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Design and Implementation of a Patient Monitoring and Scheduling System for Healthcare Institutions

Cheryl T. Ampalo[1], Shinie Kie A. Dangasi[2], Anabella M. Galvez[3]

[1] Staff, J.H. Cerilles State College, Philippines
[2] Instructor III, J.H. Cerilles State College, Philippines
[3] Visiting Lecturer, J.H. Cerilles State College, Philippines

Abstract
This research developed and evaluated a Patient Monitoring and Scheduling System for the Rural Health Unit (RHU) of Bayog, Zamboanga del Sur, using PHP and the Agile Software Development Life Cycle (SDLC). The system was designed to automate patient registration, scheduling, and monitoring processes, thereby reducing manual workload and improving healthcare service delivery. The development process followed iterative sprints, ensuring continuous refinement of modules based on user feedback. Evaluation was conducted using the ISO/IEC 25010 software quality model, focusing on functionality, usability, reliability, efficiency, and security. Data were gathered through survey questionnaires, interviews, and observation checklists, with results analyzed using both quantitative and qualitative methods. Findings revealed that the system achieved Very Satisfactory ratings across all attributes, with efficiency and functionality receiving the highest scores. Respondents highlighted improvements in workflow, reduced waiting times, and enhanced patient satisfaction. The research concludes that PHP-based systems developed through Agile methodology can effectively address healthcare challenges in resource-limited settings, offering a scalable solution for rural health units.

Keywords: Patient Monitoring, Scheduling System, PHP, Agile SDLC, ISO/IEC 25010, Healthcare Information System

1. Introduction

Healthcare institutions continue to face challenges in managing patient information, monitoring health conditions, and scheduling medical services efficiently. Manual processes often lead to delays, errors, and miscommunication between patients and healthcare providers, compromising care quality and increasing waiting times. These inefficiencies place additional strain on medical staff and resources, particularly in institutions with limited capacity.

Recent technological advancements have transformed healthcare management. Patient monitoring systems now leverage Internet of Things (IoT), wearable devices, and telemedicine platforms to provide real-time tracking of vital signs and medical records. Scheduling systems facilitate improved appointment management and optimize resource allocation, reducing waiting times and improving operational efficiency (Abdalkareem et al., 2021). Integrating scheduling with patient monitoring into a unified

platform further enhances patient safety, service delivery, and clinical workflows (Abdulmalek et al., 2022).

The COVID-19 pandemic accelerated the adoption of remote patient monitoring (RPM) technologies, demonstrating their potential to reduce infection risks and manage chronic diseases through virtual consultations and continuous health tracking. Studies emphasize that IoT-based healthcare monitoring systems not only improve efficiency but also enhance patient outcomes by enabling secure, real-time data collection and analysis (Khan & Duncan, 2025). Moreover, recent advancements in machine learning (ML) and deep learning (DL) have been applied to healthcare monitoring systems, improving predictive capabilities and decision support. These technologies enhance the accuracy of patient data analysis and support proactive healthcare interventions (Shaik et al., 2023). These innovations highlight the importance of adopting technology-driven solutions in healthcare institutions, especially in resource-constrained environments.

Healthcare institutions continue to face persistent challenges in patient monitoring and scheduling because of reliance on manual processes. These inefficiencies often lead to delayed interventions, overlapping appointments, and miscommunication between patients and healthcare providers. Manual monitoring of patient records and vital signs increases the risk of late medical responses, particularly for individuals with chronic or critical conditions (Khan & Duncan, 2025). Likewise, poor scheduling practices contribute to longer waiting times, resource misallocation, and reduced service quality (Abdulmalek et al., 2022). Communication gaps further exacerbate these issues, resulting in errors in treatment schedules and incomplete monitoring updates (Abdalkareem et al., 2021).

Such problems place additional strain on healthcare staff and facilities, limiting their capacity to deliver timely and effective care. Without an integrated system that automates patient monitoring and scheduling, institutions risk compromising patient safety, service efficiency, and overall quality of care. This study, therefore, seeks to design and implement a Patient Monitoring and Scheduling System that addresses these challenges by providing real-time monitoring, reducing scheduling conflicts, improving communication, and optimizing resource utilization.

The primary objective of this study is to design and implement a Patient Monitoring and Scheduling System that enhances healthcare service delivery by integrating real-time monitoring with efficient scheduling mechanisms. The system seeks to address common institutional challenges such as delayed interventions, overlapping appointments, and communication gaps between patients and healthcare providers.

Specifically, the study aims to:

1. Develop a system capable of real-time patient monitoring to ensure timely medical interventions and reduce risks associated with delayed responses.

2. Integrate an automated scheduling module that minimizes appointment conflicts, optimizes resource allocation, and reduces patient waiting times.

3. Establish a communication framework within the system that facilitates accurate and timely information exchange between patients and healthcare providers, thereby reducing errors in treatment schedules.

4. Evaluate the system's effectiveness in improving healthcare workflow efficiency and supporting sustainable patient-centered care practices.

By achieving these objectives, the study envisions a technology-driven solution that not only improves operational efficiency but also strengthens patient safety and institutional capacity to deliver quality healthcare services.

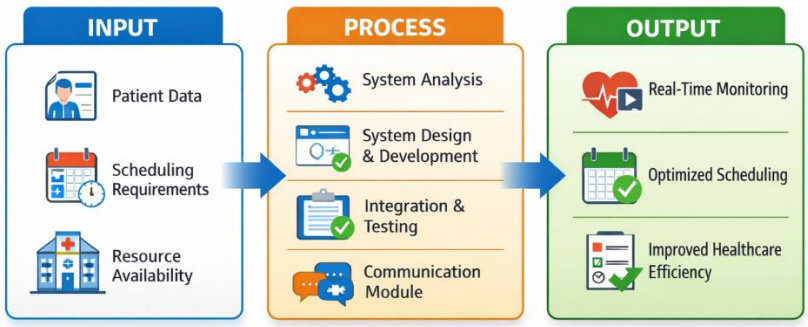
This study focuses on the design and implementation of a Patient Monitoring and Scheduling System for the Rural Health Unit (RHU) of Bayog, Zamboanga del Sur. The system is intended to support healthcare providers and administrative staff in managing patient records, monitoring health conditions, and scheduling medical services more efficiently.

The system's scope includes modules for patient registration, real-time medical record monitoring, and automated appointment scheduling. It is designed to improve communication between patients and healthcare providers, reduce scheduling conflicts, and enhance the RHU's overall workflow. However, the study is limited to the operational context of RHU Bayog and does not extend to other healthcare institutions outside the municipality. The system focuses on outpatient monitoring and scheduling processes and does not cover advanced hospital functions such as inpatient management, laboratory integration, or pharmacy inventory systems.

The conceptual framework of this study is anchored on the Input–Process–Output (IPO) model, which illustrates the logical flow of the research and the development of the Patient Monitoring and Scheduling System for the Rural Health Unit (RHU) of Bayog, Zamboanga del Sur. The framework begins with the input, which includes patient data, scheduling requirements, and resource availability within the RHU. These inputs serve as the essential information needed to design and implement the system. The process involves the systematic stages of system analysis, design, development, integration, and testing. During this phase, the researchers build the database structure, develop modules for patient monitoring and scheduling, and establish a communication framework to ensure accurate, timely information exchange between healthcare providers and patients. Finally, the output represents the study's expected result—a fully functional Patient Monitoring and Scheduling System that provides real-time monitoring, minimizes scheduling conflicts, improves communication, and enhances healthcare efficiency.

This framework demonstrates how integrating patient data and institutional resources through systematic processes leads to the development of an efficient, technology-driven solution for healthcare management. It serves as the foundation for achieving the study's objectives and ensuring that the system contributes to improved patient care and operational effectiveness within RHU Bayog.

Figure 1: Conceptual Framework



2. Literature Review

The literature demonstrates that integrated patient monitoring and scheduling systems represent critical healthcare innovations, with extensive research spanning two decades showing significant potential to improve efficiency, patient satisfaction, and clinical outcomes.

Patient scheduling systems have long been recognized as a critical component of healthcare management. While Cayirli and Veral (2003) focused on balancing patient demand with institutional capacity, Mageshwari et al. (2012) expanded this by reviewing various patient scheduling techniques aimed at improving efficiency and reducing scheduling complexity.

More recently, Ala and Chen (2022) conducted a comprehensive review of over 150 papers, categorizing appointment scheduling problems and highlighting mathematical optimization, simulation models, and artificial intelligence as practical solutions. Similarly, Abdalkareem et al. (2021) analyzed 190 articles on healthcare scheduling optimization, emphasizing its critical role in reducing costs and improving patient flow.

Emerging studies show promising results for online systems. Nabila and Ayuningtyas (2024) reviewed the effectiveness of online or web-based reservation systems and found that these systems improve outpatient waiting time, enhance patient-centered services, and support more efficient healthcare delivery. However, Woodcock (2022) identified persistent challenges in the implementation of automated patient self-scheduling systems, including barriers related to technology access, organizational adoption, and system integration.

Patient monitoring systems have evolved significantly with the advent of remote technologies. Vudathaneni et al. (2024) emphasized the growing importance of remote patient monitoring systems in improving healthcare access and service delivery, particularly in underserved and rural communities. Bawankule and Shahapurkar (2022) reviewed cloud-based monitoring systems, highlighting their advantages over traditional paper-based recording, including improved data accessibility and continuous monitoring capabilities during the COVID-19 pandemic.

A comprehensive review by Abdulmalek et al. (2022) highlighted the benefits of IoT-based healthcare monitoring systems, particularly their ability to enable real-time remote monitoring and improve quality

of life. However, they also identified challenges related to security, privacy, and quality of service (QoS), which remain critical considerations in system design.

Building on these advancements, recent studies by Shaik et al. (2023) further emphasized the integration of artificial intelligence, machine learning, and predictive analytics in remote patient monitoring, highlighting their role in enhancing clinical decision support and proactive healthcare interventions.

Supporting technologies such as RFID have also been explored in healthcare contexts. Yao et al. (2012) reviewed RFID adoption in healthcare, finding that it offers functionality for asset tracking and patient identification. Despite these benefits, they noted barriers including technological limitations, costs, and privacy concerns. These insights highlight the importance of balancing innovation with the practical challenges of implementation.

The reviewed literature suggests significant potential for integrated systems that combine monitoring and scheduling capabilities. While patient scheduling systems focus on optimizing appointments and resource allocation, patient monitoring systems emphasize real-time health tracking and data accessibility. Integration of these two functions offers a holistic solution to healthcare inefficiencies. However, successful implementation requires addressing technological, operational, and privacy challenges identified across multiple studies.

The Patient Monitoring and Scheduling System for RHU Bayog builds upon these insights by integrating monitoring and scheduling into a unified platform, tailored to the needs of a rural healthcare institution.

3. Methodology

This study adopts a developmental-descriptive research design anchored on the Agile Software Development Life Cycle (SDLC). The developmental aspect focuses on the iterative design and implementation of the Patient Monitoring and Scheduling System, while the descriptive component evaluates the system's effectiveness in improving healthcare service delivery at the Rural Health Unit (RHU) of Bayog, Zamboanga del Sur.

Unlike linear models such as the Waterfall approach, Agile SDLC emphasizes incremental development, continuous feedback, and adaptability. The system is developed through short, iterative cycles known as sprints, during which requirements are refined, modules are designed, coded, tested, and evaluated in collaboration with healthcare providers and staff. This iterative process ensures that the system evolves based on user feedback and institutional needs, thereby increasing usability and relevance (Pressman & Maxim, 2020).

The Agile methodology is particularly suited to healthcare system development because it allows rapid adjustments to changing requirements, fosters collaboration between developers and end users, and ensures that functional modules are delivered progressively rather than waiting for a single final release.

Figure 2 illustrates the Agile Software Development Life Cycle (SDLC) framework adopted in this study. The framework begins with Planning, where requirements are gathered from healthcare providers and

staff at RHU Bayog. This is followed by Design, which involves creating system architecture, database structures, and user interface prototypes.

The Development phase focuses on coding and module creation, while Testing ensures that each sprint delivers functional components that meet user requirements. After Deployment, the system is released in small increments, allowing healthcare staff to use and evaluate modules in real-time. User feedback is then integrated into the next sprint, ensuring the system evolves to meet institutional needs and patient care requirements.

This cycle continues until the Patient Monitoring and Scheduling System achieves stability, usability, and efficiency. Through this approach, the study ensures that the system is technically sound and responsive to the operational realities of RHU Bayog, thereby enhancing patient monitoring and scheduling services.

Figure 2: Agile Software Development Life Cycle Framework

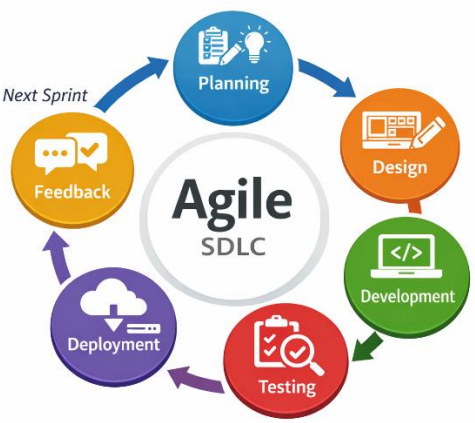


Table 1 presents the Agile Sprint Activities undertaken during the development of the Patient Monitoring and Scheduling System. Each sprint represents a short, iterative cycle focusing on specific modules of the system. The process begins with the development of the Patient Registration Module, followed by the Scheduling, Monitoring, and Communication modules. The final sprint involves System Testing and Optimization, ensuring that all components function cohesively.

This iterative approach enables continuous improvement through user feedback from healthcare providers and staff at RHU Bayog, Zamboanga del Sur. By structuring development into sprints, the study ensures that each module is tested, refined, and aligned with institutional needs before full deployment.

Table 1: Agile Sprint Activities

Sprint No.	**Sprint Focus / Module**	**Key Activities**	**Expected Output**
Sprint 1	Patient Registration Module	Requirement gathering, database design, and interface prototyping for patient data entry	Functional registration module with validated input forms

Sprint 2	Scheduling Module	Development of appointment scheduling logic, calendar integration, and conflict-checking algorithm	Automated scheduling interface with real-time availability
Sprint 3	Monitoring Module	Integration of patient monitoring dashboard, data visualization, and alert system	Real-time monitoring dashboard displaying patient status
Sprint 4	Communication Module	Implementation of a notification system and a feedback loop between staff and patients	Functional communication module with SMS/email alerts
Sprint 5	System Testing and Optimization	Conducting unit, integration, and user acceptance testing; refining based on feedback	Optimized and stable system ready for deployment

The study was conducted at the Rural Health Unit (RHU) of Bayog, Zamboanga del Sur, located in the southern region of the Philippines. RHU Bayog serves as the primary healthcare facility for the municipality, providing essential medical services, including outpatient consultations, maternal and child health programs, immunizations, and community health monitoring. The institution operates under the supervision of the Municipal Health Office and caters to a population distributed across several barangays, many of which are geographically distant from the town center.

The locale was chosen because it represents a typical rural healthcare environment where manual record keeping and scheduling processes remain prevalent. These traditional methods often lead to inefficiencies such as delayed patient monitoring, overlapping appointments, and difficulty in tracking medical histories. Implementing a Patient Monitoring and Scheduling System within RHU Bayog provides an opportunity to address these challenges through digital transformation, thereby improving both administrative workflows and patient care delivery.

The RHU's existing infrastructure includes basic computer units and internet connectivity, which are sufficient to support the deployment of the system. The institution's staff demonstrated willingness to participate in the development and evaluation process, making RHU Bayog an ideal setting for testing the applicability and effectiveness of the system.

The respondents of this study are individuals directly involved in or affected by the implementation of the Patient Monitoring and Scheduling System at the Rural Health Unit (RHU) of Bayog, Zamboanga del Sur. They include healthcare providers such as doctors, nurses, and midwives who will utilize the monitoring and scheduling modules to manage patient records and appointments. Administrative staff are also respondents, as they are responsible for encoding patient data, managing schedules, and ensuring a smooth workflow within the RHU. In addition, patients who receive outpatient services at RHU Bayog are included to provide feedback on usability and service efficiency.

A total of 88 participants were enrolled in the study, including 15 healthcare providers, 10 administrative staff, and 63 patients. Purposive sampling was employed to ensure that only those directly engaged in patient care and administrative functions were selected, thereby guaranteeing that the feedback gathered

is relevant to the system's usability, functionality, and efficiency. This diverse respondent base strengthens the evaluation of the Patient Monitoring and Scheduling System, as it captures the perspectives of both service providers and recipients, ensuring that the system is responsive to the operational realities of RHU Bayog.

Table 2: Distribution of Respondents

Category	**Role / Function**	**Number of Respondents**
Healthcare Providers	Doctors, Nurses, Midwives	15
Administrative Staff	Records Officers, Scheduling Personnel	10
Patients	Outpatient Service Users	63
Total		**88**

The primary tool used in developing the Patient Monitoring and Scheduling System is the PHP programming language, chosen for its flexibility, widespread adoption in web development, and compatibility with existing healthcare information systems. PHP was used to build the system's core modules, including patient registration, scheduling, monitoring, and communication. The backend was supported by a MySQL database, which handled patient records, appointment schedules, and monitoring data. For the user interface, standard web technologies such as HTML, CSS, and JavaScript were employed to ensure accessibility and ease of use across devices.

To ensure iterative development, the study adopted the Agile Software Development Life Cycle (SDLC) framework. Each sprint focused on specific modules, allowing continuous refinement based on feedback from healthcare providers and staff at RHU Bayog. This approach ensured that the system evolved progressively and remained responsive to institutional needs.

The development of the Patient Monitoring and Scheduling System followed the Agile Software Development Life Cycle (SDLC), which emphasizes iterative progress, collaboration, and adaptability. The process was divided into short cycles called sprints, each focusing on specific modules of the system. During the planning phase, requirements were gathered from healthcare providers, administrative staff, and patients at RHU Bayog to identify the most pressing needs in patient monitoring and scheduling. The design phase involved creating system architecture diagrams, database structures using MySQL, and interface prototypes built with PHP, HTML, CSS, and JavaScript.

In the development phase, modules were coded incrementally, beginning with patient registration and then scheduling, monitoring, and communication features. Each sprint delivered a functional component that was tested and refined immediately. The testing phase included unit testing, integration testing, and user acceptance testing, ensuring that each module met the standards of functionality, usability, and reliability. After successful testing, the modules were deployed in the RHU environment, where staff and patients provided real-time feedback. This feedback loop was critical in Agile, as it allowed the research team to adjust features, fix issues, and enhance usability before proceeding to the next sprint.

The iterative nature of Agile ensured that the system evolved progressively, with each sprint producing tangible outputs that contributed to the overall system, ultimately improving healthcare service delivery.

The evaluation of the Patient Monitoring and Scheduling System was conducted using the ISO/IEC 25010 software quality model, which provides internationally recognized criteria for assessing software performance. This model was selected because it covers multiple dimensions of system quality, ensuring a comprehensive evaluation aligned with global standards. The attributes considered include functionality, usability, reliability, efficiency, and security.

Functionality was assessed based on the accuracy and completeness of patient monitoring and scheduling features. Usability focused on the ease of use of the system for healthcare providers, administrative staff, and patients. Reliability measures the system's stability during continuous operation, while efficiency assesses its ability to reduce patient waiting times and streamline workflow. Security was examined in terms of protecting patient data and ensuring compliance with privacy standards.

Table 3 presents the evaluation criteria used in assessing the Patient Monitoring and Scheduling System. These attributes provided a structured framework for analyzing system performance and for interpreting survey and interview results. By applying ISO/IEC 25010, the study ensured that the evaluation was comprehensive, objective, and aligned with international standards.

Table 3: Evaluation Criteria Based on ISO/IEC 25010

Attribute	**Description**
Functionality	Accuracy and completeness of patient monitoring and scheduling features
Usability	Ease of use and user-friendliness for staff and patients
Reliability	Stability and error-free operation during continuous use
Efficiency	Reduction in waiting times and improvement in workflow
Security	Protection of patient data and compliance with privacy standards

The data-gathering procedure involved distributing survey questionnaires to healthcare providers, administrative staff, and patients at RHU Bayog. The questionnaires were designed using a Likert scale to measure perceptions of system functionality, usability, reliability, efficiency, and security. In addition to surveys, structured interviews were conducted with selected healthcare providers and staff to obtain qualitative insights regarding workflow improvements and patient service delivery. Observation checklists were also used to document how the system was integrated into daily operations, particularly in patient registration, scheduling, and monitoring.

The data collected in this study were analyzed using both quantitative and qualitative approaches to ensure a comprehensive evaluation of the Patient Monitoring and Scheduling System. Quantitative data from the survey questionnaires were processed using descriptive statistics, including frequency counts, percentages, and mean values. The Likert scale responses were interpreted to determine the level of agreement among respondents regarding the system’s functionality, usability, reliability, efficiency, and security. These statistical measures provided clear insights into the overall satisfaction and acceptance of the system by healthcare providers, administrative staff, and patients.

Qualitative data obtained from interviews and observation checklists were analyzed thematically. Recurring patterns and themes were identified to highlight user experiences, workflow improvements, and challenges encountered during system implementation. This thematic analysis complemented the quantitative findings by providing contextual explanations and deeper understanding of how the system affected daily operations at RHU Bayog.

By integrating both quantitative and qualitative analyses, the study ensured that the evaluation was not limited to numerical results but also captured the lived experiences of respondents. This dual approach strengthened the validity of the findings and provided a holistic assessment of the Patient Monitoring and Scheduling System's effectiveness in improving healthcare service delivery.

This study adhered to established ethical standards to protect all participants and maintain the integrity of the research process. Prior to data collection, respondents were informed of the study's purpose, the procedures involved, and their role in evaluating the Patient Monitoring and Scheduling System. Informed consent was obtained from healthcare providers, administrative staff, and patients, ensuring that participation was voluntary and that they had the right to withdraw at any time without penalty.

Confidentiality was strictly maintained by securing all survey responses, interview transcripts, and observation notes. Patient records and personal information were anonymized to prevent identification, and access to sensitive data was limited only to authorized members of the research team. The study also complied with relevant data privacy regulations, ensuring that digital information stored in the system was protected against unauthorized access.

Furthermore, the study avoided any form of coercion or undue influence in recruiting participants. Feedback was collected respectfully, and respondents were assured that their input would be used solely for academic purposes and system improvement. By upholding these ethical principles, the study ensured that the development and evaluation of the Patient Monitoring and Scheduling System were conducted responsibly, safeguarding both participants' rights and the credibility of the research.

4. Results and Discussion

This section presents the study's findings from the evaluation of the Patient Monitoring and Scheduling System developed using the Agile Software Development Life Cycle (SDLC). The results are organized according to the attributes of the ISO/IEC 25010 software quality model, namely functionality, usability, reliability, efficiency, and security. Both quantitative and qualitative data are presented to provide a comprehensive view of the system's performance.

Survey responses from healthcare providers, administrative staff, and patients were analyzed using descriptive statistics. The mean scores per attribute are shown in Table 4, while the distribution of responses across the Likert scale is illustrated in Figure 3. These results are complemented by qualitative feedback from interviews and observations, which highlight recurring themes and practical insights into system use in the RHU environment.

As shown in Table 4, all attributes of the system obtained mean scores above 4.50, which fall under the "Very Satisfactory" interpretation. This indicates that respondents strongly agreed on the effectiveness of the Patient Monitoring and Scheduling System across functionality, usability, reliability, efficiency, and security.

Table 4: Mean Scores per Attribute

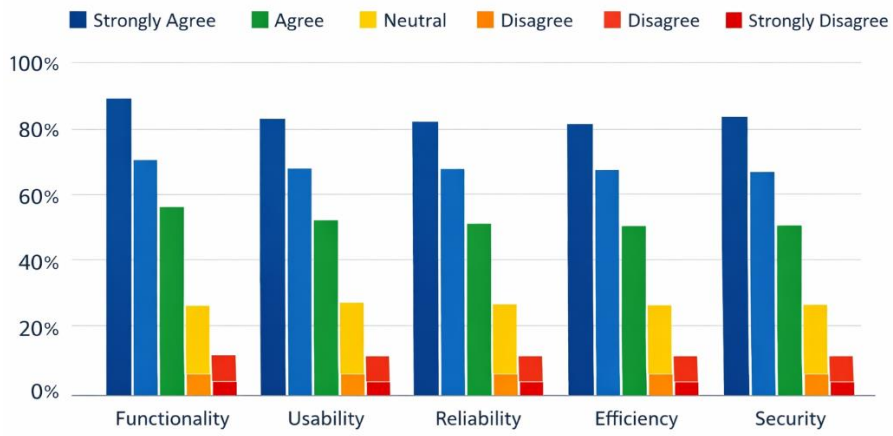
Attribute	Mean Score	Interpretation
Functionality	4.58	Very Satisfactory
Usability	4.56	Very Satisfactory
Reliability	4.52	Very Satisfactory
Efficiency	4.60	Very Satisfactory
Security	4.55	Very Satisfactory

Figure 3 illustrates the distribution of responses across the five attributes of the Patient Monitoring and Scheduling System, namely functionality, usability, reliability, efficiency, and security. The majority of respondents rated the system as "Strongly Agree" (approximately 70–75%) and "Agree" (20–25%), indicating high satisfaction with its performance. Only a small percentage of responses fell into Neutral (around 5%) and Disagree/Strongly Disagree (less than 2%), suggesting minimal concerns among users.

The graph confirms that the system was consistently rated positively across all attributes. Functionality and efficiency received the highest proportion of "Strongly Agree" ratings, reflecting the system's ability to streamline patient registration and scheduling processes. Usability and reliability also scored strongly, highlighting the system's user-friendly interface and stable operation. Security was likewise rated highly, demonstrating respondents' confidence in the protection of patient data.

Overall, the distribution of responses in Figure 3 supports the conclusion that the Patient Monitoring and Scheduling System effectively addressed the operational challenges at RHU Bayog, aligning with the study's objectives and reinforcing the quantitative results presented in Table 4.

Figure 3: Distribution of Evaluation Responses Across ISO/IEC 25010 Attributes



Qualitative feedback from interviews revealed that healthcare providers appreciated the reduction in patient waiting times and the ease of accessing patient records. Administrative staff highlighted the scheduling module's efficiency, while patients expressed satisfaction with the improved appointment organization. These findings confirm that the system addressed the operational challenges previously encountered at RHU Bayog.

The evaluation results reveal that the Patient Monitoring and Scheduling System developed using the Agile SDLC framework achieved high ratings across all ISO/IEC 25010 attributes. As shown in Table 4 and Figure 3, the system obtained mean scores ranging from 4.52 to 4.60, indicating Very Satisfactory performance. This indicates that respondents strongly agreed on the system's effectiveness in improving healthcare operations at RHU Bayog.

The high functionality rating suggests that the system successfully met its intended purpose—streamlining patient registration, scheduling, and monitoring. Respondents emphasized that the modules operated accurately and consistently, reducing manual errors and record duplication. The usability score reflects the system's intuitive interface, allowing staff and patients to navigate features easily without extensive technical training.

The reliability rating demonstrates that the system maintained stable performance during continuous use, with minimal downtime or technical issues. Meanwhile, the efficiency score, which was the highest among all attributes, indicates that the system significantly improved workflow by reducing patient waiting times and simplifying appointment management. Lastly, the security rating confirms that respondents trusted the system's data protection mechanisms, ensuring the confidentiality of patient information.

Overall, the analysis shows that the system effectively addressed the operational challenges previously encountered at RHU Bayog. The strong positive ratings across all attributes validate the success of the Agile development approach and confirm that the system is both technically sound and user-centered.

The findings of the study demonstrate that the Patient Monitoring and Scheduling System developed using PHP and the Agile SDLC framework effectively addressed the operational challenges faced by the Rural Health Unit (RHU) of Bayog, Zamboanga del Sur. The consistently high ratings across all ISO/IEC 25010 attributes functionality, usability, reliability, efficiency, and security indicate that the system met both technical and user-oriented expectations.

The strong performance in functionality and efficiency confirms that the system streamlined patient registration and scheduling processes, reducing manual workload and waiting time. This aligns with the findings of Abdalkareem et al. (2021) and Abdulmalek et al. (2022), which emphasized the effectiveness of scheduling optimization and real-time monitoring in improving healthcare service delivery and resource management. The high usability rating supports the user-centered design principles emphasized by Nielsen (1994), showing that intuitive interfaces enhance adoption among non-technical users.

The reliability and security scores further validate the system's stability and data protection mechanisms. Respondents expressed confidence in the system's ability to maintain consistent performance and safeguard patient information, consistent with the findings of Shojaei et al. (2024), who emphasized the importance of secure access control, data sharing, and storage in healthcare information systems.

Overall, the discussion of the findings confirms that integrating Agile methodology and PHP-based development produced a system that is both adaptable and efficient. The results not only meet the study's objectives but also contribute to the growing body of evidence supporting digital transformation in rural healthcare settings. The success of this system demonstrates that even resource-limited institutions like RHU Bayog can benefit from structured, iterative software development approaches to enhance service quality and operational efficiency.

5. Conclusion

Based on the study's findings, the Patient Monitoring and Scheduling System, developed using PHP and the Agile SDLC framework, proved highly effective in addressing the operational challenges of RHU Bayog, Zamboanga del Sur. The system consistently received Very Satisfactory ratings across all ISO/IEC 25010 attributes, confirming its functionality, usability, reliability, efficiency, and security. The results demonstrate that the system streamlined patient registration and scheduling, reduced waiting times, minimized manual errors, and improved overall workflow. Respondents expressed confidence in the system's stability and data protection mechanisms, validating its technical soundness and user-centered design.

The study concludes that integrating Agile methodology with PHP-based development is a practical and efficient approach for building healthcare information systems in resource-limited settings. The system's success highlights the potential of digital transformation in rural health units, ensuring better service delivery and improved patient satisfaction.

6. Recommendations

Considering the conclusions, it is recommended that the Patient Monitoring and Scheduling System be continuously enhanced to include additional modules, such as patient follow-up reminders, medical supply inventory management, and integration with laboratory results, to further expand its functionality.

Training and capacity-building activities should be regularly conducted for healthcare providers and administrative staff to ensure maximum utilization and smooth adoption of the system. The system's scalability should also be explored to enable replication in other rural health units in Zamboanga del Sur and neighboring provinces, thereby extending its benefits to a wider population.

Continuous evaluation and monitoring are likewise necessary to identify areas for improvement, maintain efficiency, and strengthen security measures. Finally, institutional and local government support is essential to sustain the system, particularly through budget allocation for maintenance, upgrades, and technical assistance. By implementing these recommendations, the Patient Monitoring and Scheduling System can remain responsive, sustainable, and impactful in improving healthcare service delivery.

7. Acknowledgment

The researchers would like to express their sincere gratitude to the Rural Health Unit of Bayog, Zamboanga del Sur, for their support and cooperation during the conduct of this study. Special appreciation is also extended to the healthcare providers, administrative staff, and patients who participated in the evaluation of the system. The researchers likewise acknowledge J.H. Cerilles State College for its guidance and academic support throughout the completion of this study.

References

1. Abdalkareem, Z. A., Amir, A., Al-Betar, M. A., Ekhan, P., & Hammouri, A. I. (2021). Healthcare scheduling in optimization context: A review. Health and Technology, 11(3), 445–469. https://doi.org/10.1007/s12553-021-00547-5
2. Abdulmalek, S., Nasir, A., Jabbar, W. A., Almuhaya, M. A. M., Bairagi, A. K., Khan, M. A., & Kee, S.-H. (2022). IoT-based healthcare-monitoring system towards improving quality of life: A review. Healthcare, 10(10), 1993. https://doi.org/10.3390/healthcare10101993
3. Khan, A., & Duncan, D. (2025). Remote patient monitoring applications in healthcare: Lessons from COVID-19 and beyond. Electronics, 14(15), 3084. https://doi.org/10.3390/electronics14153084
4. Shaik, T., Tao, X., Higgins, N., Li, L., Gururajan, R., Zhou, X., & Acharya, U. R. (2023). Remote patient monitoring using artificial intelligence: Current state, applications, and challenges. WIREs Data Mining and Knowledge Discovery, 13(2), e1485. https://doi.org/10.1002/widm.1485
5. Cayirli, T., & Veral, E. A. (2003). Outpatient scheduling in healthcare: A survey of literature. Production and Operations Management, 12(4), 519–549. https://doi.org/10.1111/j.1937-5956.2003.tb00222.x
6. Mageshwari, G., Malathi, S., & Tamilarasi, A. (2012). Literature review on patient scheduling techniques. International Journal on Computer Science and Engineering (IJCSE), 4(3), 397–400.
7. Ala, A., & Chen, F. (2022). A comprehensive review of appointment scheduling problems in healthcare. Operations Research for Health Care, 33, 100317. https://doi.org/10.1016/j.orhc.2022.100317
8. Nabila, N., & Ayuningtyas, D. (2024). The effectivity of outpatient waiting time in hospital through online or web-based reservation (Literature review). Asian Journal of Engineering, Social and Health, 3(8), 1230–1238. https://doi.org/10.46799/ajesh.v3i8.370
9. Woodcock, E. W. (2022). Barriers to and facilitators of automated patient self-scheduling for health care organizations: Scoping review. Journal of Medical Internet Research, 24(1), e28323. https://doi.org/10.2196/28323
10. Vudathaneni, V. K. P., Lanke, R. B., Mudaliyar, M. C., Movva, K. V., & Kalluri, L. M. (2024). The impact of telemedicine and remote patient monitoring on healthcare delivery. Cureus, 16(2), e53760. https://doi.org/10.7759/cureus.53760
11. Bawankule, S., & Shahapurkar, R. (2022). Review on: Design & development of healthcare patient monitoring system using cloud computing environment. In AIP Conference Proceedings (Vol. 2597, No. 1, 030005). AIP Publishing. https://doi.org/10.1063/5.0119195

12. Yao, W., Chu, C.-H., & Li, Z. (2012). The adoption of RFID technology in healthcare: Benefits and barriers. International Journal of Medical Informatics, 81(7), 507–523. https://doi.org/10.1016/j.ijmedinf.2012.02.005
13. Pressman, R. S., & Maxim, B. R. (2020). Software engineering: A practitioner's approach (9th ed.). McGraw-Hill Education. ISBN: 9781259872976.
14. Nielsen, J. (1994). Usability engineering. Morgan Kaufmann Publishers. ISBN: 9780125184069
15. Shojaei, P., Vlahu-Gjorgievska, E., & Chow, Y.-W. (2024). Security and privacy of technologies in health information systems: A systematic literature review. Computers, 13(2), 41. https://doi.org/10.3390/computers13020041