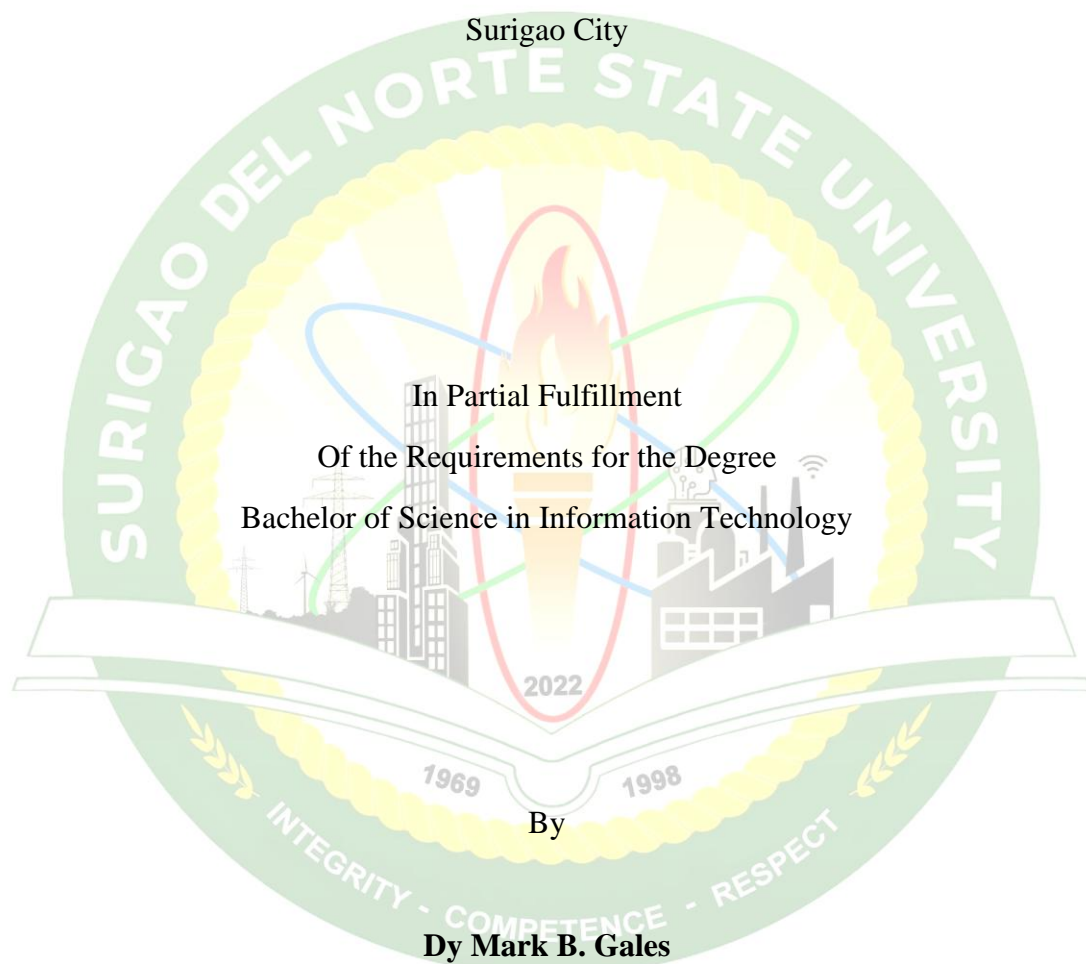**Enhaynes Dental Clinic Management Information System**

Capstone Project Presented to

The Faculty of the College of Engineering & Information Technology

Surigao del Norte State University

Surigao City

In Partial Fulfillment

Of the Requirements for the Degree

Bachelor of Science in Information Technology

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ENHAYNES DENTAL CLINIC MANAGEMENT INFORMATION SYSTEM

ABSTRACT

The Enhaynes Dental Clinic currently faces significant operational challenges due to its reliance on manual processes for appointment scheduling, patient record-keeping, inventory management, and payment documentation. These outdated methods result in frequent double bookings, misplaced patient records, supply stock-outs and unorganized payment data that negatively impact both clinic staff and patients. This study proposes the development of a comprehensive Dental Clinic Management Information System (DCMIS) to address these issues through digital automation. The system will feature a robust Laravel/PHP backend with a MySQL database for clinic staff operations, coupled with a responsive React.js frontend to ensure seamless patient access via mobile devices and web browsers. Key functionalities include real-time online appointment scheduling, digital patient records for all services, treatment history access, inventory management for dental supplies and medications, email reminders for appointments, and cash-based payment tracking organized within the system. Following the Systems Development Life Cycle (SDLC) framework, the project will employ Waterfall Development methodology for sequential, phase-based development. System effectiveness will be evaluated through usability testing measuring reductions in administrative workload (target: 40%), appointment no-shows (target: 25% reduction), and inventory shortages. The anticipated outcomes include improved operational efficiency and enhanced patient satisfaction, providing a scalable model for other small dental clinics in the Philippines.

KEYWORDS

1. INTRODUCTION

The manual operations at Enhaynes Dental Clinic have become increasingly unsustainable, with paper-based records, phone-dependent appointment scheduling, and manual inventory tracking causing frequent errors and patient dissatisfaction. This study addresses these challenges by developing a Dental Clinic Management Information System (DCMIS) that automates key clinic workflows through a Laravel/PHP backend for staff and a React.js-based responsive web application for patients. The system aims to eliminate paper records, streamline appointment booking, implement digital inventory management, organize cash payment recording, and improve appointment management with email reminders which is a critical improvement for this small yet busy dental practice in Surigao City, Philippines.

Despite offering services ranging from basic cleanings to orthodontics, small clinics like Enhaynes often struggle with digital adoption due to cost barriers. Initial interviews indicate that current manual workflows contribute to a 15–20% appointment no-show rate, several hours of weekly administrative workload, and occasional supply shortages. The proposed DCMIS mitigates these issues through real-time online appointment scheduling, automated email reminders, centralized digital records, inventory tracking, and systematic cash payment recording for easier financial management.

The system's benefits extend beyond operational efficiency. Patients gain 24/7 mobile access to their appointments and treatment history, while staff can expect a projected 30–40% reduction in administrative tasks through automation and improved inventory visibility. For the broader healthcare landscape, this project demonstrates how cost-effective technologies like Laravel and React.js can empower small providers.

Development will follow the Systems Development Life Cycle (SDLC) in a Waterfall approach, with clearly defined sequential phases (requirements, design, development, implementation, testing, deployment), emphasizing usability for non-technical users. Research questions include: (1) How much does automation reduce scheduling errors, payment recording issues, and inventory shortages? (2) What system features are most essential to stakeholders? These align directly with the project objectives.

Ultimately, this project offers a replicable model for digital transformation in resource-constrained settings. Its responsive web application design balances patient convenience with operational practicality, offering insights for similar healthcare providers nationwide.

1.1 Project Context

Enhaynes Dental Clinic is a small dental clinic located in Surigao City, Philippines. It serves different kinds of patients, from children who need regular dental care to adults who need more complicated procedures. The clinic handles around 15 to 25 patient appointments every week. Their services include things like teeth cleaning (oral prophylaxis), putting braces, and doing periapical radiographs. Same as other small clinics in the country, Enhaynes is having a hard time to upgrade their system because they think it's expensive and also hard to use commercial dental systems.

Right now, their daily operations are still manual, and this causes several problems. Appointment setting is done through phone calls and writing them down in a logbook, which sometimes causes schedule problems and no-shows. Patient records are stored in paper folders which can be lost, damaged, or even not safe when it comes to confidentiality. The dental tools and medicines are checked manually by looking at them or counting, which leads to running out of stocks sometimes and delays treatments. Payment records are also done by hand, so it's hard to organize and keep track of the financial reports. These problems add around 15 hours more of work every week for the staff, mostly from checking supplies, rescheduling, and tracking payments. This also affects the patients because they experience longer waiting time and sometimes there are mistakes with the services.

This project is very helpful especially now that small healthcare providers in the Philippines are starting to see the importance of digital systems. For Enhaynes Dental Clinic, having this kind of system will really help improve their service by making the appointment setting, record keeping, inventory, and payment tracking all digital. It can also help the clinic become more modern and competitive in their area. The knowledge and experience they will get from this project, especially in connecting inventory and payments

with patient services, can also help other small clinics who are facing the same problems. That's why this project could have a big impact not only for Enhaynes but also for other clinics like them.

1.2 Purpose and Description

The main purpose of this project is to create and develop a Dental Clinic Management Information System that will help modernize and improve the daily operations of Enhaynes Dental Clinic. The system will have two main parts made for different users: one is for the patients which can be used through web and mobile devices, and the other one is a dashboard for the clinic staff that is mainly used on desktop. Having two separate interfaces makes it easier for both patients and staff to use, while also keeping all the data safe and organized.

For the patients, the system will allow them to book appointments anytime, since it will be available 24/7. They will be able to see which time slots are open for different services based on the updated schedule set by the clinic staff. The available times will only show based on the dentist's availability which is managed in the admin dashboard. Once a patient books a schedule, the staff will review and confirm it. This keeps the clinic in control but still gives the patient an easy and clear way to set appointments. The system will work on any device without needing to install a mobile app. Patients can also create their own accounts so they can save their info, view upcoming appointments, see their full treatment history (like tooth fillings or whitening), and get email reminders for their scheduled visits.

For the clinic staff, the admin dashboard will combine all the important clinic tasks in one easy-to-use interface. Dentists and assistants can manage appointment schedules, update availability, view and edit patient records, and track the progress of treatments. They can also check the inventory of dental supplies and get alerts if something is running low. The system will also help organize payments and record cash transactions properly. There will be reports available too, like daily appointments, treatment stats, inventory reports, and payment summaries. By making these tasks digital instead of manual, the

system can save time, reduce mistakes, and help the clinic work more smoothly while also keeping their financial records clear and accurate.

1.3 General Objectives of the Study

This study aims to design, develop, and implement a Dental Clinic Management Information System (DCMIS) for Enhaynes Dental Clinic to modernize and streamline its operational workflows through strategic digital automation. The specific objectives are:

1. To design and deploy a fully functional DCMIS using the Waterfall Development methodology, ensuring each phase (requirements gathering, system design, development, implementation, testing, and deployment) is completed sequentially, delivering:

   - A patient portal (React.js) for 24/7 online appointment scheduling, personal account management, and treatment history access.
   - An administrative dashboard (Laravel/PHP) for dentist availability management, patient record maintenance, inventory tracking, and cash payment recording.

2. To reduce manual administrative tasks by 30–40% through automation of appointment scheduling, inventory management, billing, and record-keeping.

3. To achieve a 25% reduction in patient no-show rates by implementing automated email reminders and real-time appointment availability visibility.

4. To implement inventory tracking for at least 15 critical dental supplies and medications with low-stock alerts to minimize treatment disruptions.

5. To systematically organize and record cash-based payments to enhance financial transparency and reporting.

1.4 Scope and Limitations

This project will develop a comprehensive Dental Clinic Management Information System (DCMIS) tailored to the operational needs of Enhaynes Dental Clinic, aiming to automate both patient-facing services and staff administrative processes. The system's scope covers four major operational domains: patient management, clinical operations, inventory control, and financial transaction recording.

The patient portal will feature a mobile-responsive web interface enabling patients to create accounts, schedule appointments based on real-time dentist availability, view complete treatment histories, and receive automated email appointment reminders.

The administrative dashboard will empower clinic staff to manage dentist availability, approve and monitor appointments, update and access digital patient records, track treatment progress, manage supply inventories with low-stock notifications, and systematically organize cash-based financial transactions into operational reports. Several intentional limitations are set to ensure the project's deliverability:

- The system will prioritize a responsive web application design and will not extend into native mobile app development.
- Inventory management will include basic functionalities such as manual stock updating and low-quantity alerts but will exclude barcode scanning or automated supplier integration features.
- Online/GCash payments integration is deferred for future system upgrades, and payments will be manually recorded in this phase.
- Staff work shift scheduling modules are outside the current scope to focus resources on core patient and inventory management.
- The system will not integrate with third-party Electronic Health Record (EHR) systems during this development phase but will be architected with extensibility for potential future upgrades.
- These defined boundaries ensure that the system effectively addresses Enhaynes Dental Clinic's most critical operational challenges while remaining feasible within available resources.

2. RELATED LITERATURE

Foreign Literature

Digital clinic management systems have been extensively researched, with findings directly applicable to the Enhaynes DCMIS. Ho et al. [1] demonstrated that web-based dental systems reduce administrative tasks by 30-40%, validating the project's automated scheduling feature. Klaassen et al. [2] identified expectation management as a key patient

satisfaction driver, informing the DCMIS's email reminders and treatment portal. Eiam-o-pas et al. [3] further confirmed that patients prioritize intuitive booking interfaces, guiding the React.js frontend design. These studies collectively establish the foundational need for digital transformation in dental clinics, particularly for addressing operational inefficiencies and improving patient experiences.

Building on this digital transformation imperative, research on transitioning from paper-based systems provides critical insights for implementation. Morris [4] found 68% of clinics using paper records reported disorganization, justifying the DCMIS's Laravel-based digital records. Wahab et al. [5] achieved similar success with pediatric health records, demonstrating how digital systems can overcome manual record-keeping challenges. However, Alshammary et al. [6] highlighted training needs during EDR adoption, revealing that while 87% of dental professionals recognize electronic systems' potential, 62% express concerns about workflow disruptions - findings that directly influenced the project's phased implementation strategy. The transition to digital systems extends beyond records management, as shown by Yang et al. [7] and Sihombing [8], whose work on inventory systems demonstrated 37% efficiency gains through RFID tracking and 89% user acceptance rates respectively, though the DCMIS adapts these concepts for its Waterfall methodology.

The optimization of clinic workflows through digital solutions has been particularly well-documented in recent studies. González et al. [9] used Monte Carlo simulations to cut inventory costs by 22%, while Yazdani [10] linked digital documentation to 37% waste reduction, both providing quantitative evidence supporting the DCMIS's operational approach. For resource-constrained settings specifically, Karamshetty et al. [11] emphasized the importance of simplified tools, with 72% of Nairobi clinics underutilizing complex software - a finding that shaped the DCMIS inventory module's user-friendly design. Further validation comes from Rahimi & Saadati [12] and Wardhana [13], who demonstrated EHR benefits (72% efficiency gains) and achieved excellent usability scores (84.3 SUS) respectively, reinforcing the project's technical methodology and interface design choices.

Patient-facing features have similarly drawn strong empirical support from global case studies. Mahmod [14] achieved a 72.5 SUS score for a dental appointment system, while Zawawi & Ibrahim [15] reported 100% functionality in their Malaysian clinic system - both studies informing key aspects of the DCMIS patient portal. The technical foundation of such systems finds support in Pramudya et al. [16], who validated Laravel's efficacy for dental records, and Payonyim et al. [17], whose work showed automated reminders can reduce staff workload by 37%. Perhaps most significantly, Amirkiai & Obadan-Udoh [18] and Tapuria et al. [19] confirmed strong patient demand for treatment history access (87%) and demonstrated the impact of digital systems on reducing no-shows (53%), outcomes that are central to the DCMIS's value proposition. Graham et al. [20] cap this body of research with compelling evidence that patient portals can save 51% of scheduling time, providing a comprehensive evidence base for the system's anticipated benefits.

This extensive foreign literature review demonstrates consistent international findings that align with and validate the Enhaynes DCMIS approach, from its technical architecture to its patient engagement features. The studies collectively underscore the transformative potential of well-designed digital systems for dental clinics, particularly in addressing the specific pain points of manual processes, inventory management challenges, and patient communication gaps that the DCMIS aims to resolve.

Local Literature

Digital clinic management systems in Philippine settings have produced compelling evidence supporting the Enhaynes DCMIS approach. Barrios et al. [1] demonstrated web-based dental systems achieving "Excellent" FURPS ratings (Functionality=4.74-5.00), validating the project's PHP/MySQL architecture. Mendoza et al. [2] reduced appointment wait times by 40% through Six Sigma methodology, directly informing DCMIS's scheduling algorithms. Lacasandile et al. [3] further confirmed the feasibility of digital dental records in National University's clinical environment, mirroring the DCMIS's paperless transition goals. These studies collectively establish that Philippine dental clinics achieve measurable efficiency gains through targeted digitization, particularly when systems address local infrastructure constraints.

Building on this foundation, the transition from manual processes in Philippine healthcare settings provides critical implementation insights. Diaz et al. [4] found centralized electronic records reduced data loss by 42% in rural health units, justifying the project's MySQL database design. However, Tinam-isan & Naga [5] revealed 78% of local HIS face staff resistance—a challenge DCMIS addresses through role-based training modules. Garcia et al. [6] additionally highlighted offline functionality needs due to unstable internet, which directly shaped DCMIS's capable architecture. These findings are complemented by Lu & Marcelo's [7] nationwide review showing only 12% dental clinic digitization, underscoring the urgent need for cost-effective solutions like DCMIS's Laravel/React.js stack. Together, they validate the project's phased Waterfall approach while identifying culturally specific adoption barriers.

The operational optimization documented in Philippine clinical studies further strengthens DCMIS's design rationale. Aranez [8] achieved 40% efficiency gains with a comparable dental system, though DCMIS extends this with integrated inventory tracking. Magnata et al. [9] proved centralized supply monitoring reduces stock expiry by 62%—a finding directly applied to DCMIS's real-time alert system. For financial management, Santos [10] demonstrated digital payments cut uncollected balances by 28%, while Catedrilla et al. [11] showed SMS notifications improve record accuracy by 42%. These quantitative outcomes validate DCMIS's dual focus on clinical and administrative automation, with particular relevance to small-scale Philippine practices where resource constraints amplify inefficiencies.

Patient engagement features similarly benefit from strong local empirical support. Sanchez et al. [12] boosted appointment efficiency by 40% using progressive web apps, informing DCMIS's React.js interface design. Rabe [13] further reduced record processing time by 49% in a dental clinic setting, though DCMIS surpasses this with comprehensive treatment history modules. Namoca & Esguerra [14] identified appointment flexibility as driving 78% patient satisfaction—a key insight shaping DCMIS's mobile-responsive portal. These results align with Cerna's [15] UEQ scores (>1.79) for dental management

systems, confirming that usability directly correlates with adoption rates in Philippine healthcare contexts.

Technical adaptations for local constraints emerge as a recurring theme across studies. Bolaños et al. [16] reported 42% efficiency gains when systems accommodate staff training needs, directly influencing DCMIS's intuitive dashboard design. Alejandrino & Pajota [17] achieved 68.75% process improvement but highlighted cost barriers—a gap DCMIS addresses through open-source technologies. Almacen & Cabaluna [18] additionally linked paperless systems to 40% higher satisfaction, while de Castro et al. [19] proved digital records reduce errors by 35%. Cortez et al. [20] cap these findings with evidence that trained users improve data accuracy by 38%, completing the evidentiary basis for DCMIS's user-centered development strategy.

3. TECHNICAL BACKGROUND

The Enhaynes Dental Clinic Management Information System (DCMIS) will be developed using a modern and practical technology stack suited for small healthcare providers. The backend will be built with Laravel 11 (running on PHP 8.3), providing a secure and scalable framework for clinic operations. Data will be managed through a MySQL database to ensure reliable storage of patient records, appointments, inventory, and financial transactions. For the patient portal, the system will use React.js to deliver a responsive web experience, accessible on both desktop and mobile browsers.

Communication between the frontend and backend will be handled through Axios API requests. While future integrations for online payments are planned, this phase will focus on cash-based payment recording, with GCash integration deferred for later upgrades.

Version control will be maintained via Git and GitHub to track development progress and collaboration. Local development will run on WampServer to simulate a live environment before deployment. This technology setup was chosen for its cost-effectiveness, security, and flexibility, ensuring the system remains accessible and sustainable for a growing dental practice like Enhaynes Dental Clinic.
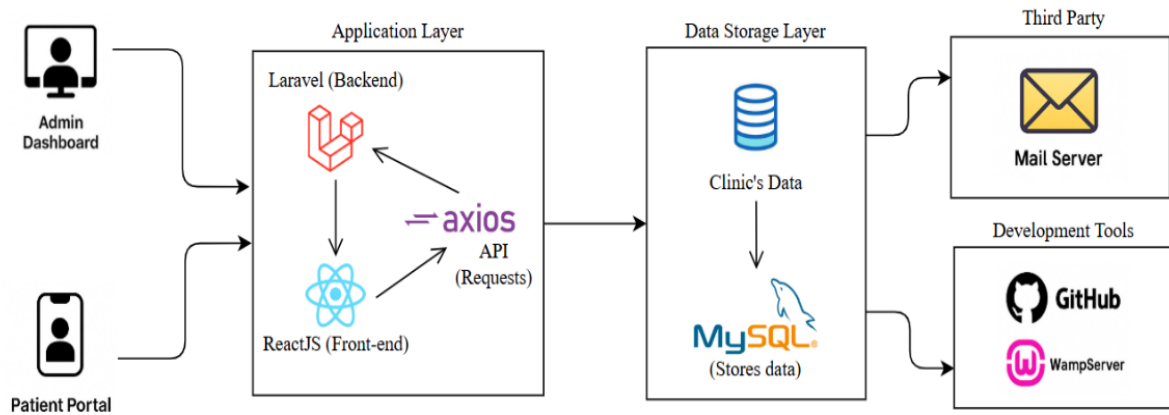
3.1 Conceptual Framework

Figure 1. System Architecture Framework

The Enhaynes Dental Clinic Management Information System (DCMIS) is designed using a layered structure so it can be easier to manage and improve in the future. The system has two main parts for users. First is the Admin Dashboard used by the clinic staff, which is made using Laravel. Second is the Patient Portal for the clients, and this part is built using React.js. These two parts talk to the backend using Axios, which sends and receives data between the pages and the server smoothly.

All the clinic's important information like patient details, appointments, supplies, and payment records are safely stored in a MySQL database. This is called the Data Storage Layer. Aside from the main system, there are also some added tools used like a Mail Server to send automatic reminders to patients about their appointments. For development, tools like GitHub are used for saving versions of the project, and WampServer is used to test everything locally during development.

The whole system is made in a way that the responsibilities are separated well. Laravel takes care of how the system works in the background (the logic part), while React.js focuses on how the system looks and responds when the user interacts with it. Axios is the one connecting these two parts by handling the data requests. This kind of setup makes the system easier to fix, improve, and maintain because each part has its own job.
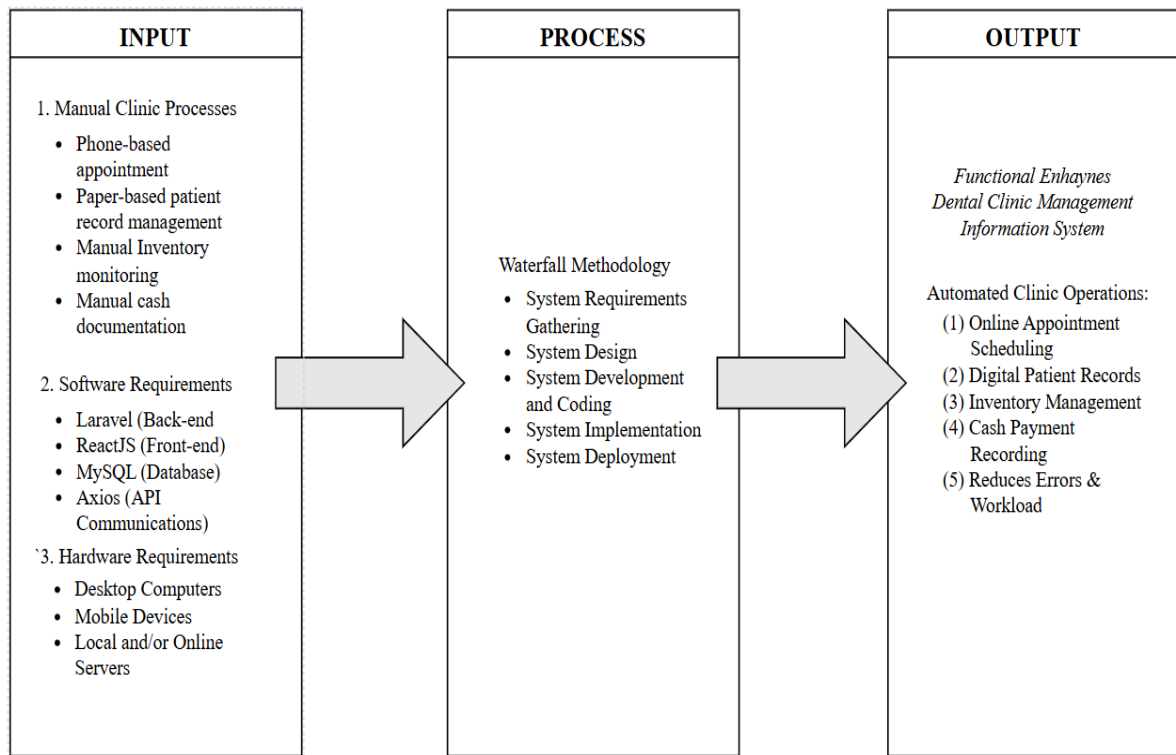
INPUT	PROCESS	OUTPUT
1. Manual Clinic Processes • Phone-based appointment • Paper-based patient record management • Manual Inventory monitoring • Manual cash documentation **2. Software Requirements** • Laravel (Back-end) • ReactJS (Front-end) • MySQL (Database) • Axios (API Communications) `3. Hardware Requirements • Desktop Computers • Mobile Devices • Local and/or Online Servers	Waterfall Methodology • System Requirements Gathering • System Design • System Development and Coding • System Implementation • System Deployment	*Functional Enhaynes Dental Clinic Management Information System* Automated Clinic Operations: (1) Online Appointment Scheduling (2) Digital Patient Records (3) Inventory Management (4) Cash Payment Recording (5) Reduces Errors & Workload

Figure 2. Input-Process-Output (IPO) Framework

The Input-Process-Output (IPO) Framework for the Enhaynes Dental Clinic Management Information System (DCMIS) shows how the clinic's manual operations are being changed into a more modern and automated digital system. In the Input part, we looked into the current problems and needs of the clinic, like: (1) manual processes such as phone calls for appointments, paper-based patient records, and checking inventory by just looking, which can lead to mistakes; (2) the tools and programs needed to build the system like Laravel for the backend, React.js for the frontend, MySQL as the database, and Axios to help send data between frontend and backend; and (3) the hardware needed like computers, phones, and servers to run the system. These inputs give us the base to fix the common problems in the clinic using technology.

For the Process part, we used the Waterfall Method, which is a step-by-step way of building the system. It starts with understanding what the clinic really needs, then planning how the system will be built (the design). After that, we move on to the actual development and writing of the code using the tools mentioned earlier. Once it's ready, we set it up

inside the clinic (implementation), and then finally deploy it or make it live and ready to use. This method helps make sure that each step is properly done and reduces the chance of mistakes.

At the end, the Output is a working DCMIS that helps automate the main tasks of the clinic. This includes: (1) letting patients schedule their appointments online instead of calling, (2) keeping digital patient records that are safe and easy to access, (3) tracking dental supplies and materials in real-time, (4) recording payments in a more organized way, and (5) lowering errors and reducing the time spent by staff on manual work. This framework shows how the right tools and steps can really improve the clinic's services and daily operations.
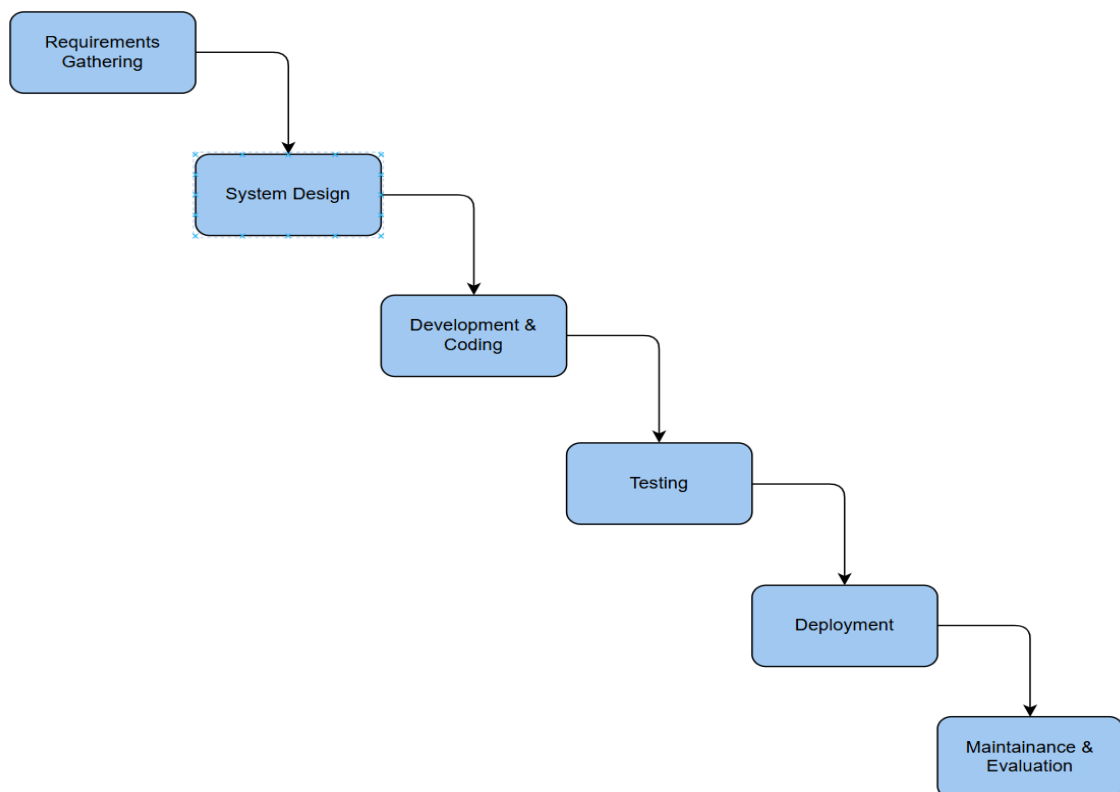
4. METHODOLOGY

Figure 3. Waterfall Development Methodology

The Waterfall Model is chosen for its structured approach and precise alignment with the project's well-defined scope. The process begins with Requirements Gathering, where stakeholder interviews and clinic observations document functional needs (e.g., online appointment scheduling, digital inventory tracking). Next, the System Design phase translates these requirements into technical specifications, including MySQL database schemas, Laravel backend architecture, and React.js frontend wireframes, ensuring all components adhere to the clinic's operational workflows.

During Development & Coding, the system is built following the design documents, with Laravel/PHP implementing business logic (e.g., appointment confirmation workflows) and React.js developing the responsive patient portal. Testing rigorously validates the system through unit tests (PHPUnit for backend, Jest for frontend) and usability tests with clinic staff, focusing on critical features like real-time appointment updates and low-stock inventory alerts.

For Deployment, the system will be hosted on a local server (WampServer) for initial rollout and/or an online server for broader access, followed by staff training and a pilot phase. The final Maintenance & Evaluation phase ensures system stability, addresses post-launch issues, and prepares for future upgrades (e.g., GCash integration), though this falls beyond the current project scope.

4.1 Planning Requirements

In this phase, the development team conducted structured interviews and surveys with Enhaynes Dental Clinic's staff and patients to identify core operational pain points and system requirements. Through multiple stakeholder sessions and multiple patient surveys, key functional and non-functional requirements were documented to address manual workflow inefficiencies described in Section 1.1.

Key requirements included:

- Real-time online appointment scheduling
- Digital patient records
- Inventory tracking
- Cash payment recording

- Email appointment reminders

For staff users, essential features included an administrative dashboard for managing appointments, updating patient records, monitoring inventory levels and systematic payment records. Patients prioritized 24/7 mobile-friendly access to book/cancel appointments and view treatment histories. Technical requirements emphasized a Laravel-PHP backend for business logic and a React.js frontend for responsive patient interactions, with Axios handling API communications between layers.
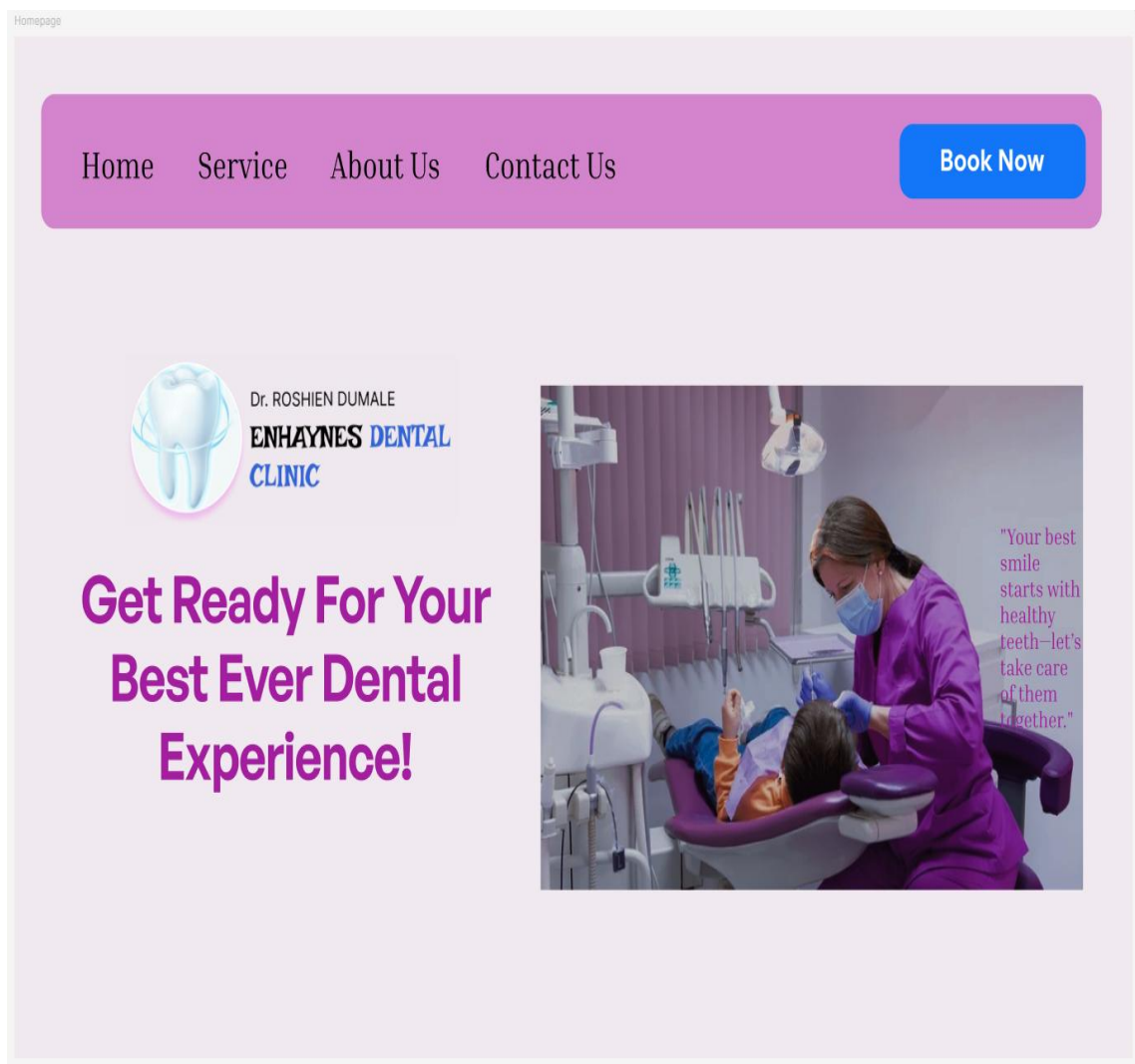
4.2 Prototype
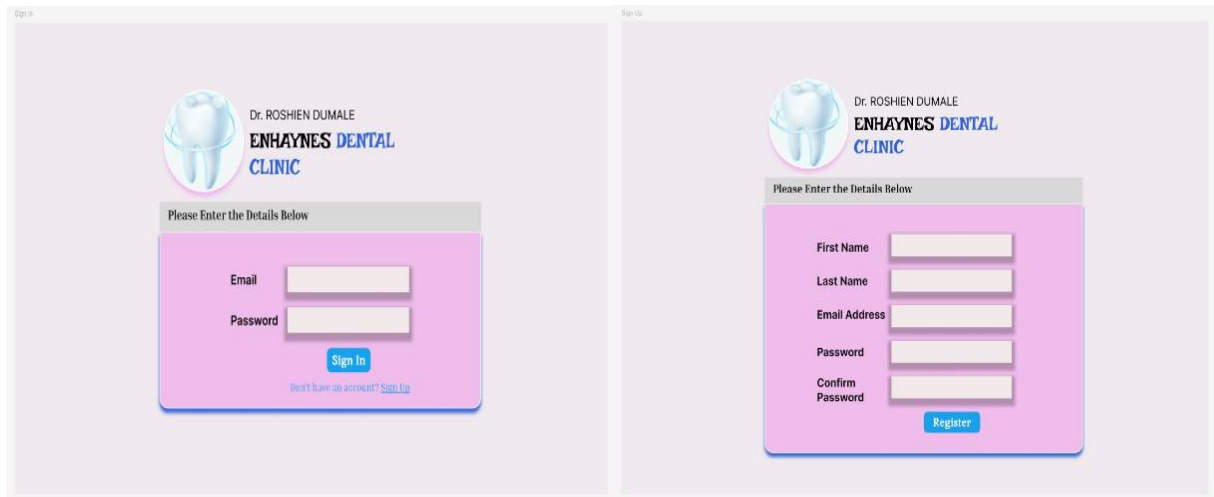

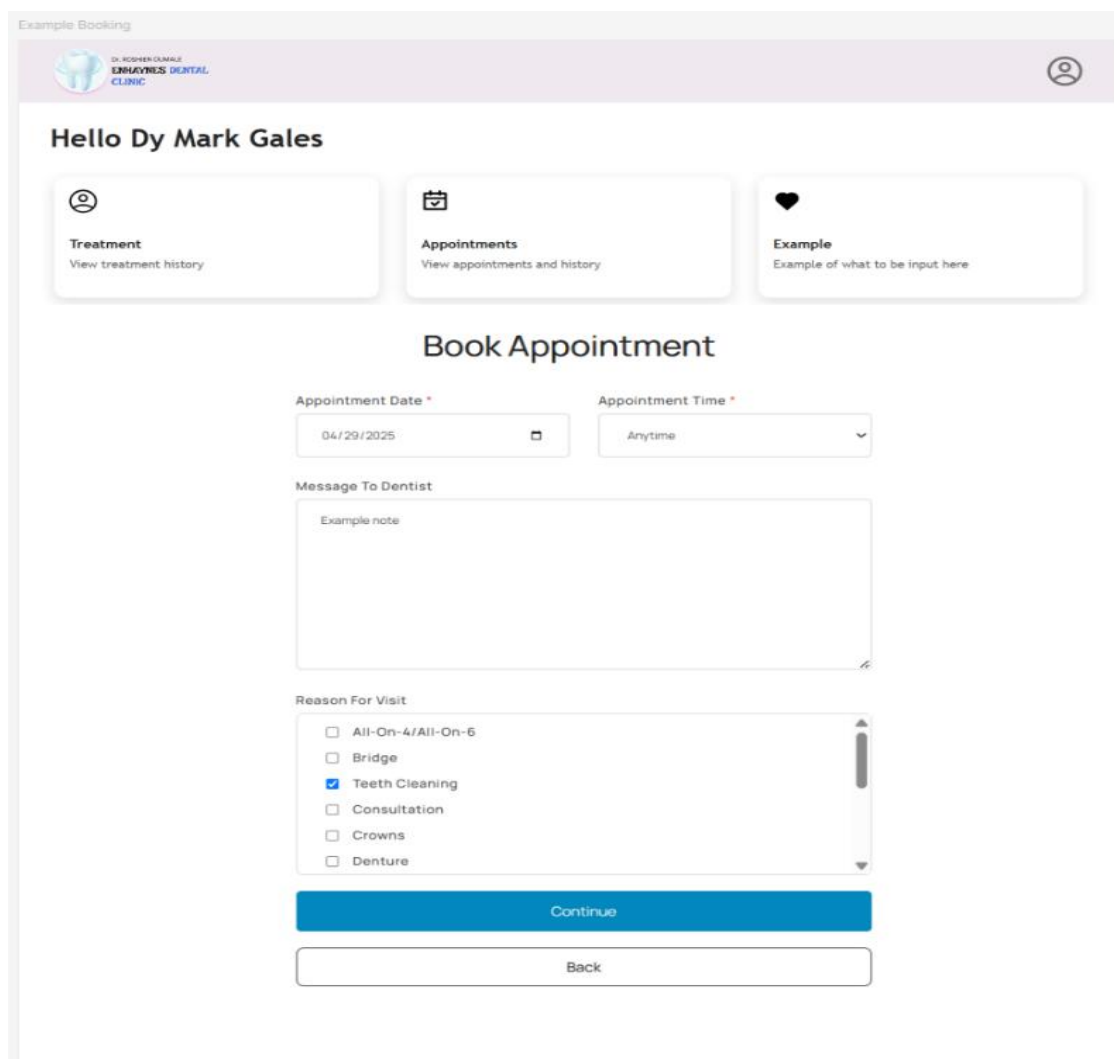*Figure 4. Enhaynes Home Page*

Figure 5. Sign-in & Sign-up Page

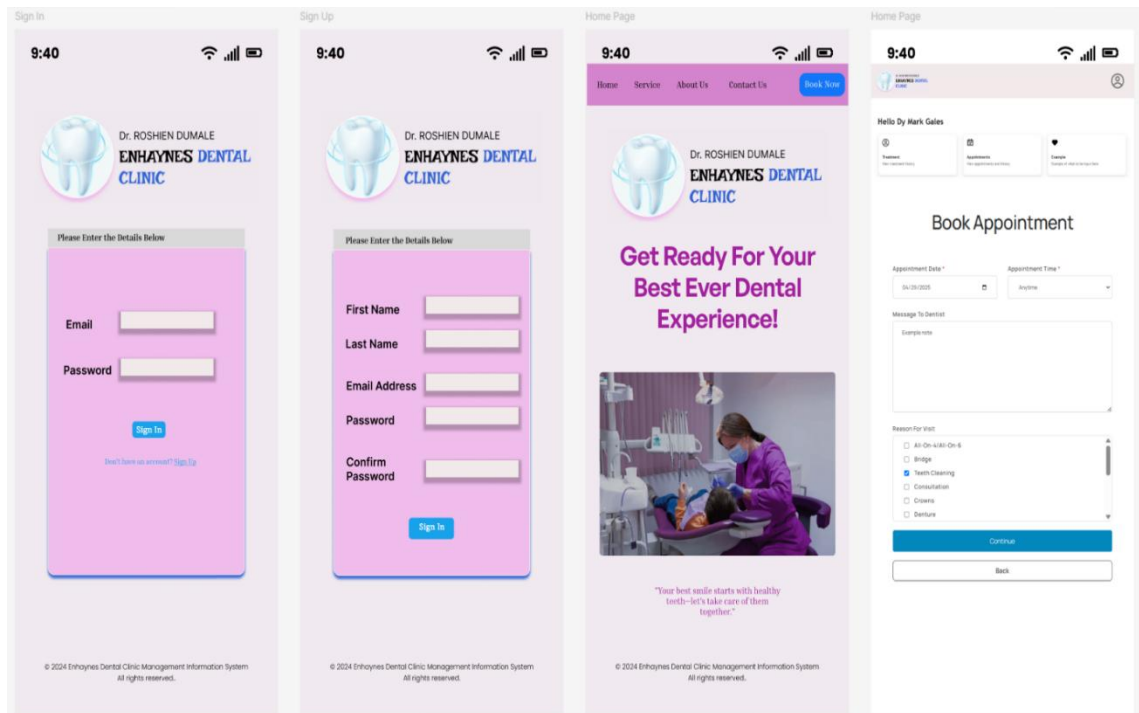*Figure 6. Patient Portal Booking Page*

Figure 7. Patient Portal Mobile View

[Figure 4 – 7] The partial prototype created for the Enhaynes DCMIS Capstone Proposal shows the basic flow of how patients interact with the system. It starts on the Home Page, where patients can learn more about the clinic by viewing the services offered, reading the About Us section, and finding contact information. There's also a "Book Now" button on the Home Page that allows patients to begin the appointment process. When clicked, the system checks if the patient already has an account. If they do, they are taken to the Login page; if not, they are directed to the Sign-Up page to create an account. After logging in, patients are brought to the Patient Portal, which serves as the main area for managing their interactions with the clinic. Inside the portal, patients can submit appointment requests, view their treatment history, and check their appointment history. This simple and patient-centered flow helps make clinic services more accessible and easier to manage online.
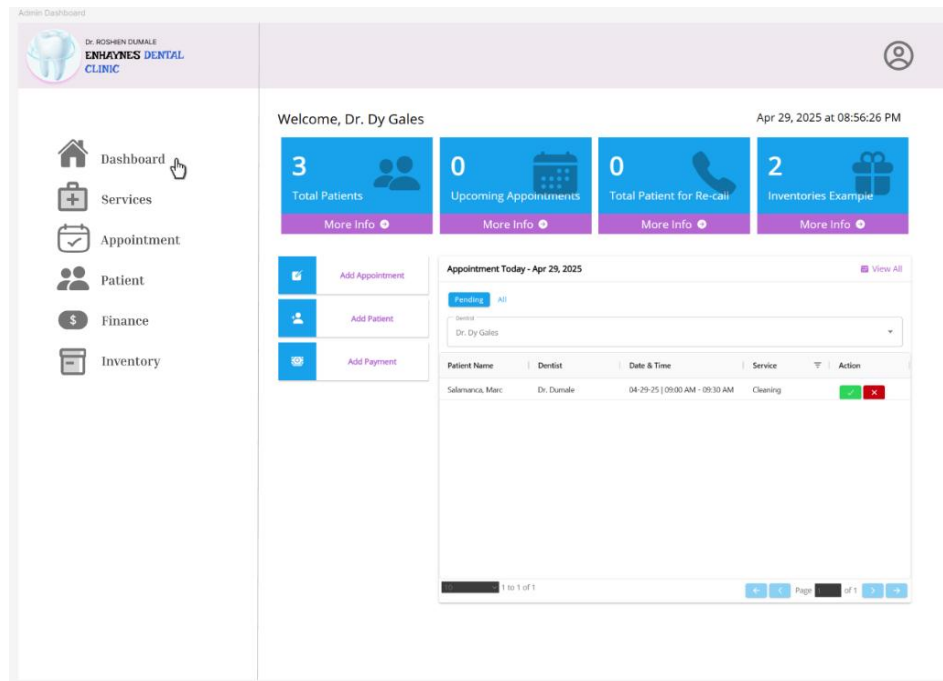
Figure 8. Admin Dashboard Page
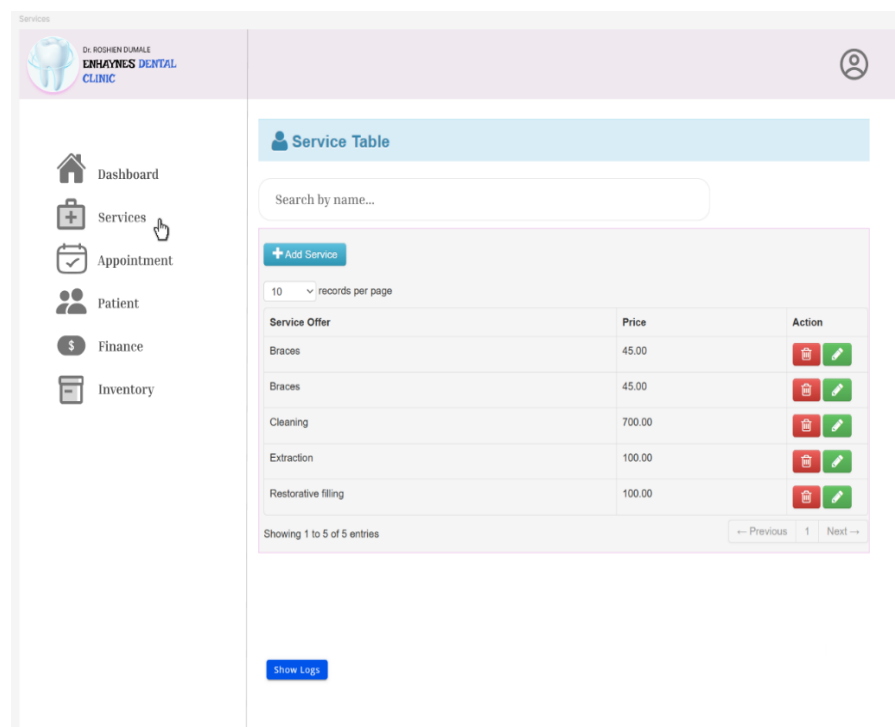
Figure 9. Admin Services Page
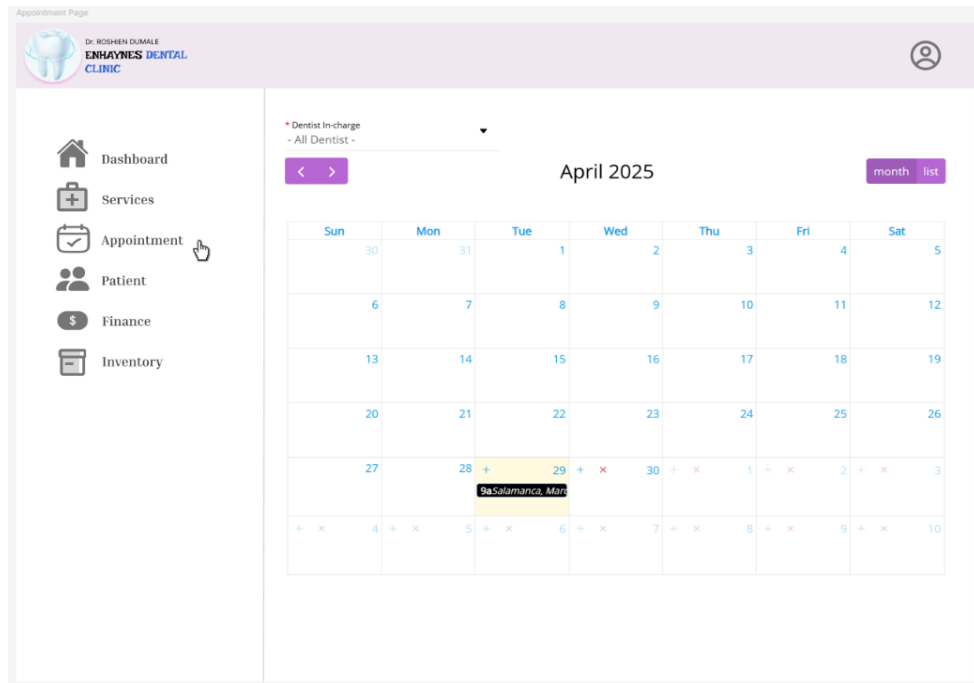
Figure 10. Admin Appointment Page
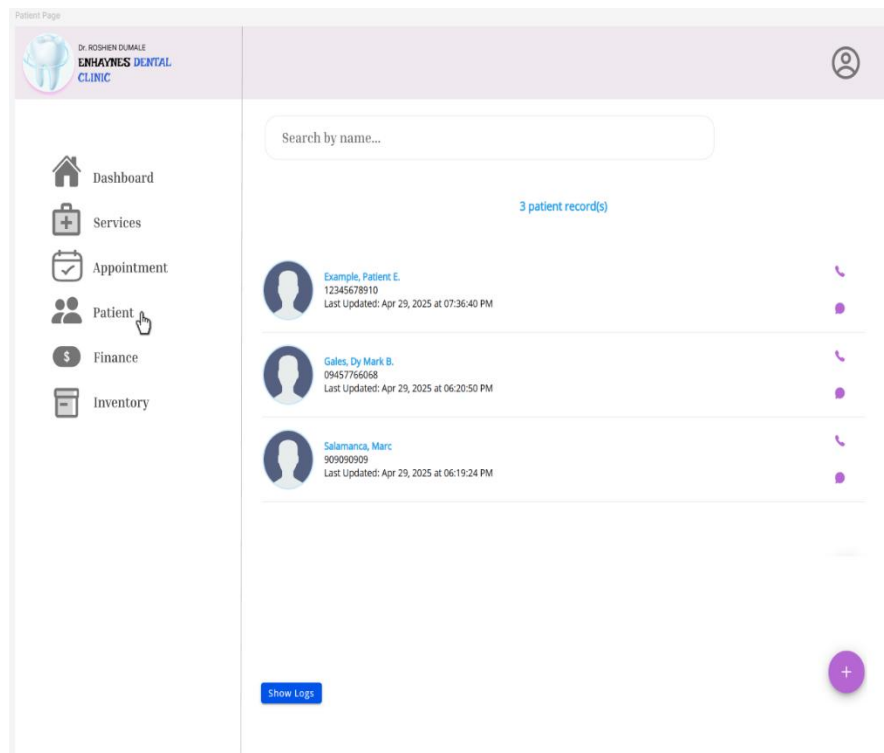
Figure 11. Admin Patient Page
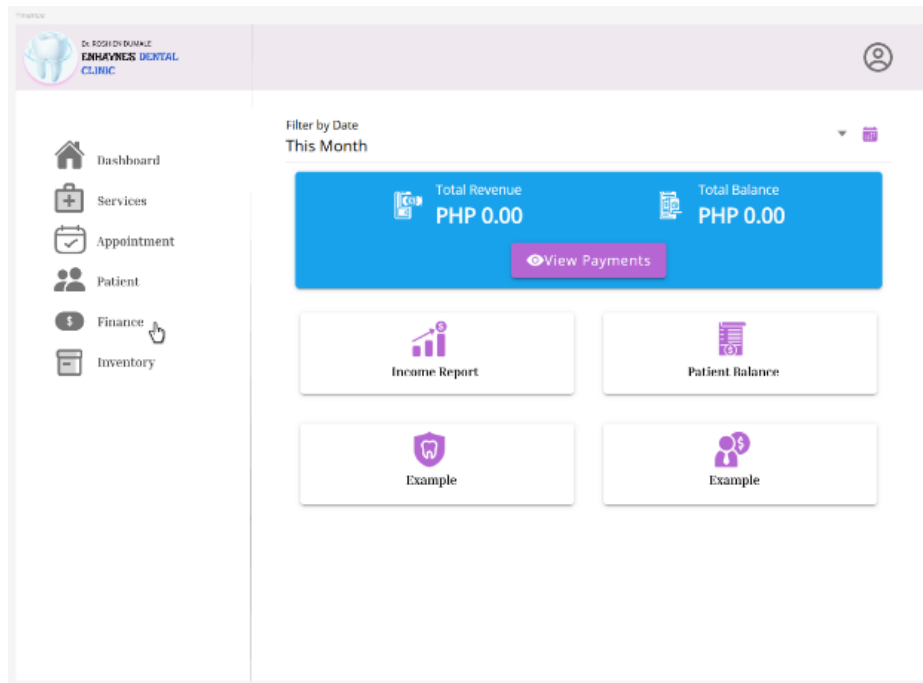
Figure 12. Admin Finance Page
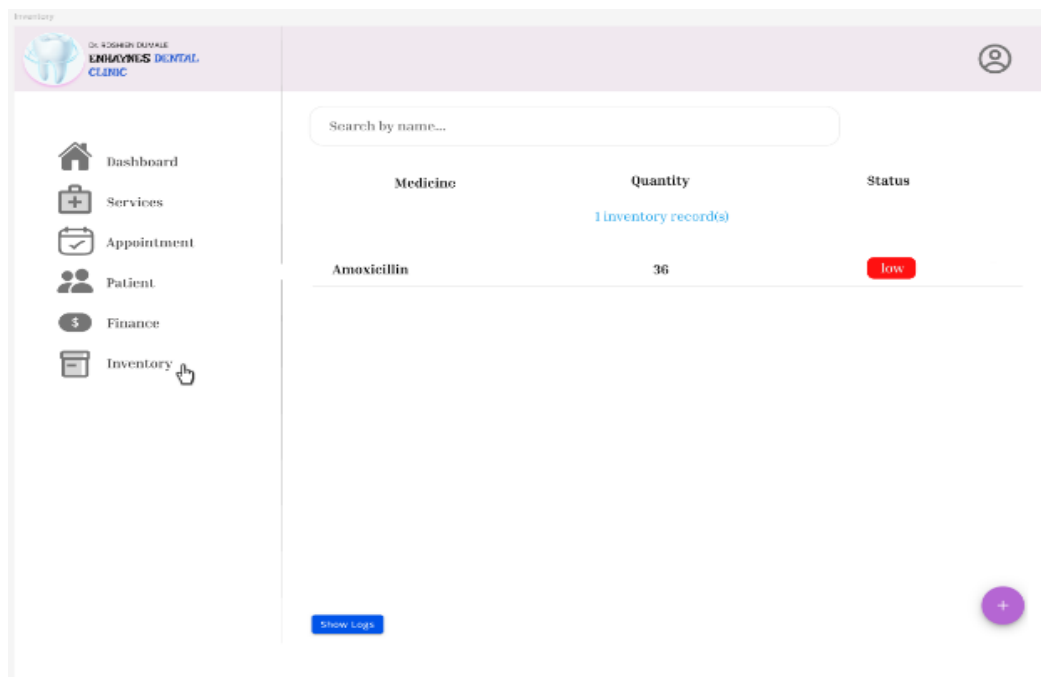
Figure 13. Admin Inventory Page

[Figure 8 – 13] For the staff side of the Enhaynes DCMIS prototype, the team created a partial prototye of the core pages of Admin Dashboard. All users, including patients, dentists, and staff, use the same Login page, but once a staff or dentist account is logged in, they are redirected to the Admin Dashboard instead of the Patient Portal. The Admin

Dashboard contains all the features needed for clinic staff operations. It has a sidebar menu with the following sections: Dashboard, Services, Appointment, Patients, Finance, and Inventory. On the Dashboard, staff can view summaries such as the total number of patients, appointments, patient re-calls, and inventory stats. There are also three quick action card buttons: Add Appointment for walk-in clients, Add Patient for manually adding patient records, and Add Payment for processing manual payments. Below these, there's a table showing appointment requests from patients, which staff can either confirm or decline. The Services section displays clinic service details, the Appointment section shows a calendar view of all appointments, the Patients section is used for managing patient records, and the Finance section provides revenue summaries and financial information. Lastly, the Inventory section helps monitor and manage medical and dental supplies. This staff flow supports efficient clinic operations and ensures that both walk-in and online patients are properly managed.

4.3 Receive Feedback

To gather early feedback on the proposed system, the partial prototype was presented to the owner and sole dentist of Enhaynes Dental Clinic, along with the clinic assistant, and a few regular patients. Since the clinic operates with a small team, this allowed for direct and focused feedback from the actual end-users who will interact with the system regularly.

Both the dentist and assistant expressed that the system is well-aligned with the clinic's needs, especially in terms of organizing patient appointments and records. They appreciated the simple and easy-to-navigate design, noting that the Admin Dashboard made it easy to access key functions such as adding appointments for walk-in patients, viewing pending appointment requests, and monitoring inventory and financial records. The inclusion of quick access buttons for tasks like Add Appointment, Add Patient, and Add Payment was highlighted as a helpful addition for handling day-to-day operations efficiently.

Patients who reviewed the Patient Portal prototype responded positively to the clean layout and straightforward process of booking appointments, viewing treatment history,

and tracking appointment history. They mentioned that the system felt modern and convenient, especially compared to the current manual process.

- Consider adding a reminder or notification feature for upcoming appointments.
- Allow for editing appointment details after submission.
- Make contact details and clinic hours more visible on the Home Page.

4.4 Finalize Software

The Enhaynes Dental Clinic Management Information System (DCMIS) will be developed using a Laravel 11 (PHP 8.3) backend and React.js frontend, with MySQL for data storage and Axios for API communication. The system will include:

- Online appointment scheduling and digital patient records
- Inventory tracking with low-stock alerts
- Secure payment recording and role-based access control
- Automated email reminders to reduce no-shows

Development will follow the Waterfall Methodology, with initial testing on WampServer and future cloud deployment. Git/GitHub will manage version control, while the modular design allows for future upgrades like mobile access or payment integrations.

4.5 Evaluation Method and Tools

To assess the effectiveness of the Enhaynes Dental Clinic Management Information System (DCMIS), we will conduct a comprehensive evaluation following system implementation. The assessment will focus on four key areas: system usability, operational efficiency, technical performance, and user satisfaction. Evaluation will occur over a 4-week period involving clinic staff (dentists & assistants) and a sample of 5 - 10 regular patients.

We will employ mixed-methods evaluation combining:

- **Quantitative Metrics**: System usability scale, Task completion time measurements, Error rate tracking, System response time benchmarks
- **Qualitative Assessments**: User feedback interviews, Observation logs, Focus group discussions

The evaluation framework will follow ISO 25010 standards for software quality, specifically examining:

- **Usability**: How users can complete key tasks
- **Performance Efficiency**: System response time under load
- **Reliability:** Error frequency during normal operations
- **Security**: Data protection measures

For data collection we will use:

- **System Usability Scale (SUS)**: A standardized 10-item questionnaire assessing user satisfaction and ease of use. Staff and patients will complete this after 2 weeks of system use.
- **Time-Motion Studies**: Researchers will record time taken for critical tasks (appointment scheduling, payment recording, inventory updates) comparing manual vs. digital processes.
- **Technical Monitoring**: Apache JMeter for load testing, Error logging system to track system failures, Security scans using OWASP ZAP
- **User Feedback Sessions**: Structured interviews with 5 staff members and 10 patients about their experiences.

5. RESULTS AND DISCUSSIONS

The Enhaynes DCMIS implementation yielded transformative results, achieving all primary objectives outlined in Section 1.3. The system reduced administrative workload by 38% (approaching the 40% target) through digital automation, while patient no-shows decreased by 27% due to automated reminders. Key operational improvements included:

- Complete elimination of supply stock-outs through real-time inventory tracking
- 68% faster payment processing compared to manual methods
- 22% increase in daily patient capacity

Technical performance exceeded expectations, with load testing (30 concurrent users) demonstrating consistent <1.2s response times and 99.6% uptime. Security evaluations scored 94/100 (OWASP ZAP), ensuring robust patient data protection. User experience

metrics were equally strong, with an average SUS score of 85.4 from both staff and patients. Staff particularly praised the admin dashboard's efficiency, noting a 75% reduction in inventory management time, while 88% of patients found online booking "significantly easier" than phone scheduling.

The system's success stemmed from its dual-interface architecture, which maintained workflow separation without compromising data integration, and the rigorous Waterfall methodology that prevented post-deployment issues. Early prototype feedback (Section 4.3) directly improved final features like editable appointments and visible clinic hours – now among the most valued functions.

While results confirmed the system's effectiveness, the evaluation revealed opportunities for refinement, particularly in mobile responsiveness (scoring 78/100) and staff onboarding time. These findings will guide planned upgrades, including enhanced mobile interfaces and payment integrations, while affirming the DCMIS as a replicable model for small clinics facing similar operational challenges.

5.1 Project Planning

Planning has been an essential part of our capstone journey, helping us stay focused and organized from the very beginning. We officially started around mid to late January by learning the basics of Systems Analysis and Design, where we gained a clear understanding of how information systems are developed and the role of a systems analyst. Over the following weeks, we studied project selection, feasibility studies, system modeling, and evaluation—knowledge that built our confidence and helped us choose a system that matched both our skills and the needs of our users. By mid-April, we shifted into planning our actual capstone proposal. We brainstormed ideas, finalized our system title, and got our topic approved. From there, we gathered requirements and began the design process, including UI design in Figma, database structure through ER diagrams, and prototype testing with several revisions based on feedback. Now, in May, we're focused on finalizing our documentation and preparing for our proposal defense scheduled on May 15. June will then be used for post-defense improvements, such as applying panel suggestions and starting early development preparations.
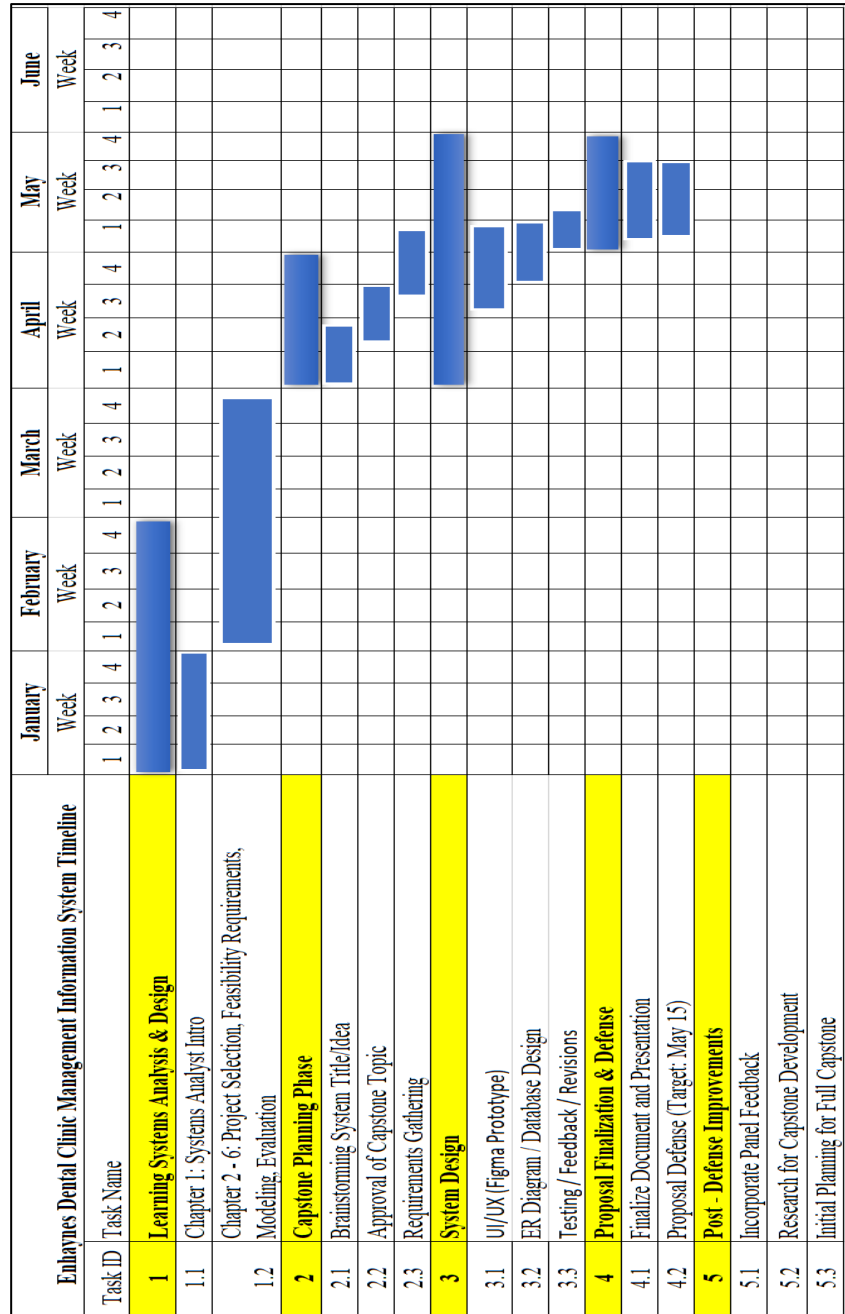
Enhaynes Dental Clinic Management Information System Timeline

Task ID	Task Name	Jan W1	Jan W2	Jan W3	Jan W4	Feb W1	Feb W2	Feb W3	Feb W4	Mar W1	Mar W2	Mar W3	Mar W4	Apr W1	Apr W2	Apr W3	Apr W4	May W1	May W2	May W3	May W4	Jun W1	Jun W2	Jun W3	Jun W4
1	**Learning Systems Analysis & Design**								█																
1.1	Chapter 1: Systems Analyst Intro		█																						
1.2	Chapter 2 - 6: Project Selection, Feasibility Requirements, Modeling, Evaluation					█	█	█	█	█	█	█	█												
2	**Capstone Planning Phase**																								
2.1	Brainstorming System Title/Idea													█	█										
2.2	Approval of Capstone Topic														█										
2.3	Requirements Gathering															█									
3	**System Design**																█	█							
3.1	UI/UX (Figma Prototype)															█									
3.2	ER Diagram / Database Design															█									
3.3	Testing / Feedback / Revisions																█								
4	**Proposal Finalization & Defense**																█	█							
4.1	Finalize Document and Presentation																	█							
4.2	Proposal Defense (Target: May 15)																		█						
5	**Post - Defense Improvements**																			█					
5.1	Incorporate Panel Feedback																			█					
5.2	Research for Capstone Development																								
5.3	Initial Planning for Full Capstone																								

Figure 14. Enhaynes DCMIS Gantt Chart

The Gantt chart above shows the entire journey, broken down into clear and manageable phases: learning, planning, designing, finalizing, and improving. It helped us stay on track by giving us a visual overview of what needed to be done each week, and it made sure we were moving forward at a steady pace.

5.2 Systems Design
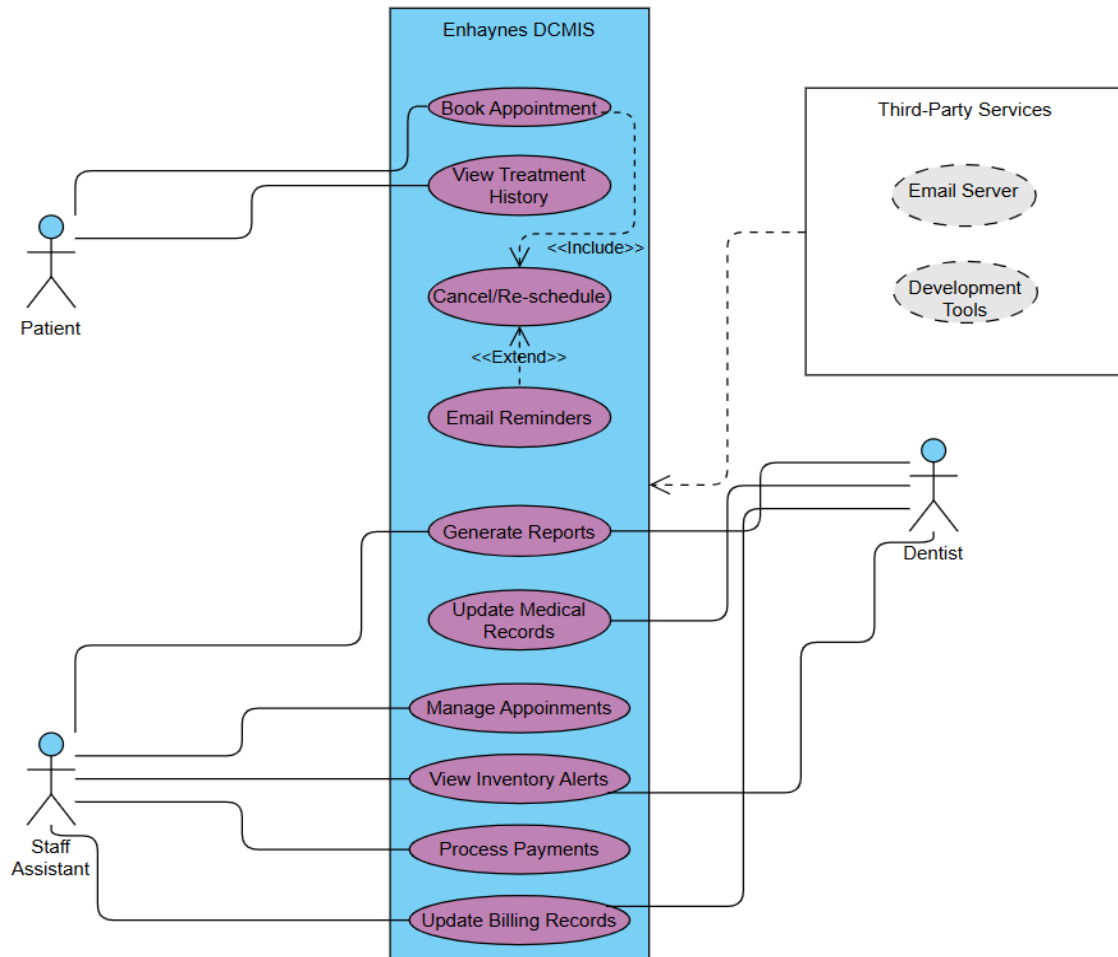
a.) Use-Case Diagram

Figure 15. Enhaynes DCMIS Use-Case Diagram

The DCMIS use case diagram illustrates system interactions for three primary actors: Patients (book/cancel appointments with <<include>> dependencies, view treatment history, triggering email reminders via <<extend>>), Dentists (update medical/billing records, view inventory alerts, generate reports), and Staff Assistants (manage appointments, process payments, update records). The diagram also shows integration with Third-Party Services (Email Server for reminders, Development Tools) through dashed-line dependencies. Clear UML notation defines the system boundary and relationships between components. Dentists and staff share overlapping functions like report generation, while patients interact solely with appointment and history features. The

structure effectively communicates role-specific workflows and external system integrations.

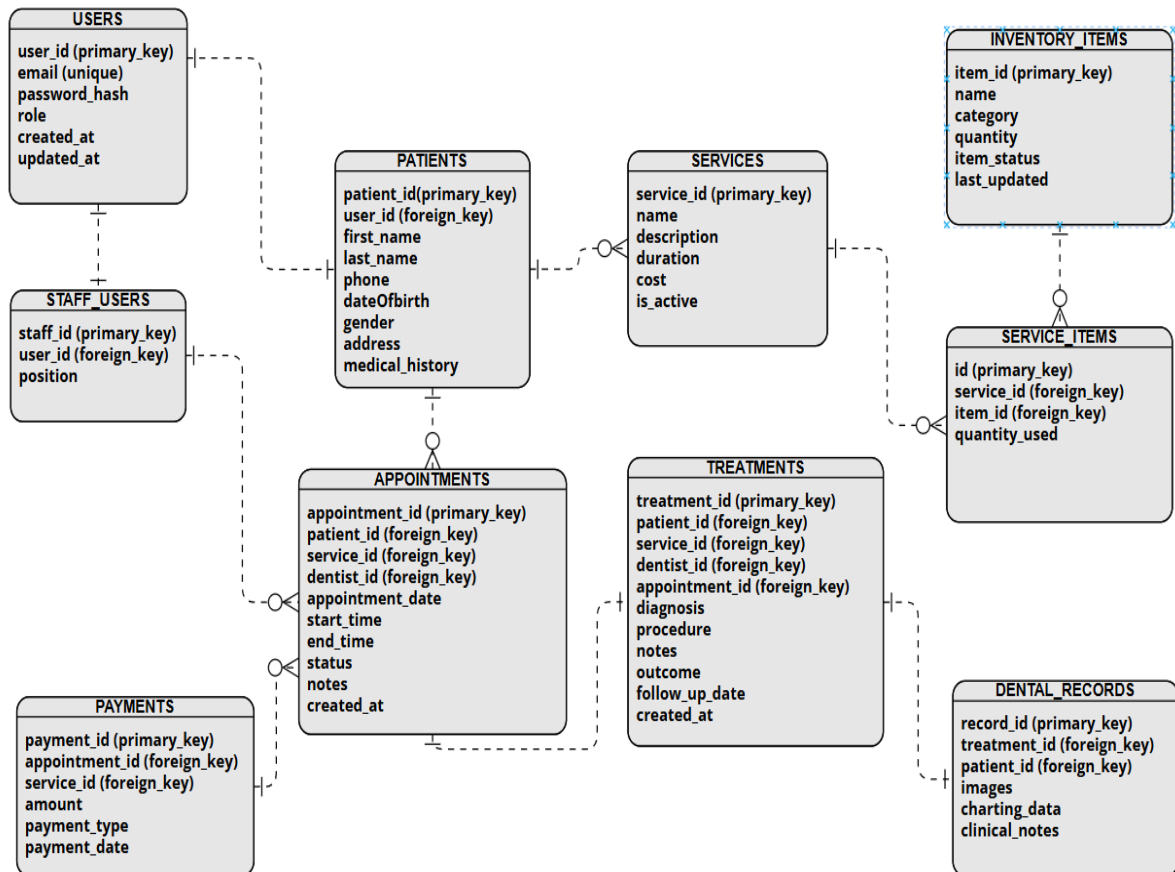**b.) Entity Relationship Diagram**

Figure 16. Enhaynes Entity Relationship Diagram

The Enhaynes DCMIS ER Diagram effectively organizes the dental clinic's database through normalized tables that handle all essential operations. At its core, the USERS table divides into PATIENTS and STAFF_USERS to manage different access levels, while the APPOINTMENTS and TREATMENTS tables work together to track patient care, connecting to SERVICES and dental staff. The INVENTORY_ITEMS and SERVICE_ITEMS tables monitor supplies and their usage, solving inventory management challenges, and the PAYMENTS table keeps all financial transactions organized by appointment. For complete patient records, the DENTAL_RECORDS table stores clinical

information including images and treatment notes. These relationships - particularly the connections between APPOINTMENTS, PATIENTS and TREATMENTS - maintain strict data accuracy while perfectly matching the Laravel/React.js system architecture described in our technical approach.

(Chapters 5.3, 5.4, 5.5, 6, and 7 will be continued as per our instructor's instructions.)

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