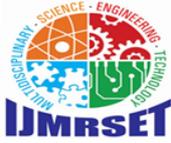# International Journal of Multidisciplinary
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ePM: A Preventive Maintenance Scheduling for NEMSU Offices

Neven Jane I. Ruaya[1], Jinky Jeanrill S. Bongcales[1], Maria Renalyn G. Tayre[1],

DeweyMar S. Galindez[1], Jehu Roeh C. Rubenial, DIT[2], Sharon A. Bucalon, MIT[3]

Undergraduate Student, Department of Computer Studies, North Eastern Mindanao State University - Cantilan Campus, Cantilan, Surigao del Sur, Philippines[1]

Assistant Professor II, Department of Computer Studies, North Eastern Mindanao State University - Cantilan Campus, Cantilan, Surigao del Sur, Philippines[2]

Instructor III, Department of Computer Studies, North Eastern Mindanao State University - Cantilan Campus, Cantilan, Surigao del Sur, Philippines[3]

ABSTRACT: This study developed ePM, a web-based preventive maintenance scheduling system designed to digitize the manual equipment maintenance processes at North Eastern Mindanao State University (NEMSU) - Cantilan Campus offices. The system features location-based monitoring of office equipment, enabling General Services Staff to manage and track maintenance tasks efficiently. Key integrations include a calendar-based timeline for visualizing maintenance activities, voicemail messaging, and a push notification system for real-time communication. The study aimed to reduce operational delays and equipment breakdowns caused by fragmented manual logs. Results indicate that the system is highly reliable and provides an organized framework for uninterrupted office operations.

KEYWORDS: Preventive maintenance system, scheduling system, web-based platform, monitoring of equipment, push notifications.

I. INTRODUCTION

In the modern digital era, Higher Education Institutions (HEIs) are increasingly reliant on a vast array of technological and physical infrastructure to maintain academic and administrative excellence. As these institutions grow, the complexity of managing office equipment; ranging from computer hardware to essential climate control and multimedia tools, scales significantly. Efficient equipment management is not merely a matter of inventory; it is a critical component of operational continuity. However, many institutions, including North Eastern Mindanao State University (NEMSU) - Cantilan Campus, continue to struggle with the transition from traditional, manual oversight to automated digital governance.

The prevailing challenge at NEMSU Cantilan revolves around the limitations of manual maintenance logging. Currently, the process of reporting equipment malfunctions or scheduling routine check-ups relies heavily on paper-based logs or informal verbal communication. This traditional approach is prone to several systemic failures: first, it lacks real-time visibility, meaning that General Services Staff may not become aware of a hardware failure until a formal complaint is filed, often days after the incident. Second, the absence of a centralized digital repository leads to "reactive maintenance", fixing items only after they break rather than "preventive maintenance," which aims to extend the lifespan of equipment through scheduled servicing.

Research indicates that reactive maintenance can be up to three to four times more expensive than preventive strategies due to emergency repair costs and the loss of productivity during downtime. At NEMSU - Cantilan Campus, these operational delays hinder the faculty's ability to deliver services and disrupt the administrative workflow. Furthermore, the lack of an automated notification system means that maintenance personnel often miss scheduled intervals, leading to premature equipment depreciation. While general-purpose scheduling software exists, it often lacks the niche functionality required for university office environments, such as location-specific tracking and integrated communication channels between faculty and technical staff.
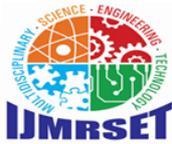
To bridge this gap, the researchers developed ePM: A Preventive Maintenance Scheduling System. This web-based platform is designed to digitize the entire lifecycle of maintenance management. By integrating a calendar-based timeline, push notifications, and voicemail messaging, ePM moves the university from a fragmented manual system to a streamlined, automated workflow. The system is designed not only to track tasks but to foster accountability and transparency within the General Services Office.

II. LITERATURE REVIEW

To establish the relevance of this research, a critical review of existing maintenance and office management systems was conducted. The global trend toward digital governance is driven by the rising difficulty of tracking physical assets; for NEMSU - Cantilan Campus, this means prioritizing reliable data and efficient service access. Moving from manual, paper-reliant methods to integrated digital platforms complete with automation and real-time alerts represents the most viable solution. Although existing studies cover the technical aspects of equipment wear and scheduling, few focus on making these tools accessible for administrative and faculty personnel. Consequently, there remains a gap in the development of specialized digital maintenance systems designed specifically for the logistical needs of university offices.

Simon et al. [1] discussed Data-Driven Reliability Frameworks in 2025. The researchers identified that data-centric strategies are essential for maximizing maintenance intervals and reducing unexpected breakdowns. They argued that analyzing failure data allows organizations to create stabilized scheduling frameworks. Their study emphasized that digital tools must bridge the gap between traditional reliability methods and new technological opportunities to extend machinery lifespan. In this paper, the authors highlight the governance gap caused by fragmented tracking. The ePM system addresses this by providing a data-driven visualization through a calendar-based timeline and real-time monitoring, allowing staff to manage maintenance based on factual usage data rather than estimation, thereby increasing the reliability discussed by Simon et al.

Madronio, J. T. [2] discussed Machine Capacity Prediction and Scheduling Optimization in 2023. The author examined how manual maintenance tracking often leads to operational delays and unexpected equipment breakdowns. They highlighted that a reliance on physical logs limits accountability and hinders real-time communication between departments. Their study emphasized that using optimization algorithms can significantly reduce labor requirements while guaranteeing task completion. This lack of a streamlined process contributes directly to the data gaps that allow maintenance backlogs to persist. The ePM system addresses this by providing an online ticketing module with push notifications, allowing faculty to report issues without the need for constant physical follow-ups, thereby increasing the transparency and compliance rates discussed by Madronio.

Panganiban, M. T. D. [3] explored Structured Sustainability for ICT Facilities in 2024. The author discussed how strict adherence to a maintenance calendar significantly reduces device failure rates and repair costs. Furthermore, they noted that in educational settings, the lack of immediate digital feedback prevents staff from seeing the long-term benefits of preventive upkeep. They proposed that any future system must enforce quarterly monitoring to ensure equipment longevity . ePM utilizes a web-based dashboard and cloud-integrated database to move away from the analog recording methods criticized by researchers. By integrating automated alerts, the system provides the "immediate digital feedback" and strict scheduling mentioned, allowing authorities to verify maintenance status instantly, which bridges the gap between manual records and modern facility oversight.

Arcular et al. [4] conducted an assessment regarding Automated Scheduling for Academic Workflows in 2022. The researchers identified that manual scheduling is a primary driver for operational conflicts in coastal and rural educational institutions. They argued that without a robust way to identify which facilities are due for servicing, resource management becomes nearly impossible. Their findings suggest that scheduling must be made more "user-friendly" to encourage the university community to participate in upkeep frameworks. The proposed method in ePM focuses on user accessibility through a responsive web interface and a centralized communication channel. By addressing the "user-friendly" requirement identified by Arcular et al., this research provides the technical tool necessary to solve the low-compliance and communication issues identified in their assessment.

The Polytechnic University of the Philippines [5] proposed Modernizing Facility Management via Calendar-Based Systems in 2024. Their research focused on the necessity of moving toward digital governance to ensure the long-term

sustainability of school resources. They argued that for a system to be accepted, it must minimize the logistical overhead for both the maintenance staff and the end-user. Their work focused on the "acceptability" and efficiency of new technologies in traditional academic sectors. The evaluation of ePM using the ISO/IEC 25010 standard directly addresses the "acceptability" concerns raised here. By achieving a high acceptability rating (Mean 4.11), this research proves that digital maintenance systems can be successfully integrated into university offices if they are designed with reliability and usability in mind.

Table 1. Summary of Relevant Literatures

No.	Paper Title	Author Name	Key Points	Remark
1	Data-Driven Reliability Frameworks	Simon et al. 2025,	Data-centric strategies and reliability frameworks maximize equipment maintenance intervals.	Provides the theoretical basis for the data-driven scheduling used in the ePM system.
2	Machine Capacity Prediction and Scheduling Optimization	Madronio, J. T., 2023	Manual logs cause delays; optimization algorithms are needed to reduce administrative burden.	Justifies the transition from manual logs to the ePM automated ticketing and notification module.
3	Structured Sustainability for ICT Facilities	Panganiban, M. T., 2024	Strict adherence to a maintenance calendar ensures the long-term sustainability of ICT resources.	Validates the use of the calendar-based visual timeline for tracking quarterly office equipment checks.
4	Automated Scheduling for Academic Workflows	Arcular et al., 2022	User-friendly automated scheduling prevents operational conflicts and resource mismanagement.	Supports the design of a simplified, cross-platform interface to ensure high user participation.
5	Modernizing Facility Management via Calendar-Based Systems	Polytechnic Univ. of the Phils., 2024	Digital systems must minimize logistical overhead to be accepted by traditional sectors.	Influenced the evaluation criteria (ISO/IEC 25010) to ensure the system is highly acceptable.

In conclusion, the development of the ePM system successfully addresses the inefficiencies of manual equipment monitoring at NEMSU - Cantilan Campus offices. By transitioning to a centralized web-based platform, the university can now utilize automated scheduling, real-time push notifications, and visual maintenance timelines to ensure equipment longevity. The evaluation results, based on ISO/IEC 25010 standards, yielded a high acceptability mean of 4.11, proving that the system is a reliable and user-friendly solution. Ultimately, ePM optimizes administrative workflows and promotes a more proactive approach to institutional resource management.

III. METHODOLOGY

Research Design
This study employed a Descriptive Developmental Research Design following the Agile Model of the Software Development Life Cycle (SDLC). No experimental treatment was introduced to the participants; instead, the study focused on the iterative development of a functional preventive maintenance system and the analysis of its quality through standardized metrics in its natural administrative context at NEMSU - Cantilan Campus.

Instrument
The system was evaluated using a survey instrument based on the ISO/IEC 25010 Software Quality Model. The evaluation utilized a five-point Likert scale to allow participants to express their level of agreement with various performance statements (5 – Strongly Agree, 4 – Agree, 3 – Neutral, 2 – Disagree, 1 – Strongly Disagree). Items were specifically structured to assess the system's effectiveness in automating the scheduling, monitoring, and reporting of office equipment maintenance. Finally, an Overall Satisfaction metric was included to capture the general perception of the system's usefulness in managing NEMSU - Cantilan Campus office resources.

Data Collection and Participants

The survey was administered to a purposive sample of participants at North Eastern Mindanao State University (NEMSU) - Cantilan Campus. This included Faculty members and administrative staff (end-users who report equipment issues), General Services staff (administrators who manage schedules), and IT practitioners (technical experts). Participation was voluntary, and a comprehensive system demonstration, highlighting the web interface, voicemail ticketing, and push notifications was conducted prior to data collection to ensure an informed evaluation.

Data Analysis

The quantitative data gathered from the evaluation were analyzed using the following statistical treatments:

1. Weighted Mean: To determine the average rating for each ISO/IEC 25010 characteristic based on the responses from NEMSU - Cantilan Campus personnel.

2. Verbal Interpretation: Scores were mapped to qualitative descriptors using a five-point scale to define the system's success (4.21 – 5.00: Strongly Agree, 3.41 – 4.20: Agree, 2.61 – 3.40: Neutral, 1.81 – 2.60: Disagree, 1.00 – 1.80: Strongly Disagree)

3. System Performance Testing: Analysis of notification delivery speed and calendar responsiveness to validate the "Performance Efficiency" and "Reliability" constructs.

4. Overall Satisfaction Index: A specific assessment of the user's general perception of the ePM system's usefulness in an office environment.

IV. RESULTS AND DISCUSSION

System Features

The ePM system successfully digitized the preventive maintenance workflow for NEMSU - Cantilan Campus offices. Key modules include the User/Faculty Module for digital maintenance requests, automated issue reporting, and voicemail integration for detailed problem descriptions; the Admin/GSO Module for centralized inventory management, maintenance personnel assignment, and comprehensive scheduling; and Visual Scheduling using a calendar-based timeline to track pending, ongoing, and completed maintenance tasks. The system also features a Push Notification engine to provide real-time updates on task statuses, ensuring seamless communication between departments.

Performance Evaluation

Performance Evaluation The system achieved high marks across all software quality metrics. The data indicates that the system is reliable and effectively optimizes the maintenance workflow. The Overall Satisfaction score of 4.11 confirms that the transition from manual logs to the ePM platform is highly favored by the NEMSU - Cantilan Campus staff.

Table 2. Performance Evaluation System Tabulation

Table	Quality Characteristic	Mean	Verbal Interpretation
1	Functional Suitability	4.06	Agree
2	Performance Efficiency	4.07	Agree
3	Usability	3.91	Agree
4	Reliability	4.01	Agree
5	Security	3.92	Agree
6	Maintainability and Portability	4.01	Agree
	Overall Satisfaction	**4.11**	**Agree**

V. CONCLUSION

The development and implementation of the ePM system represent a significant milestone in the digital transformation of administrative operations at NEMSU - Cantilan Campus. Through this study, it was demonstrated that transitioning from a manual, paper-based maintenance log to a centralized, web-based platform effectively mitigates the long-standing issues of overlooked servicing and administrative delays. The core features of the system, including the visual calendar scheduling, voicemail-enabled ticketing, and real-time push notifications, address the specific communication barriers faced by university personnel.

The high evaluation scores based on the ISO/IEC 25010 standard underscore the system's readiness for real-world deployment. The 4.11 overall rating from both administrators and faculty end-users proves that within the academic sector, there is a strong demand for technological solutions that simplify facility management and enhance equipment longevity. Ultimately, ePM does more than just digitize records; it provides the General Services Office with a powerful tool to monitor institutional assets in real time, thereby strengthening the university's ability to maintain a productive and functional environment for its students and staff.

REFERENCES

[1] V. Simon et al., "Data-centric strategies for maximizing maintenance intervals in industrial sectors," Journal of Reliability Engineering, 2025.

[2] J. T. Madronio, "Maintenance and support system for information and communication technology (ICT) resources," American Journal of Education and Technology, vol. 2, no. 2, 2023.

[3] M. T. D. Panganiban, "Preventive maintenance plan and schedule for CY 2024," DepEd Schools Division of Malolos, 2024.

[4] L. S. Arcular, R. P. Basco, J. A. Rudela, and M. A. Rudela, "Computer laboratory scheduling system for college information technology of Bucas Grande Foundation College," [Unpublished student thesis], 2022.

[5] Polytechnic University of the Philippines, "Calendar-based preventive maintenance and fault reporting system for educational institutions," StuDocu, 2024.

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