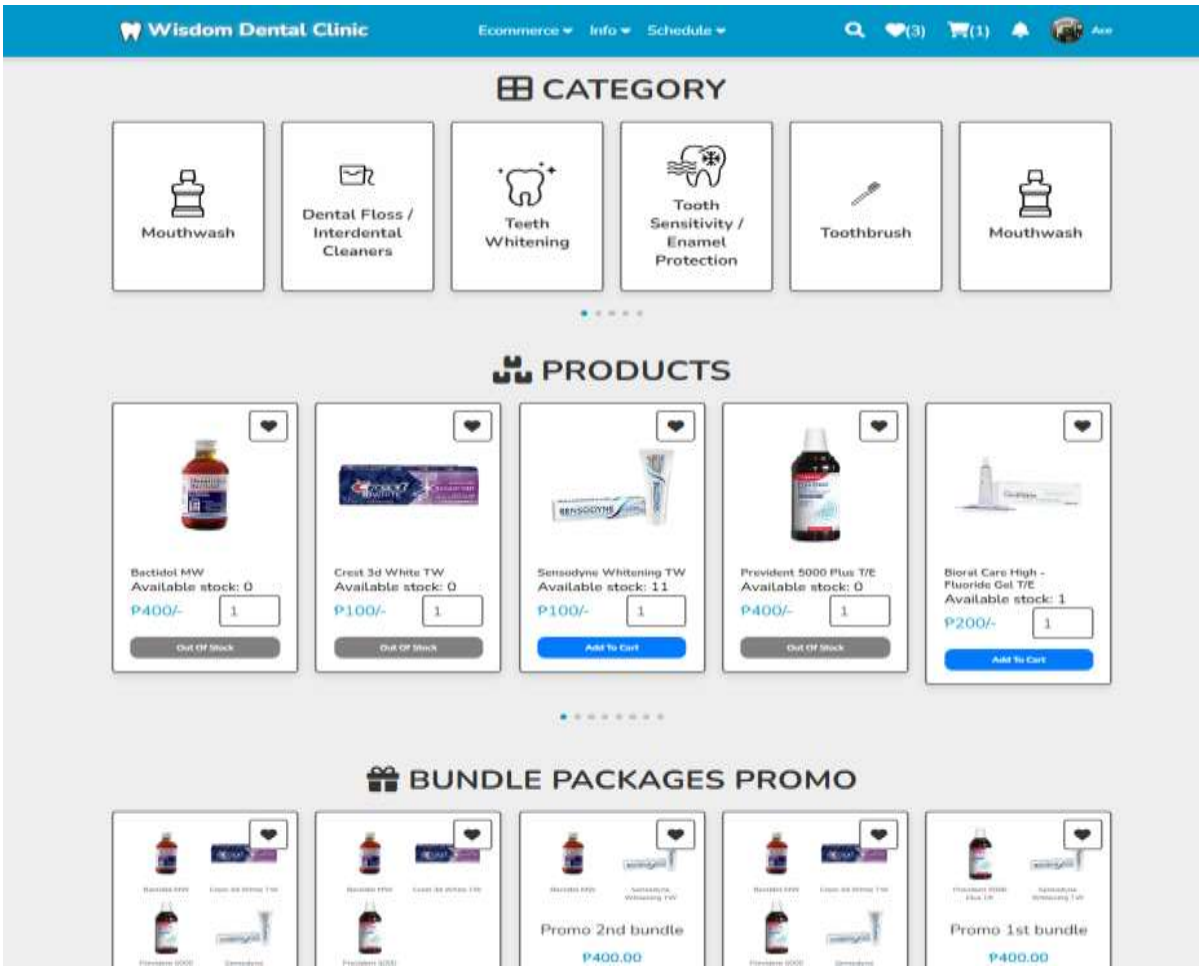
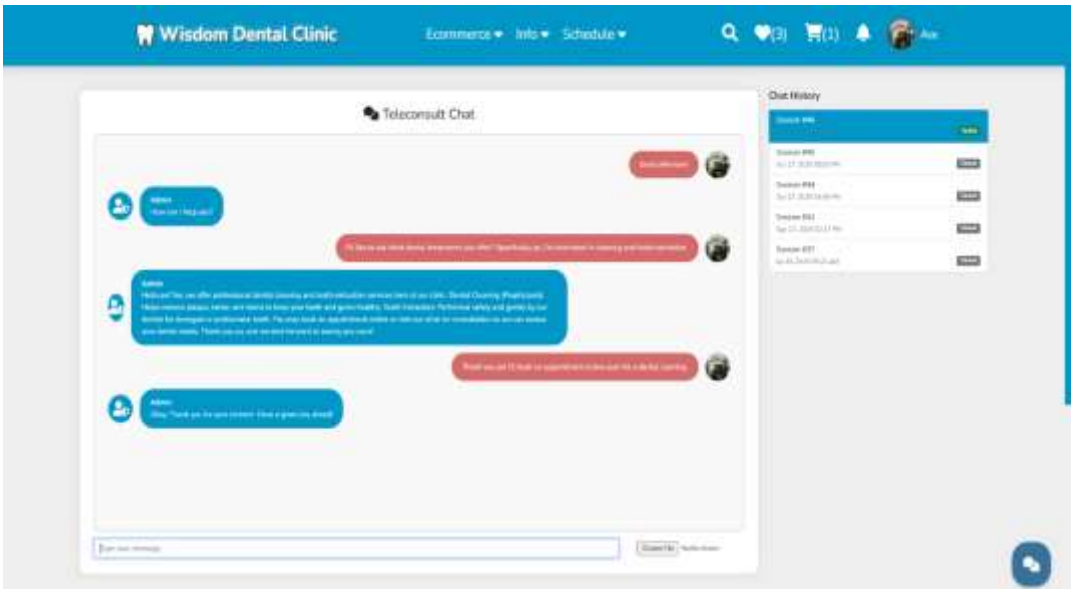


Figure 10: Teleconsultation



Comparison with Similar Dental Systems, compared to existing dental management and e-commerce platforms, Wisdom Dental offers a more unified solution by combining appointment scheduling, teleconsultation, online product sales, and real-time analytics into a single integrated system. While most systems focus on either booking management or inventory control, Wisdom Dental provides comprehensive reporting with predictive features, allowing administrators to forecast income and analyze business performance visually. This integration of

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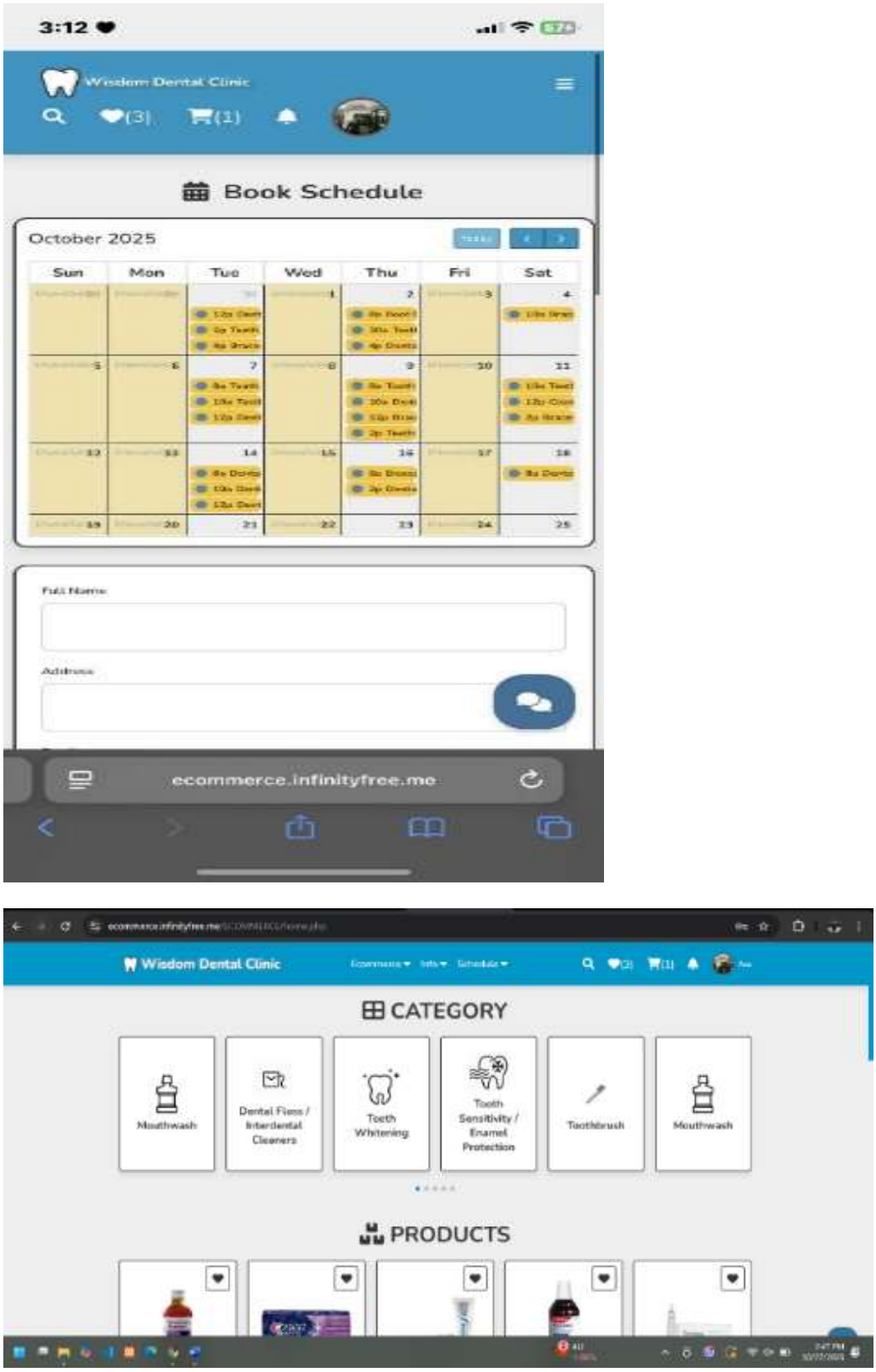
financial forecasting and digital booking makes the platform more adaptive and efficient than conventional systems used in smaller clinics.

Figure 11: Responsiveness



The developed website is fully responsive across various technologies and devices, ensuring that all data and interface components adapt seamlessly to different screen sizes, such as desktops, tablets, and mobile phones. Every page—including booking schedules, product categories, and user dashboards—is designed using responsive web design principles, allowing users to view and interact with the system conveniently without

compromising layout or functionality. This adaptability enhances accessibility and user experience, ensuring that patients, administrators, and staff can manage appointments, view updates, and access dental product information efficiently from any device.

Assessment: Summary Of Respondents On The System

The table shows the distribution of respondents:

Table 1: Distribution of Respondents

Respondents (groupings)	Size (n)	Percentage
Users	30	60%
Technical	20	40%
Total (n)	**50**	**100.0%**

Likewise, summary tables present the consolidated evaluation of respondents. It highlights their overall assessments using the ISO 25010 software quality model.

Table 2: Summary Table of Evaluation of User and Technical-Respondents

Criteria (ISO25010)	Respondents (50)			
	Male (22)		Female (28)	
	WM	VI	WM	VI
1. Functional Suitability	3.72	SA	3.7	SA
2. Reliability	3.7	SA	3.89	SA
3. Usability	3.72	SA	3.84	SA
4. Effectiveness	3.72	SA	3.89	SA
5. Robustness	3.77	SA	3.88	SA
Overall Average Mean (gender)	3.73	SA	3.84	SA

The system's evaluation findings, comparing male and female responders, are displayed in the table according to ISO 25010 criteria. In every category, both groups gave the system a "Strongly Agree" rating, indicating that they thought it was dependable and efficient. The average mean score for male respondents was 3.73, whilst female respondents gave it a slightly higher rating of 3.84. This suggests that the system's general performance, usability, and utility were viewed well by both sexes.

Ethical Considerations

The research guarantees that all data gathered from respondents are treated with utmost confidentiality and integrity. Personal details of participants are kept private, and no identifiable information is shared without their permission. The study upholds the principle of voluntary participation, allowing respondents to freely join or withdraw anytime without any negative consequences. Strict data protection protocols are followed to avoid unauthorized access or misuse of information. Lastly, the results are presented truthfully and accurately, ensuring that there is no manipulation or bias that could affect the credibility of the study.

Summary

The digital booking and e-commerce platform developed addresses the inefficiencies of manual patient management by integrating appointment scheduling, product ordering, and data analysis into a single, unified

system. Designed with user-friendly interfaces for both patients and administrators, the platform includes essential features such as log-in authentication, dashboards, e-commerce functionalities, carts, checkout, and online consultations. Administrative functions include appointment handling, order processing, and inventory management.

To ensure fairness and reliability in service delivery, the system incorporates a First-Come-First-Serve (FCFS) algorithm for scheduling and a downpayment mechanism to minimize appointment no-shows. The effectiveness of the platform is reinforced by theoretical models such as the Technology Acceptance Model (TAM), the E-commerce Business Model, SERVQUAL Model, and Predictive Analysis and Time Series Forecasting Algorithms which demonstrate its usability and practical value. Additionally, the platform aligns with international quality standards like ISO 25010. This study is significant to management, staff and patients of dental clinics.

CONCLUSION

The creation of the digital booking and e-commerce platform combined appointment scheduling, product ordering, and data analysis in one system. Using models such as the Technology Acceptance Model (TAM), E-commerce Business Model, SERVQUAL, and predictive analytics, the study showed that the system is practical, easy to use, and meets the quality standards of ISO 25010.

RECOMMENDATION

Considering the results and limitations identified in this study, the following are recommended: (a) focus on expanding the platform's scalability and functionality on the current single-branch setup; (b) adding offline capabilities or a hybrid online-offline mode is also advised to enable continuous service in the event of poor internet connections; (c) improve the system's e-commerce and payment modules by adding more varied payment methods like "PayPal", credit/debit cards and installment plans; (d) improved inventory forecasting tools for better supply chain management; (e) maintain comprehensive patient data security as the platform grows; (f) data privacy should be strengthened to satisfy international requirements such as HIPAA or GDRP; (g) updates should also focus on interface enhancements, such as updating social media and external connections, simplifying the registration process to remove duplicate accounts and including a simpler return navigation mechanism to facilitate page transitions.

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