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Outpatient Clinic Management System at Adventist Medical Center Bacolod

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Abstract. The increasing demand for efficient and secure healthcare systems calls for innovative digital solutions [1]. This capstone project presents the development of an Outpatient Clinic Management System for Outpatient Department of Adventist Medical Center Bacolod, aiming to transition from a paper-based process to a hybrid web-based and desktop-based system application. The system is designed to streamline clinical operations, improve patient record management, and support administrative decision-making [2]. The system ensures the accurate and secure handling of medical data while reducing manual workloads [3]. The system project will undergo thorough testing and evaluation to guarantee the reliability and security of patient demographic data [4]. Sufficient training and continuous support will be available to ensure optimal system utilization [5]. Resistance to change and insufficient training could hinder user adoption and system efficacy [6]. Comprehensive documentation, comprising user manuals and technical specifications, is vital for guiding users throughout the project [4]. A rapid application development model helps the developer quickly deliver the system project to the customer [7]. This project's development was guided by the Gantt chart, which outlines the timeline schedule for system development [8]. Higher or minimum requirements for hardware devices are essential to ensure the system's seamless operation [4]. Vulnerability in patient data security and breaches of confidentiality are vital in this project [9]. The hospital complies with data protection regulations. The Clinic Management System significantly improves workflow efficiency and data management within the clinic. It reduces human error, enhances patient service, and provides actionable insights through comprehensive reporting and data analytic visualization. By digitizing core processes such as appointment scheduling, consultation, prescription, ordering, and recordkeeping, the system streamlines clinical operations and supports timely, informed decision-making [3]. The system's modular design allows for easy maintenance and scalability, making it adaptable to future requirements and healthcare innovations [4]. Its user-friendly interface and reliable functionality increase staff productivity and reduce administrative burden [4]. The integration of features such as audit trails and automated email notifications further contributes to operational transparency and improved patient engagement [4]. To keep the OPD Clinic Management System efficient and future-ready, regular updates, system expansions, and strong technical support are recommended [10].

Keywords. Outpatient Clinic Management System, System Development, Software Testing, Healthcare Information System, Healthcare Digitalization, Workflow Improvement, Philippines

1. INTRODUCTION

The global healthcare industry faces significant challenges, including an aging population, rising chronic diseases, and increasing costs, necessitating efficient outpatient clinic management systems. These systems are crucial for enhancing operational efficiency, reducing waiting times, and improving patient outcomes, especially in recent public health crises like the pandemic. Additionally, evolving regulatory requirements and the shift toward value-based care emphasize the need for robust management solutions that can adapt to complex healthcare environments. Implementing effective systems is essential for healthcare providers to meet the demands of a competitive and dynamic industry [1]

In the Asian context, where healthcare resources are often scarce and populations are large, efficient management of outpatient clinics is essential. The healthcare system in Myanmar faces significant challenges in its healthcare system. The World Health Organization (WHO) ranked Myanmar's healthcare system 190th out of 191 countries in a 2002 report on health system performance. The main provider of health services in Myanmar is the Ministry of Health and Sports (MoHS), which oversees primary healthcare, basic health services, and access to treatments and rehabilitation services. However, due to limited resources, healthcare quality remains low [11].

The same applies to the Philippines. Outpatient clinics are pivotal healthcare establishments offering medical services to non-hospitalized patients, with efficient management crucial, particularly in resource-constrained settings. According to Orange Health Consultants (OHC), digitalization is increasingly prevalent in various healthcare domains, including e-prescriptions, hospital management information systems, and Integrated Clinic Information Systems (iClinicSys) for primary care facilities. This report, commissioned and funded by the Embassy of the Kingdom of the Netherlands in the Philippines in collaboration with the Netherlands Enterprise Agency, underscores the evolving landscape of Philippine healthcare following a decade of escalated public healthcare spending [12].

Locally, Adventist Medical Center Bacolod's outpatient department (OPD) clinic faces several pressing challenges, including managing a high volume of patient medical documents, coordinating effectively with specialists, providing timely access to medical records and history, manually handwriting prescriptions, and ensuring the confidentiality and security of patient data, because of the paper-based system. As healthcare demands continue to evolve, a robust and tailored outpatient clinic management solution is critical to improving operational efficiency and enhancing patient care. The proponent aims to develop a comprehensive, tailored solution that streamlines appointment and consultation management, enhances coordination with specialists and electronic prescriptions, ensures prompt access to medical records, and safeguards patient data. This initiative not only addresses the unique challenges of the OPD but also reinforces the institution's commitment to delivering exemplary, patient-centered healthcare services in a rapidly evolving medical landscape. This paper base approach complicates data security and retrieval, especially for old patients. A computer-based system allows one-click access to patient medical histories and records. As healthcare increasingly embraces technology, implementing robust computer-based systems is essential for optimizing clinical practices and improving patient care [13].

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Despite significant advancements in healthcare technology, there remains a critical gap in the literature concerning developing and implementing electronic healthcare records (EHR) in Asian and Philippine healthcare contexts. Most existing research primarily focuses on general hospital management systems, neglecting the specific challenges and requirements of outpatient clinics. This oversight is particularly concerned given the unique healthcare dynamics and patient populations in these regions, which demand tailored solutions. By addressing this gap, the project contributes valuable insights into outpatient care delivery, enhancing our understanding of how EHR systems can be effectively designed and implemented to meet the diverse needs of patients and healthcare providers. This emphasis highlights the importance of localized research and underscores the potential for improved health outcomes in these settings through better management of health information [14].

The rationale of this study is to explore the development and utilization of the Clinic Management System as a comprehensive and hybrid solution to streamline and optimize the core operations of outpatient department clinics at Adventist Medical Center Bacolod. By integrating essential functions such as patient consultation, appointment scheduling, electronic prescribing, basic document archiving, and medical record keeping into a centralized system, this study aims to highlight the relational dynamics between these operations and their impact on clinic efficiency. The transition from a paper-based system to a digital one will significantly enhance staff efficiency, allowing them to access a patient's medical history with just one click. This study will help transform risk-stratified patient management for better clinical outcomes, and higher patient satisfaction [15].

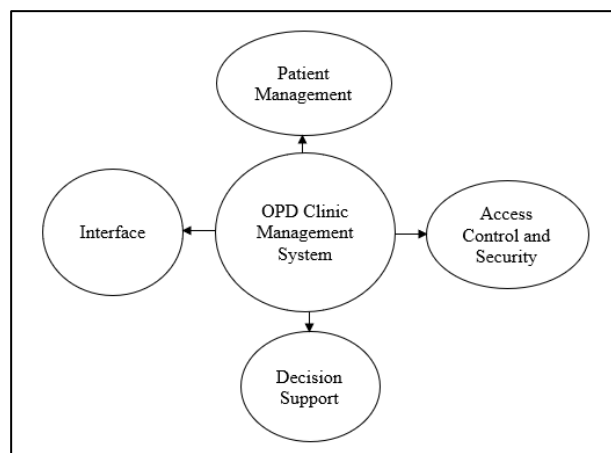
2. PRODUCT DESCRIPTIONS

In the product perspective, the OPD Clinic Management System at Adventist Medical Center Bacolod is a hybrid desktop and web-based application designed to serve as the primary management tool for the outpatient clinic's operations. It handles a range of patient management processes, including appointment scheduling, consultation management, electronic prescriptions, doctor's orders, scanned patient medical document archiving. It enhanced decision-making by leveraging data analytics, generating reports, and visualizing dashboards. Access control and security are very important in this system to protect sensitive data, prevent unauthorized actions, reduce insider threats, ensure accountability, and maintain system integrity. To ensure accountability and transparency, the audit trail feature provides a detailed, chronological record of all activities and changes within the system, tracking the user responsible, the time of action, and the specific tasks performed. Additionally, the system supports email notifications to patients about their upcoming consultation schedules, with user intervention. Additionally, the system supports email notifications to patients about their

upcoming consultation schedules, with user intervention, ensuring timely reminders and reducing the likelihood of missed appointments.

The system's scalability ensures it can effectively adapt to the OPD clinic's evolving needs, supporting growth in user management, functionality, database capacity, and compliance with regulatory requirements. As the OPD clinic expands or experiences changes in operational requirements, the system can be easily updated or modified to meet those demands without compromising performance or reliability. Since the system was developed internally by the proponent, or by the hospital's Information Technology Services Department Manager, there is a comprehensive understanding of its architecture and infrastructure. This in-house development approach allows for smoother adjustments, quicker troubleshooting, and the integration of custom features tailored to the clinic's specific objectives. A contingency plan is essential, which is why the hospital owns all resources, including the source code of the project and the devices used in its development. The system uses modular approach that allows easy addition or modification of features without affecting the entire system. The system is developed with clean, well-documented, and modular code, making it easier for developers to add new features or make changes without disrupting the overall system. As a result, the system is not only equipped to handle higher data volumes and additional users but can also evolve alongside the hospital's long-term goals, ensuring continued efficiency and alignment with the organization's changing needs. This adaptability facilitates continuous improvement and positions the organization to respond swiftly to emerging challenges and opportunities in the healthcare landscape [16].

Figure 1. *Outpatient Clinic Management System Project General Features*

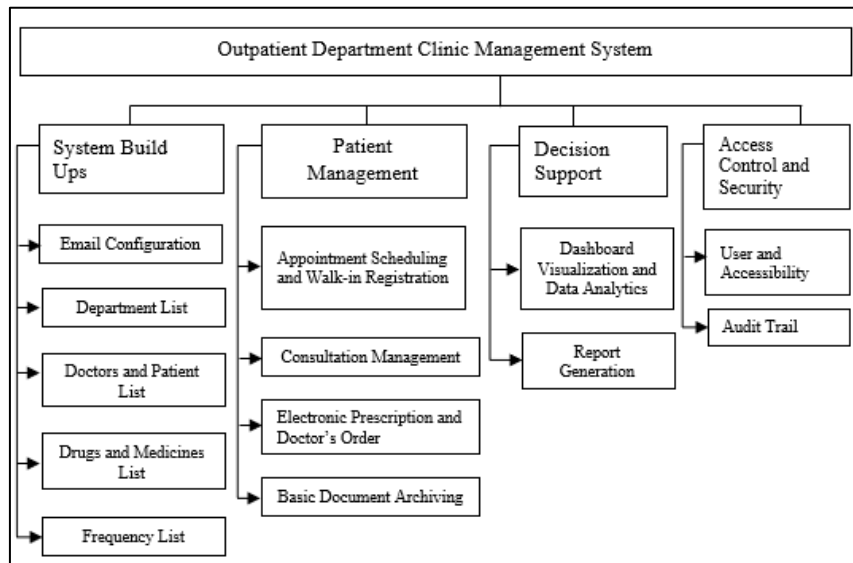


3. SYSTEM FEATURES

The system is designed to accommodate five distinct types of users, each with specific roles and responsibilities to ensure smooth clinic operations: IT Administrator, this user is responsible for providing technical support and managing the foundational setup of the system. Their tasks include configuring system and email settings, maintaining department and doctor directories, managing the drug and medicine listing, setting frequency listings, monitoring audit trails, and handling user account creation and access control. OPD Clinic Receptionist, this user handles the scheduling of patient appointments and manages patient registration for consultations. Clinic Physician, this user is responsible for managing patient consultations and maintaining electronic health records. Their functions include consultation management,

issuing electronic prescriptions, and creating doctor's orders and requests. Clinic Secretary, this user is tasked with scanning and uploading patient medical documents, printing medical certificates, and discharging patients following consultations. Administrative Council and Manager, these users are granted access to the system's dashboard, enabling them to view analytics and support data-driven decision-making.

Figure 2. *System Feature Decomposition*



The system features include the following: System build-ups, this serves as the master files and are the essential backbone of patient transactions. Simplifying patient management and ensuring that the system operates efficiently and reliably. By centralizing core information, such as doctor's profiles, clinic services, drugs and medicines, and other clinical data, it helps maintain data accuracy and consistency across the entire system. These modules enable users to effortlessly add, update, and retrieve data, which helps reduce errors, improve coordination among staff, and more organized.

Patient management start with the patient appointment scheduling and or walkin registration. Appointment scheduling enables patients to book consultation appointments in the OPD clinic based on the doctors' availability, helping reduce waiting times and ensuring a more streamlined and efficient patient flow. In this process, patients call the receptionist, who collects their demographic information. If the doctor is available, the receptionist schedules the appointment according to the patient's preferred time. Additionally, the system will send an email to the patient to notify and confirm their appointment, as well as help track upcoming appointments. This ensures that both patients and clinic staff are kept informed about scheduled visits, reducing the likelihood of missed appointments, and benefits of being cost-effective to the patient, improved quality of care and communication. Walk-in registration enhances patient engagement by allowing patients to personally register themselves in the system using tablets or smartphones, maximizing the use of technology. This approach ensures data accuracy and reduces data redundancy. To proceed with the registration, the patient must complete and sign the consent form.

Consultation management or electronic health recording is a core feature of clinic management systems, acting as the central hub for processing and maintaining patient electronic

health records. It involves the collection of essential patient information, including demographic details, vital signs, chief complaints, medical history, and more. This functionality allows healthcare providers to efficiently track patient visits, manage prescriptions, and doctor's orders, and medical document archiving, all while accessing comprehensive patient data in real-time. The module supports key actions such as adding new entries, editing existing records, and discharging patients, which serves as an official indication of the clinic's completion of care.

E-prescription and doctor's order are the digital creation of prescriptions and doctor's instruction or ordering, which is critical in addressing risks of handwritten, including misinterpretation and mistakes. This functionality increases the precision of prescriptions and ordering, minimizes the possibility of medication errors, and enables enhanced tracking of patients' medication and ordering history. E-prescribing also facilitates increased operational effectiveness in clinics through the eradication of paperwork, prevention of delays, and enabling prescriptions to reach pharmacies quickly and accurately. According to Velo and Minuz (2009), the use of automated prescribing systems is recommended as an effective tool to reduce medication errors. These systems help mitigate the risk of harm from prescribing faults and enhance the quality of medical care by minimizing errors in drug dispensing and administration [17].

According to Alpasan's 2021 study on the E-Document Archiving System, quickly retrieving and sharing the required documents can be challenging, and accessing documents from the archive storage room can be time-consuming. This system feature is particularly beneficial for the OPD clinic department, as it enables doctors to promptly access a patient's medical documents and history. With just a few clicks, doctors can retrieve the scanned medical documents of patients, such as clinical lab results, diagnostic imaging, and other patient medical documents. This feature also allows documents to be reproduced or printed as needed [18].

Data analytics is applied in both the dashboard and report generation features of the system to enhance decision support of the OPD clinic administrative council. The report generation capability allows users to create detailed reports on patient demographics, departmental census, consultation details, prescriptions, doctor's orders, discharge summaries, and visit histories. These reports provide valuable insights into clinic performance and daily operations, enabling administrators to track key trends and identify areas for improvement. The ability to customize these reports allows users to gain a comprehensive view of patient trends, treatment patterns, and system efficiency. The system's dashboard leverages data analytics to present real-time visual summaries of key performance indicators (KPIs), providing users with a quick, data-driven overview of various clinic functions. It displays important metrics such as patient wait times, appointment schedules, patient daily statistics, top-performing doctors, and consultation census by gender. In addition, the system applies machine learning to predict future patient counts. By loading historical patient data from the database and applying an exponential smoothing model in SQL Server, the system forecasts the number of patients for the next day, month, or year. This predictive capability helps the clinic plan for future demand and optimize resource allocation.

This project has a flexible management of system users and accessibility to guarantee security, scalability, and support with change management plan requirements. This feature ensures that users can access the right data and features according to their responsibilities. It emphasizes the importance of role-based access control (RBAC), where different users, such as administrators, healthcare providers, secretaries, and receptionist or staff, have tailored access levels to ensure security, and efficiency.

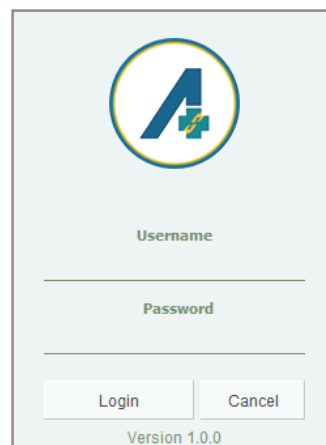
This system includes traceability components that allow user to impose good practices, monitor user activity, and instantly examine any possible incidents. The Audit Trails feature offers an unalterable record of all activities within the system, so that everyone involved is accountable for their actions. If something goes wrong, these logs can be used to track the origin and determine the responsible individual.

4. EXTERNAL INTERFACE REQUIREMENTS

The Outpatient Clinic Management System features a user-friendly and intuitive interface, designed to provide users with clear visual elements and accessible functionality, allowing them to navigate and manage the system with ease. The system is developed using a combination of Java, PHP, HTML, CSS, JSON, JavaScript, and Bootstrap, enabling it to function as a hybrid solution, supporting both web-based and desktop application operations. The web-based application, developed in PHP and hosted via XAMPP, facilitates walk-in patient registration for consultations. This component ensures accurate data entry and real-time patient interaction with the system. The desktop application, developed using Java EE (requiring a minimum of JRE 7) within the NetBeans 12 Integrated Development Environment, serves as the primary system interface. It handles the core clinic operations, ranging from appointment scheduling to patient discharge after consultation. The system utilizes Microsoft SQL Server 2016 as its central data repository, ensuring secure and efficient data storage and retrieval across both application platforms.

The figure 3 shows the login window that requires only a username and password to access the system. Only users authorized by administrators are granted credentials to open and use the system for security purposes. After completing the required fields, the user can press the Enter key or click the login button. A warning notification will appear if any fields are empty, or the provided credentials do not match.

Figure 3. *Login Interface*



The figure 4 shows the dashboard of the system that serves as a comprehensive interface that boosts operational efficiency by providing real-time access to patient overviews and analytics. It allows users to make informed decisions and enhance patient care. It can showcase metrics such as average consultation wait times per department, patient census, top-performing doctors, appointment schedules, and daily patient statistics.

Figure 4. Dashboard Interface

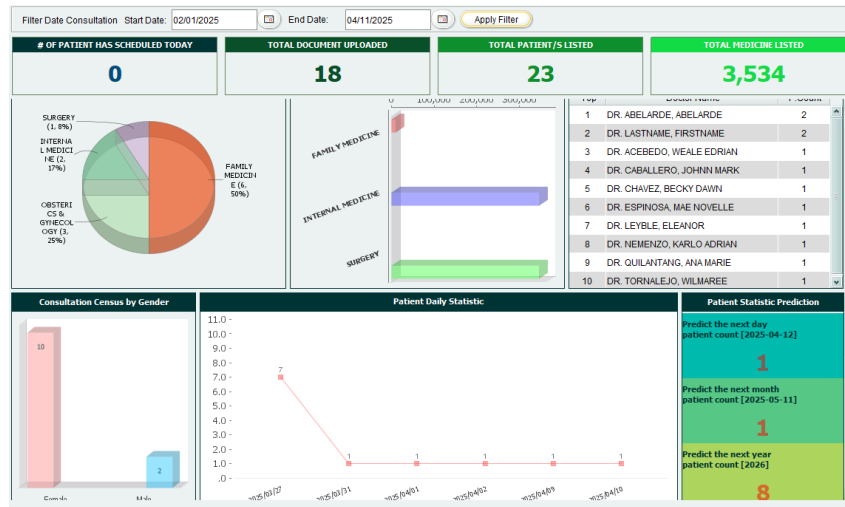
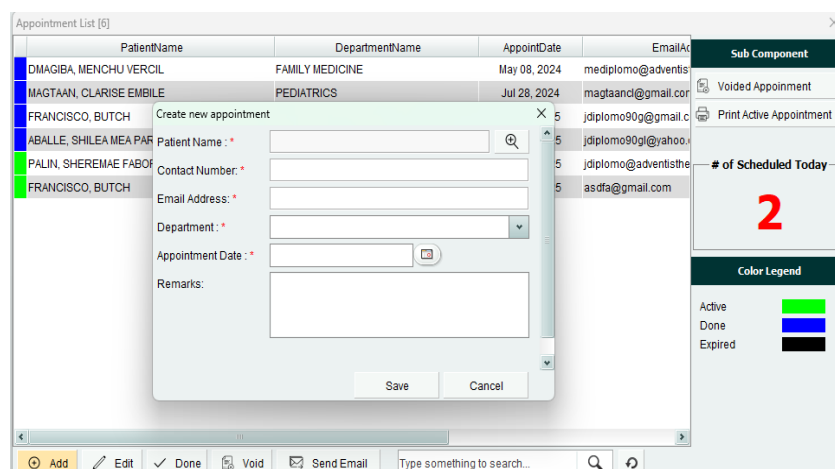


Figure 5 illustrates the Appointment Scheduling Module. In this module, the receptionist can either select an existing patient from the system database or create a new patient record if the patient does not yet exist. The receptionist is required to input the patient's contact number and email address to enable email notifications. Additionally, the receptionist must select the appropriate clinic department and specify the desired date of the appointment. A remarks field is available for entering any relevant notes or special instructions related to the appointment. Once all information is verified and confirmed with the patient, the appointment can be saved.

Upon successful entry, the system automatically sends an email notification to the patient confirming the appointment. Furthermore, the system will continue to send daily reminder emails starting five days before the scheduled consultation date, helping ensure that the patient is well-informed and prepared.

Figure 5. Appointment Scheduling Interface

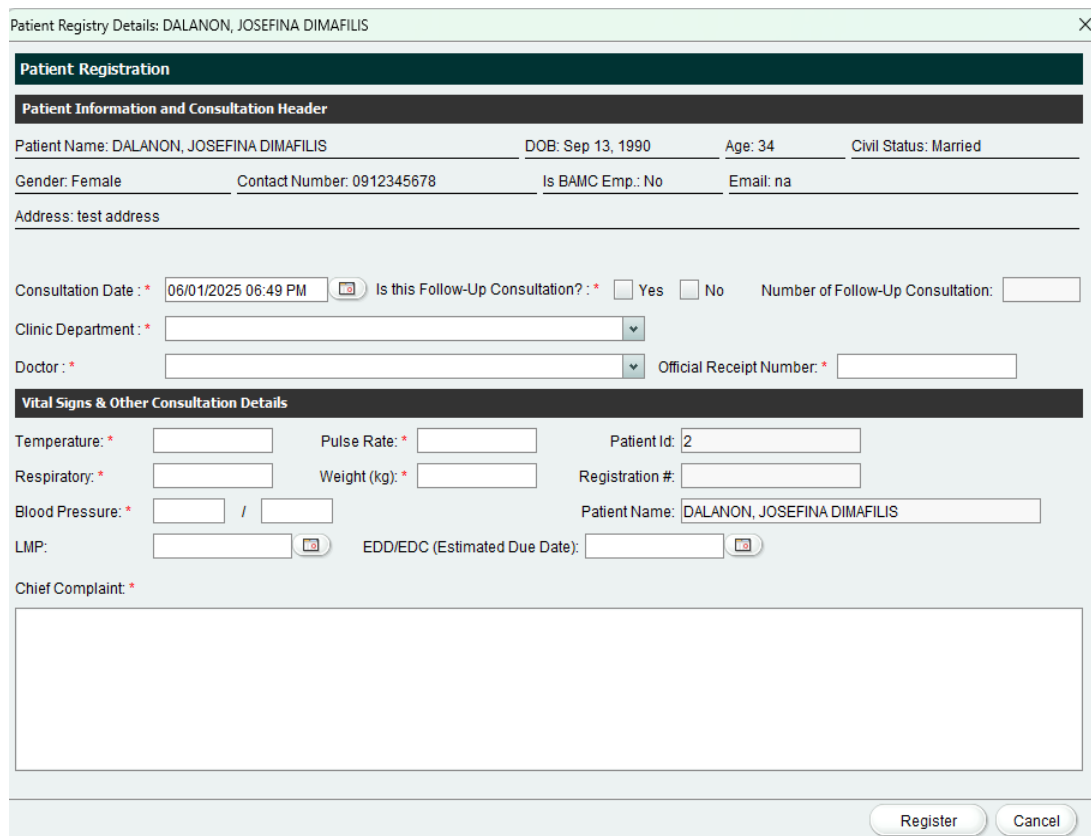


Figures 6 and 7 illustrate the Patient Registration Module, which is available in both the desktop and web-based interfaces of the system. Figure 6 presents the registration interface

from the desktop application. It features a user-friendly form designed for registering patients for consultation and displays a list of currently active patients. A "Consent Form" button is provided, which, when clicked, generates a printable consent form to be signed by the patient or guardian, ensuring compliance with confidentiality and data privacy standards. The "New" button allows users to initiate registration either from a scheduled appointment or for walk-in patients. To facilitate quick access to records, a dynamic search field is available within the registration table. Additionally, an "Edit" button enables users to correct any errors in the registration details.

Figure 7 shows the web-based application interface, which also features a user-friendly form for patient registration. The system is built with a responsive web design, ensuring compatibility across a variety of devices, including desktops, tablets, and smartphones. This design enhances usability and patient engagement while minimizing redundant data entry and typographical errors. The interface lists existing patients and includes a search function to expedite the registration process. For registering new patients, an "Add Patient" button redirects users to the registration form to initiate the consultation workflow. As with the desktop version, a printed consent form is presented to the patient or guardian by the receptionist to ensure confidentiality and adherence to data privacy regulations.

Figure 6. Desktop Application Registration Interface

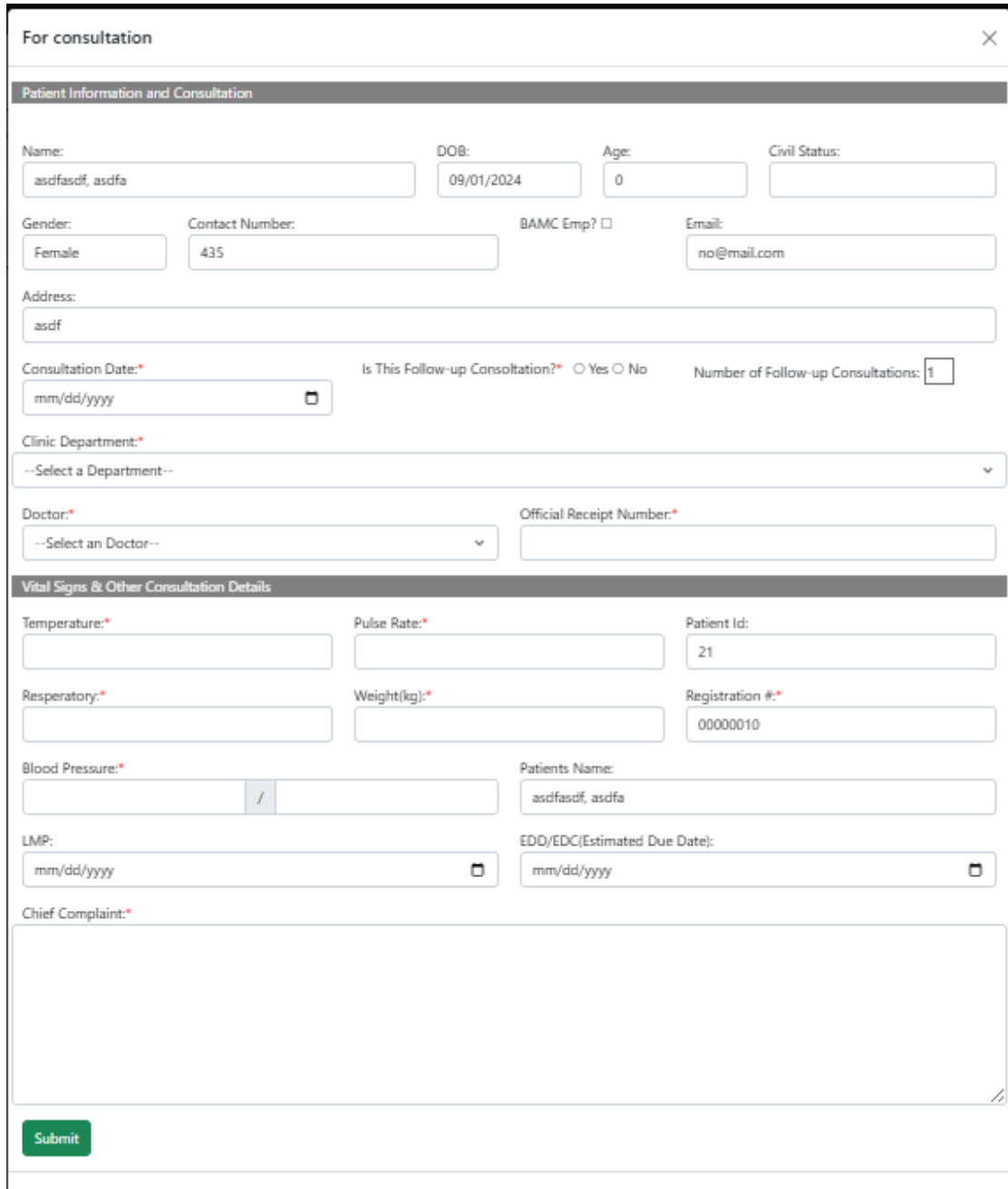


The screenshot displays a web-based registration form for a patient named DALANON, JOSEFINA DIMAFILIS. The form is organized into several sections:

- Patient Registration Header:** Displays the patient's name, DOB (Sep 13, 1990), Age (34), and Civil Status (Married).
- Patient Information and Consultation Header:** Includes fields for Gender (Female), Contact Number (0912345678), Is BAMC Emp. (No), and Email (na).
- Address:** A text field containing "test address".
- Consultation Details:** Includes a date and time selector (06/01/2025 06:49 PM), a checkbox for "Is this Follow-Up Consultation?" (Yes/No), and a field for "Number of Follow-Up Consultation".
- Department and Doctor:** Dropdown menus for "Clinic Department" and "Doctor", along with a field for "Official Receipt Number".
- Vital Signs & Other Consultation Details:**
 - Temperature, Pulse Rate, and Respiratory rate fields.
 - Weight (kg) field.
 - Blood Pressure field (format: /).
 - LMP (Last Menstrual Period) field.
 - EDD/EDC (Estimated Due Date) field.
 - Patient ID: 2
 - Registration # field.
 - Patient Name: DALANON, JOSEFINA DIMAFILIS
- Chief Complaint:** A large text area for entering the patient's main concern.

At the bottom right, there are "Register" and "Cancel" buttons.

Figure 7. Web-based Application Registration Interface



For consultation [Close]

Patient Information and Consultation

Name: DOB: Age: Civil Status:

Gender: Contact Number: BAMC Emp? Email:

Address:

Consultation Date: Is This Follow-up Consultation? Yes No Number of Follow-up Consultations:

Clinic Department:

Doctor: Official Receipt Number:

Vital Signs & Other Consultation Details

Temperature: Pulse Rate: Patient Id:

Respiratory: Weight(kg): Registration #:

Blood Pressure: Patients Name:

LMP: EDD/EDC(Estimated Due Date):

Chief Complaint:

Figure 8 illustrates the Consultation Module, which features an intuitive interface for managing patient consultations and displays a list of currently active patients. Unlike the registration form, this module allows for direct patient registration without requiring receptionist intervention—an enhancement implemented based on administrative request. Within this module, physicians are responsible for managing all aspects of the consultation process. The module serves as a centralized hub for various clinical functions, including uploading patient documents for archiving, issuing doctor’s orders, generating electronic prescriptions, creating medical certificates, and discharging patients following consultation. An

"Edit" button is available to modify existing records or to add new information; however, changes are only permitted if the patient has not yet been discharged. A dynamic search function enables users to quickly locate specific entries within the consultation table, while a filter option allows users to display a list of active patients based on the selected consultation date.

Figure 8. Consultation Interface

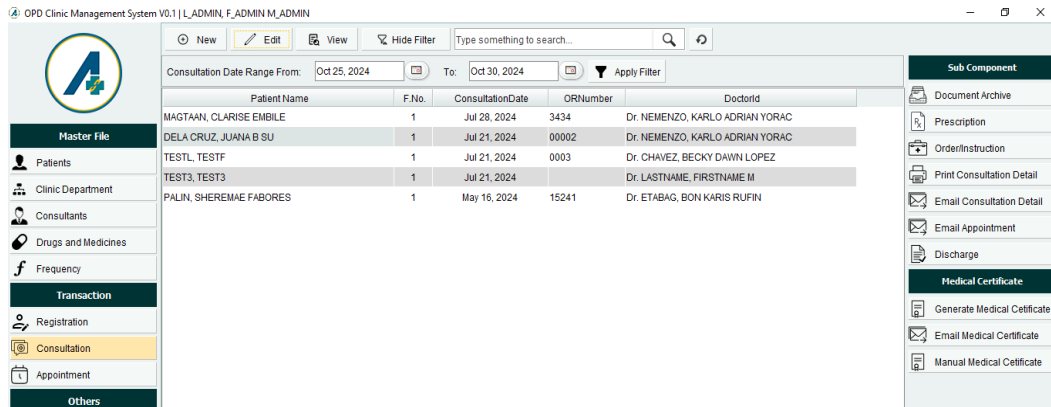


Figure 9 illustrates the Document Archiving Module, which provides an easy-to-use interface for managing the archiving of patient medical documents. Key features include the ability to upload scanned medical documents, save them directly to the system database, remove incorrectly uploaded files, merge multiple documents into a single file, export files as PDFs, and print documents when needed. It is important to note that the system is designed to support only scanned image file types for importing and saving to the database, ensuring compatibility and standardization in document handling.

Figure 9. Document Archiving Interface

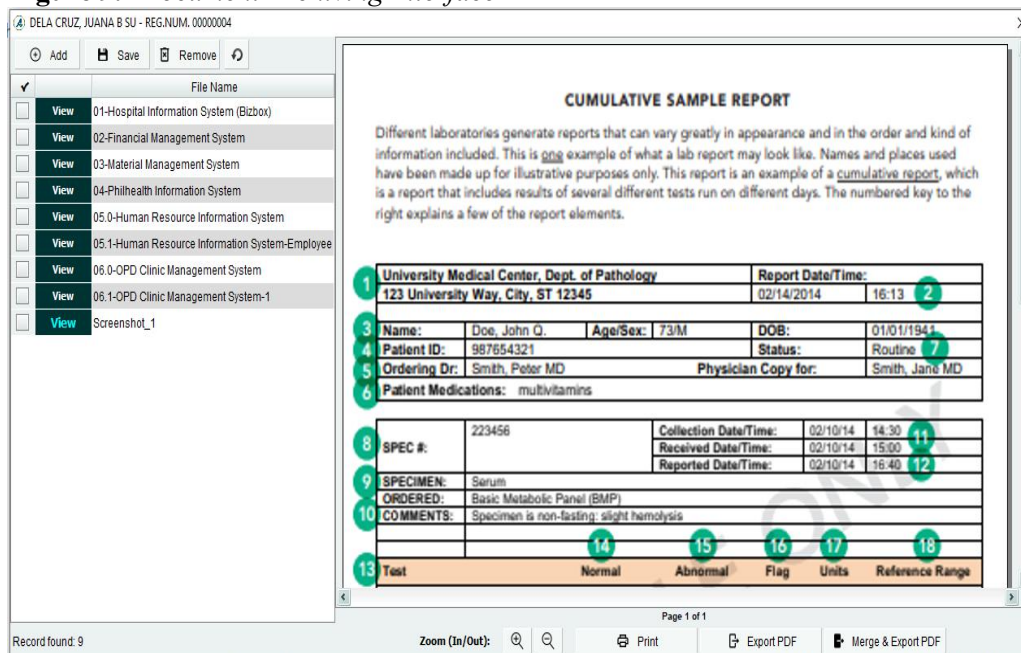
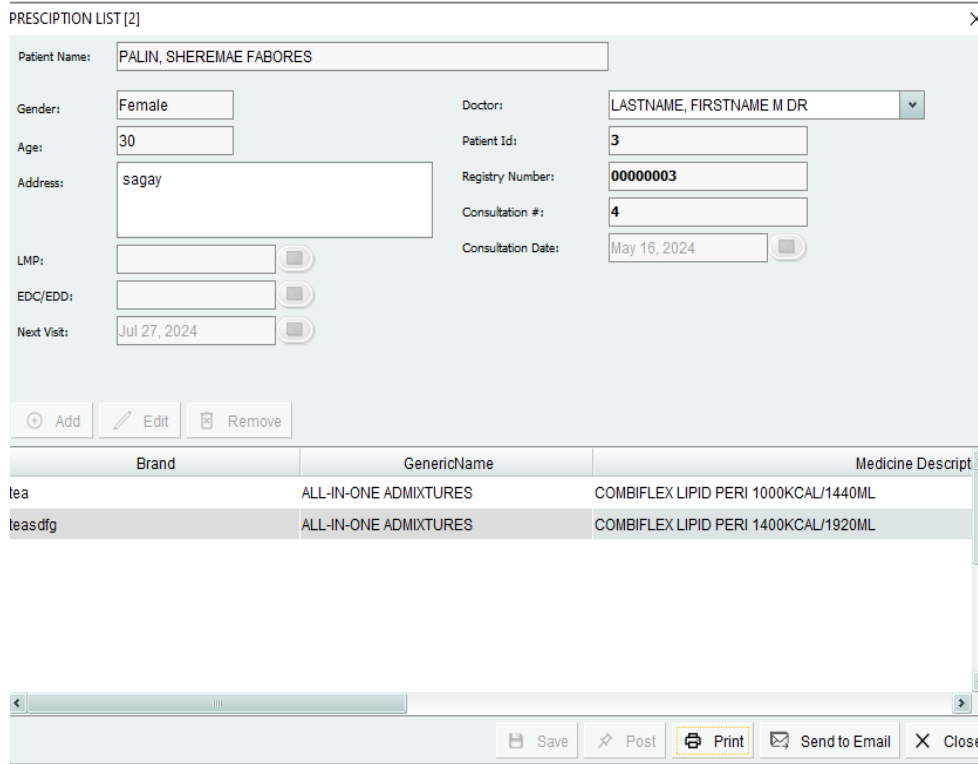


Figure 10 and 11 shows the Electronic Prescription Module and Printable Electronic Prescription, which allows users to efficiently create, modify, and manage electronic

prescriptions. The module displays essential consultation details along with the patient's information, ensuring accurate identification of the patient for whom the prescription is intended. Once a prescription has been finalized and posted, it becomes non-editable to maintain data integrity. Users have the option to print the prescription for the patient or send it via email, providing flexibility in prescription delivery.

Figure 10. *Electronic Prescription Interface*



PRESCRIPTION LIST [2] X

Patient Name: PALIN, SHEREMAE FABORES

Gender: Female Doctor: LASTNAME, FIRSTNAME M DR

Age: 30 Patient Id: 3

Address: sagay Registry Number: 00000003

LMP: Consultation #: 4

EDC/EDD: Consultation Date: May 16, 2024

Next Visit: Jul 27, 2024

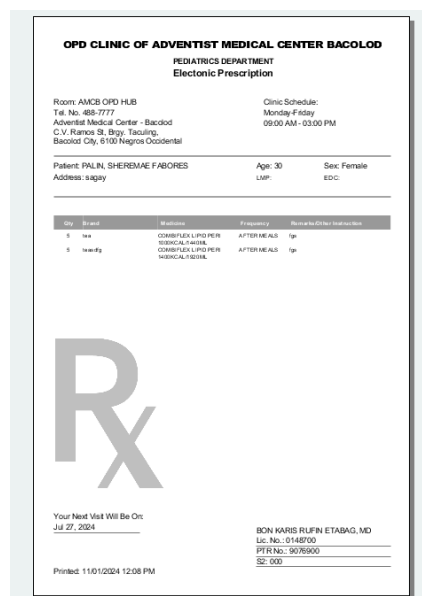
+ Add Edit Remove

Brand	GenericName	Medicine Descript
tea	ALL-IN-ONE ADMIXTURES	COMBIFLEX LIPID PERI 1000KCAL/1440ML
teasdfg	ALL-IN-ONE ADMIXTURES	COMBIFLEX LIPID PERI 1400KCAL/1920ML

Save Post Print Send to Email X Close

Figure 11.

Printable Electronic Prescription Interface



OPD CLINIC OF ADVENTIST MEDICAL CENTER BACOLOD
PEDIATRICS DEPARTMENT
Electronic Prescription

Room: AMCS OPD HUB Clinic Schedule: Monday-Friday
Tel. No. 468-7777 Adventist Medical Center - Bacolod 09:00 AM - 03:00 PM
C.V. Rianza St. Brgy. Taculing, Bacolod City, 6100 (Negros Occidental)

Patient: PALIN, SHEREMAE FABORES Age: 30 Sex: Female
Address: sagay LMP: EDC:

Qty	Brand	Medicine	Frequency	Route/Instructions
5	tea	COMBIFLEX LIPID PERI 1000KCAL/1440ML	AFTER MEALS	tp
5	teasdfg	COMBIFLEX LIPID PERI 1400KCAL/1920ML	AFTER MEALS	tp

Rx

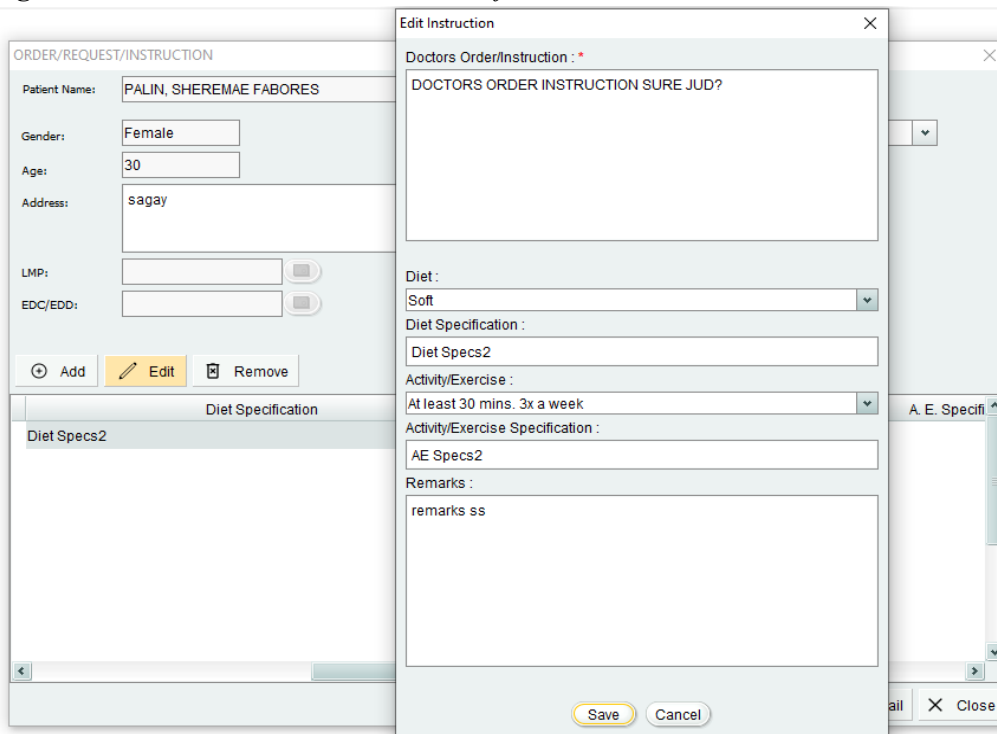
Your Next Visit Will Be On:
Jul 27, 2024

BON HARRIS RUIFIN ETABAG, MD
Lic. No.: 0148700
PFR No.: 9076900
SE: 100

Printed: 11/01/2024 12:08 PM

Figures 12 and 13 present the Electronic Doctor's Order Module and its corresponding printable format. This module allows users to efficiently create, modify, and manage doctor's orders or instructions. It displays key consultation details and patient information to ensure accurate identification of the intended recipient. Once a doctor's order is posted, it becomes non-editable to preserve the integrity of the medical record. Users can either print the order for the patient or send it via email for convenience. To ensure data completeness and prevent errors, all required fields must be properly filled out; otherwise, the transaction will not be saved to the system's database.

Figure 12. *Electronic Doctor's Order Interface*



The screenshot shows a web-based interface for creating or editing doctor's orders. The main window is titled "ORDER/REQUEST/INSTRUCTION" and contains the following fields:

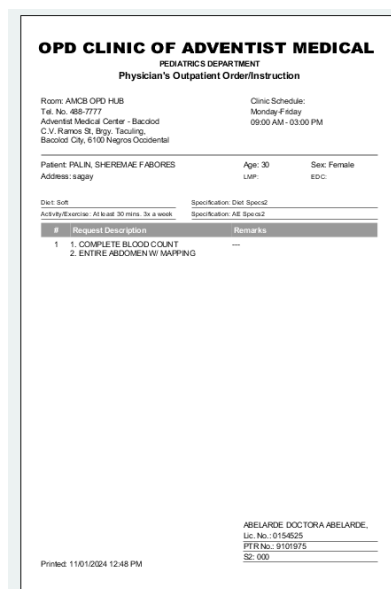
- Patient Name:** PALIN, SHEREMAE FABORES
- Gender:** Female
- Age:** 30
- Address:** sagay
- LMP:** [Empty field]
- EDC/EDD:** [Empty field]

Below these fields are buttons for "Add", "Edit", and "Remove". A section titled "Diet Specification" contains a "Diet Specs2" field. An "Edit Instruction" dialog box is open over the main form, containing:

- Doctors Order/Instruction :** * DOCTORS ORDER INSTRUCTION SURE JUD?
- Diet :** Soft
- Diet Specification :** Diet Specs2
- Activity/Exercise :** At least 30 mins. 3x a week
- Activity/Exercise Specification :** AE Specs2
- Remarks :** remarks ss

At the bottom of the dialog box are "Save" and "Cancel" buttons. A "Close" button is visible on the right side of the dialog box.

Figure 13. *Printable Doctor's Order Interface*



The printable format is a header for the OPD CLINIC OF ADVENTIST MEDICAL, PEDIATRICS DEPARTMENT. It includes the following information:

- Room:** AMCB OPD HUB
- Tel. No.:** 488-7777
- Adventist Medical Center - Bacolod**
- C.V. Ramos St. Bldg. Taculing, Bacolod City, 6100 Negros Occidental**
- Clinic Schedule:** Monday-Friday, 09:00 AM - 03:00 PM

Patient information:

- Patient:** PALIN, SHEREMAE FABORES
- Age:** 30
- Sex:** Female
- Address:** sagay
- LMP:** [Empty]
- EDC:** [Empty]

Order details:

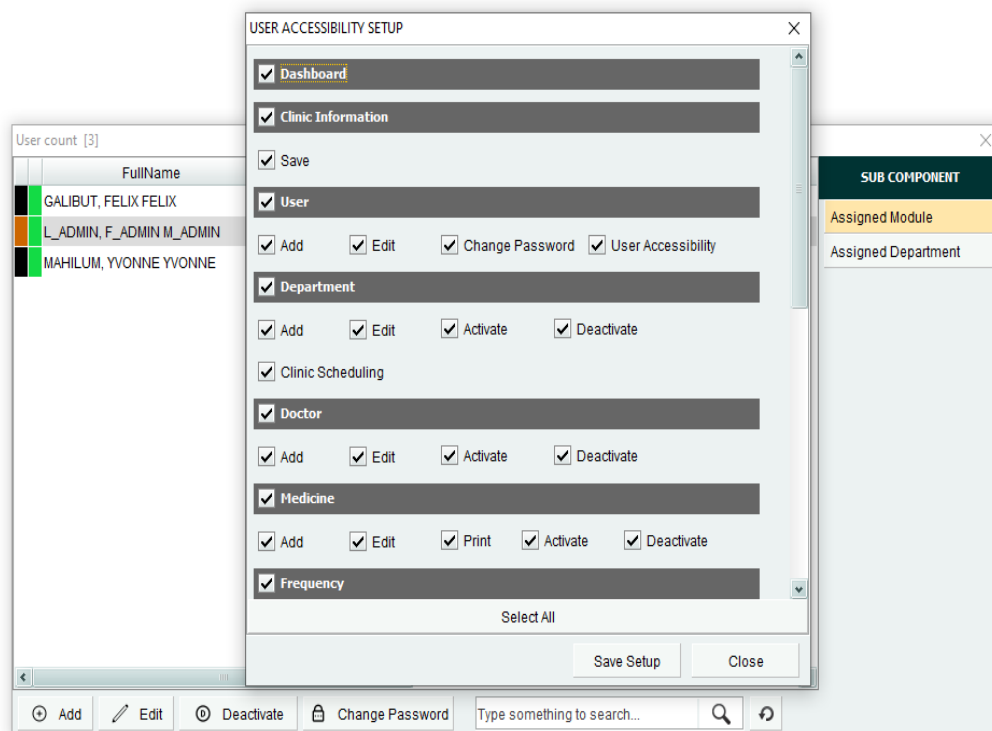
- Diet:** Soft
- Activity/Exercise:** At least 30 mins. 3x a week
- Specification:** Diet Specs2
- Specification:** AE Specs2

#	Request Description	Remarks
1	COMPLETE BLOOD COUNT	
2	ENTRE ABDOMEN W/ MAPPING	

At the bottom right, it lists the doctor's name: ABELARDE DOCTORA ABELARDE, Lic. No.: 9154625, PTR No.: 9101975, and SR: 000. The print date and time are 11/01/2024 12:48 PM.

Figure 14 illustrates the System User Management Module, which facilitates efficient management of user accounts within the system. This module enables administrators to assign specific modules and departments to each user, ensuring that access permissions align with their designated roles and responsibilities. Key features include the ability to create user accounts, modify access permissions, activate or deactivate users, and reset or change user passwords. These functionalities enhance both the security and operational efficiency of the system by maintaining proper access control and user accountability.

Figure 14. *System User and Accessibility Interface*



5. OTHER NONFUNCTIONAL REQUIREMENTS

The system is designed to meet essential non-functional requirements, including high-performance capabilities for efficient operation under heavy loads, stringent security protocols to safeguard patient data, and key software quality attributes such as usability, reliability, and maintainability to ensure smooth, uninterrupted functionality. Additionally, compliance with healthcare regulations, scalable architecture, and rigorous testing protocols enhance the system's resilience and adaptability, making it an indispensable tool in modern healthcare management.

System remains a reliable, secure, and compliant tool, protecting patient information, supporting clinic operations, and meeting legal obligations in healthcare data management. The system upholds high privacy, data protection, and operational security standards through these protocols, contributing to a trustworthy and efficient healthcare environment. The system performs automated, daily full SQL database backups to capture the most recent data, reducing the risk of data loss in case of system failure. Offsite backups are stored outside the hospital at a disaster recovery site to protect data from physical threats or natural disasters. Regular backup and recovery process testing will also be conducted using a test server and training database to

restore the system database, ensuring data integrity and completeness. Additionally, failover and redundancy are in place so that a secondary server can take over in the event of a physical system failure, providing uninterrupted access to critical data.

All users undergo regular training on security best practices, such as creating strong passwords and following access control policies. Additionally, the system administrators educate the users on the importance of access control, emphasizing the risks of sharing credentials or leaving the system unattended. This proactive approach to security training helps to protect sensitive data and reduce the chances of human errors compromising system integrity.

To evaluate user satisfaction, system usability, and non-functional performance, a post-implementation survey was conducted using a five-point Pomel scale. The survey assessed the system's five major features along with their corresponding software quality attributes. The overall mean score was 4.82, which falls under the "Excellent" category, reflecting strong user approval of the system's design and functionality.

In terms of User-Friendliness, the system was designed to ensure intuitive navigation and ease of use. The survey results showed high ratings for relevant attributes: Usability (M = 4.76) and Simplicity (M = 4.70), resulting in an overall mean of 4.73, interpreted as "Excellent".

For the Interactivity feature, which measures the system's engagement and responsiveness, the survey reported: Simplicity (M = 4.70) and Communicativeness (M = 4.90), leading to an overall mean of 4.80, also rated as "Excellent".

Reliability emerged as one of the most highly rated aspects of the system, with quality attributes scoring as follows: Accuracy (M = 4.85), Consistency (M = 4.83), and Simplicity (M = 4.90), resulting in an overall mean of 4.86, interpreted as "Excellent".

In the Compatibility category, the system scored 4.80 for Interoperability, again falling under the "Excellent" interpretation. Similarly, under the Learning Reinforcement dimension, the system received a rating of 4.80 for Learnability, also rated as "Excellent".

These consistently high ratings confirm the system's readiness for full deployment in production environments and suggest a strong potential for replication in similar clinical or enterprise-level settings.

6. PROJECT MANAGEMENT

Hardware Recommendations. The proponent conducted a thorough evaluation of the necessary hardware components to ensure the system performs efficiently and meets user expectations throughout its development and deployment. Key considerations in defining the hardware requirements included system responsiveness, reliability, and processing capability, all of which are critical for maintaining smooth and uninterrupted system operations.

To support optimal performance, minimum hardware specifications were identified, along with considerations for scalability to accommodate future upgrades based on increasing data volume and user demand. The system is engineered to deliver its best performance when supported by suitable hardware, and meeting these specifications is essential to fully leverage the application's functionality.

Outlined below are the recommended hardware configurations that provide the best compatibility with the system, ensuring reliable and efficient performance in real-world operating conditions.

Table 1. *Hardware Recommendation – Server*

Server Requirements	
Processor	Quad-Core Intel Xeon Server @ 2.30 GHz
RAM	16 GB of RAM
Storage	512 SSD Operating System Storage, 1 TB of SSD Data storage

Table 2. *Hardware Recommendation – Desktop/Laptop Computers*

Workstation Requirements	
Processor	Intel® Core™ i5
RAM	8 GB of RAM
Storage	512 GB of SSD storage

Table 3.

Hardware Recommendation – Smart Phone/Tablet

Gadget Requirements	
Processor	Octa-core Dimensity 9000
RAM	8 GB of RAM

Software Recommendations. To ensure the system performs its intended functions effectively, the proponent has carefully identified the necessary computer devices software. During the implementation phase, the proponent recommends using the appropriate software to guarantee the system operates smoothly and efficiently. To address compatibility concerns and optimize system performance, a list of highly recommended software specifications is provided below.

Table 4. *Software Recommendation – Server*

Server Requirements	
Operating System	Windows Server 2019 Standard Edition
Database Repository	SQL Server 2019 Standard Edition

Table 5. *Software Recommendation – Desktop/Laptop Computers*

Workstation Requirements	
Operating System	Windows 10 Professional
JDK (Java Development Kit)	JRE 7 (Java Runtime Environment)

Table 6. *Software Recommendation – Smart Phones/Tablet*

Gadget Requirements	
Operating System	Android 11 Red Velvet Cake
Browser	Any

Product Feasibility Assessment. At the request of the Vice President of the Medical Cluster of Adventist Medical Center Bacolod, and following a thorough analysis of technical requirements and user criteria, the proponent conducted a feasibility assessment to evaluate the practicality and effectiveness of the OPD Clinic Management System. The assessment focused on key areas including market strategy, management and personnel, economic viability, and production capability.

The system demonstrations presented to physicians and the administrative council highlighted its usability and advantages. Key features such as streamlined patient registration, automated appointment scheduling with email notifications, electronic prescriptions, real-time reporting, and dashboard visualization were emphasized as tools to support efficient clinical workflows and data-driven decision-making.

As the system was developed in-house, there are no external software development costs, significantly enhancing its cost-effectiveness. The system supports both desktop-based and web-based access, compatible with all modern web browsers, and is built with a responsive design to ensure smooth functionality across various devices and operating system.

Furthermore, the system was developed using a rapid application development (RAD) methodology, incorporating rigorous unit testing and software testing to ensure that it meets technical and operational standards. This approach has resulted in a robust, scalable, and dependable solution ready for deployment.

Time Management. A well-structured time management strategy was implemented to ensure the successful and timely development of the system. The project adopted the Rapid Application Development (RAD) methodology, which emphasizes flexibility, active user involvement, and rapid iterative development. This approach enabled continuous feedback and allowed for timely adjustments throughout the development lifecycle.

Through this methodology, the project team was able to effectively allocate tasks, optimize resource usage, and meet critical milestones, while keeping end users actively engaged in each phase of the project. All stages—from planning and analysis to development, testing, and implementation—were carefully scheduled and closely monitored using a Gantt chart to ensure progress remained on track.

Communication, Coordination, and Team Composition. A key contributor to the project's success was the active involvement of doctors, secretaries, and the OPD Clinic department head. Their commitment, collaborative effort, and valuable input during data gathering, system evaluation, and testing helped shape a system that aligns with the clinic's operational needs and ensures a smooth

Risk Management. The development and implementation of the OPD Clinic Management System includes a comprehensive risk management plan aimed at identifying,

addressing, and mitigating potential issues that may impact system performance, security, and operations. This approach focuses on two key areas: potential risks and mitigation strategies. Identified risks include data security threats, such as unauthorized access and breaches that could compromise patient confidentiality, technological issues like system downtime or hardware/software failures, and operational risks stemming from insufficient user training or human error. To mitigate these risks, the system enforces strict access controls based on user roles and permissions, implements automated and scheduled data backups along with server and database replication for data integrity and availability, and conducts regular user training programs to enhance system familiarity and reduce the likelihood of errors, thereby ensuring the system's reliability, security, and operational efficiency.

Policy Development. A comprehensive policy development framework was implemented to support the secure and efficient operation of the OPD Clinic Management System and its integration within the outpatient clinic environment. This includes a data retention policy that defines the duration for storing patient records and system logs, along with procedures for secure data disposal. An incident response plan was also established to provide a clear, predefined protocol for managing security breaches or technical failures, aiming to minimize operational disruption and recovery time. Additionally, a training policy promotes continuous learning through regular refresher courses, ensuring all system users stay informed about system features, workflow updates, and best practices—ultimately reducing operational errors and enhancing overall user competence.

7. SUMMARY

The OPD Clinic Management System is a hybrid application that integrates both desktop-based and web-based platforms, designed and developed to improve the operational workflow of the Outpatient Department (OPD) at Adventist Medical Center Bacolod. It aims to eliminate manual and paper-based processes by providing a digital platform for managing patient records, appointments, consultations, prescriptions, ordering, document archiving, and reporting functionalities. Developed using the Rapid Application Development (RAD) methodology, the project emphasizes fast development cycles, user involvement, and continuous feedback. This approach allowed the development team to quickly iterate and respond to user needs, manage tasks efficiently, and meet project milestones within the target timeframe.

The system is designed to be responsive and accessible across various devices—desktops, laptops, tablets, and smartphones—supporting patient self-registration and allowing clinic staff to operate the system conveniently from multiple access points. It features key modules such as Appointment Scheduling, Patient Registration, Consultation Management, Prescription Management, Doctor's Order Management, Electronic Medical Certificate, and Report Generation. A dynamic dashboard provides real-time visual summaries of key performance indicators (KPIs), such as daily patient statistics, wait times, doctor performance, and gender-based consultation breakdowns. Data analytics is integrated into the system, allowing the prediction of future patient visits using historical data through SQL Server's machine learning services and exponential smoothing models.

The project also incorporates strong data security measures through role-based access control, database replication, regular automated backups, and comprehensive policy development, including data retention and incident response planning. Training policies and refresher sessions were implemented to ensure users remain proficient and minimize

operational risks. A product feasibility assessment confirmed that the system is viable in terms of marketing, economic sustainability, personnel management, and production. With the system developed in-house at zero cost, it demonstrates cost-efficiency and long-term maintainability.

In conclusion, the OPD Clinic Management System offers a reliable, secure, and user-friendly platform that enhances clinic operations, supports accurate and timely healthcare delivery, and promotes digital transformation in medical record management.

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