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Research Article

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Menro: Monitoring and Management System

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ABSTRACT

The MENRO: Monitoring and Management System is a digital solution developed to modernize the manual operations of the Municipal Environment and Natural Resources Office (MENRO). The system provides a secure and user-friendly platform designed to streamline document handling, automate monitoring tasks, and ensure accurate environmental data management. The project aims to: (1) develop a user-friendly interface for seamless document and record management. This project specifically aims to: (1) develop a user-friendly interface that enables seamless document and record management, allowing administrators to effortlessly add, edit, update, and store essential information; (2) design a system capable of automatically generating comprehensive lists of apprehension receipts, including violations and penalties issued to establishments under MENRO's jurisdiction. These functions address long-standing inefficiencies in manual monitoring, recordkeeping, and compliance tracking. The system was evaluated using the ISO/IEC 25010:2011 software quality standards, focusing on functional suitability, performance efficiency, reliability, usability, compatibility, maintainability, portability, and security. Results show high usability and strong security features, ensuring that the platform meets operational needs while safeguarding sensitive environmental and legal records. By integrating real-time data access, automated reporting, and digitized forms used in environmental compliance checks, the system enhances MENRO's capability to uphold environ-mental governance with greater transparency, accuracy, and accountability.

Abbreviations

The following abbreviations are used in this manuscript:

MENRO	:	Municipal Environment and Natural Resources Office
ISO/IEC	:	International Organization for Standardization
MRF	:	Material Recovery Facility

Introduction

The Municipal Environment and Natural Resources Office (MENRO) serves as a corner- stone of local governance in safeguarding natural resources and ensuring sustainable environmental management. Its mandate includes implementing conservation programs, overseeing solid waste management, protecting terrestrial and marine ecosystems, and enforcing environmental laws and ordinances. In Romblon, MENRO carries out these tasks through collaboration with local and national agencies, managing communal forests, watersheds, and other ecological reserves while providing technical services in support of environmental rehabilitation.

Despite its critical responsibilities, many MENRO operations remain heavily reliant on manual recording, filing, and reporting. This setup often leads to delays, redundant tasks, and inaccuracies—especially in monitoring violations, issuing apprehension receipts, and maintaining updated documentation for registered establishments. As supported by, [12] digital systems in governance enhance transparency, efficiency, and accountability [1]. The absence of computerized tools creates significant barriers to MENRO's performance and responsiveness [2].

To bridge these gaps, this study developed a computerized Monitoring and Management System tailored for MENRO Romblon, with emphasis on two major objectives: (1) creating a user-friendly interface that improves document and record management, and (2) designing an automated module for generating lists of apprehension receipts, violations, and penalties for establishments. Grounded in ISO/IEC 25010:2011 software quality criteria, the system aims to strengthen data accuracy, streamline operations, and support evidence-based decision-making. This initiative contributes to the growing need for digital transformation in local environmental governance and provides a replicable model for other municipalities

Methodology

This chapter describes the methods and processes used in

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developing the MENRO Monitoring and Management System, including requirements modeling, data and process modeling, and system design [3].

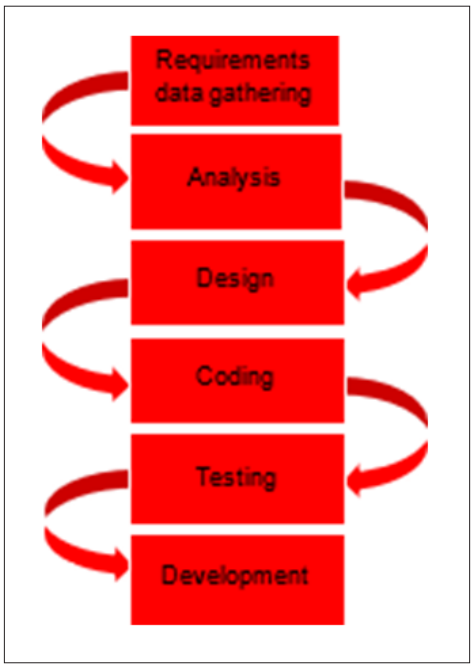

Figure 1: Waterfall Model

The project utilized the Waterfall Model; a linear and structured methodology suited for projects with clearly defined requirements. Each phase must be completed before proceeding to the next, ensuring controlled progress and thorough verification.

Requirements For Data Gathering

Data collection was conducted at MENRO Romblon to identify existing problems in manual documentation, monitoring, and recordkeeping. Information gathered helped determine the need for a digital system that automates document management and supports monitoring of violations, penalties, and establishment compliance.

Analysis

Collected data were analyzed to define the system's core features. Key requirements included: user-friendly document and record management, automated generation of apprehension receipts and violation lists.

Design

The design phase involved creating system architecture, data flow diagrams, user interface layouts, and database structure. The design ensures that the system provides intuitive navigation and clear workflows for MENRO personnel.

Coding

Coding is the process of creating instructions that a computer can follow to perform a specific task. The developer writes code based on the design specifications and perform unit testing on individual components ensuring that the coding standards and guidelines are followed.

Testing

The developers required organizations to complete various tests to ensure the accuracy of the programmed code, the conclusion of expected functionality and interoperability of application.

Deployment

Once testing is successful, the MENRO system can be deployed to the production environment. The Waterfall Model ensures a structured and systematic approach to deployment, minimizing the risk of unexpected issues in the live environment.

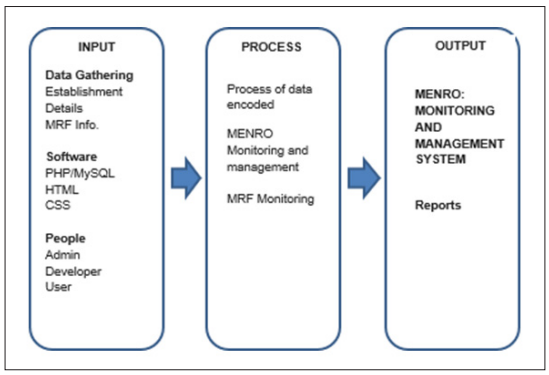

Figure 2: IPO (Input, Process, Output)

The figure above shows and explains the Input, Process, Output of the study. It has an input list for the documentation and needs preparation for the process. Addressing the inadequacy of time for development, the proponent uses the water model of system development to come up with the expected output as the proposed system studied [4,5].

The evaluation result determined after the implementation or test procedure of the system examines and analyzes outcomes. The intended users of the system do the evaluation.

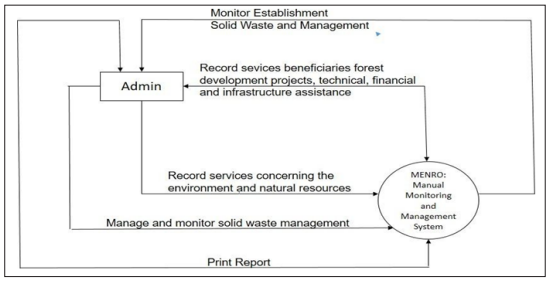

Figure 3: Context Diagram (Existing)

The diagram in Figure 3 shows an overview of how the admin interacts with the Manual MENRO Monitoring and Management System. It highlights the flow of activities, such as recording services, monitoring environmental projects, managing solid waste operations, and generating reports. Overall, this context diagram describes a manual workflow where the admin handles multiple tasks to support environmental monitoring and municipal resource management [6-10].

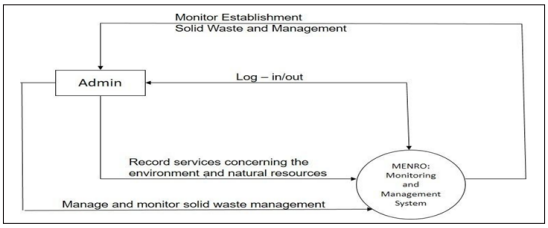

Figure 4: Context Diagram (Proposed)

The image represents a Context Diagram of a Proposed MENRO Monitoring and Management System. It shows how the admin interacts with the system and outlines the main functions. Admin is the primary user who performs major functions in the system where he/she can log in and log out, ensuring secure access to the system. The system allows the admin to record services related to the environment and natural resources. It supports the admin in managing and monitoring solid waste management activities. The admin also uses the system to monitor establishments involved in solid waste and environmental compliance. The central process, labeled MENRO: Monitoring and Management System, receives input from the admin and processes the data for monitoring and documentation [11].

The diagram shows a streamlined interaction where the admin inputs and manages environmental and solid waste data, while the MENRO system processes and supports these activities. The proposed system enhances record-keeping, monitoring, and operational management for environmental services.

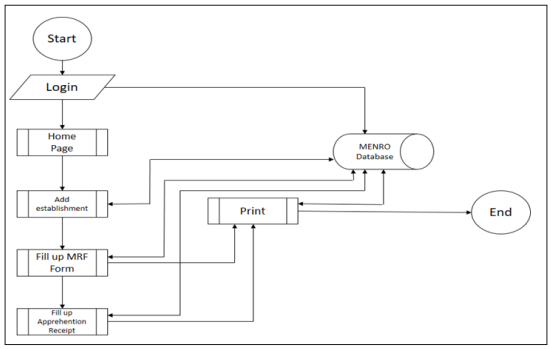

Figure 6: System Flowchart

The system flowchart for the Municipal Environment and Natural Resources Office (MENRO) Monitoring and Management System illustrates the digital transformation of MENRO's core operations—from manual processes to a centralized, automated platform [12].

The flow begins with a secure login process, followed by access to the home page, which serves as the main navigation hub for users.
From the home page, users can:

- **aAdd Establishment** – for registering and storing establishment records; Fill up
- **MRF Form** – to monitor and record environmental compliance; Fill up
- **Apprehension Receipt** – to document violations and penalties.

Each of these modules connects to a Print function that generates official reports and documents, enhancing transparency and recordkeeping. All data inputs and outputs are stored and managed through a centralized MENRO Database, enabling real-time monitoring, accurate reporting, and secure data handling. The system ends after the completion of data transactions or documentation tasks.

This structured flow supports MENRO's goal of improving efficiency, accuracy, and accountability in environmental monitoring. It addresses the existing gap caused by manual processes and aligns with best practices in public sector digitalization. By adopting this system, MENRO can better manage environmental data, respond to violations promptly, and enhance its service delivery for sustainable local governance.

Results

This section presents findings, analysis and interpretations of system. The system successfully delivered on its primary objectives (1) User-Friendly Document and Record Management, the system interface allows administrators to easily add, edit, delete, and update establishment records, forms, and other environmental documentation. With intuitive buttons, clear navigation, and automated saving features, the system greatly reduces the time and effort required for routine recordkeeping. (2) Automated Generation of Apprehension Receipts and Violation Records, the system can generate organized lists of apprehension receipts, violations, and corresponding penalties. This ensures accurate tracking of non-compliant establishments and improves accountability in environmental enforcement [13-17].

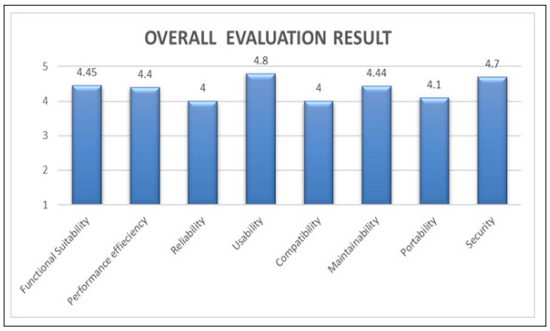

Figure 7: Overall Evaluation Result

The evaluation of the MENRO Monitoring and Management System was conducted using the ISO/IEC 25010:2011 software quality standards, which include eight key characteristics.

Figure 7 shows the key findings of the evaluation. Seven MENRO personnel evaluated the system based on software quality characteristics. Results showed in Usability – 4.8 (Highest) users found the system easy to navigate, intuitive, and efficient. Security – 4.7 strong authentication and data protection features ensure secure handling of sensitive information. Functional Suitability – 4.45 the system meets its intended purpose with accurate and reliable functions. Maintainability – 4.44, the system structure supports easy updates and modifications. Performance Efficiency – 4.4, Operations are smooth with minimal processing delays, Portability – 4.1, the system functions across several platforms but may need further optimization for broader compatibility.

Reliability – 4.0 Generally stable but may occasionally require reinforcement to prevent minor inconsistencies. Compatibility – 4.0 Limited integration with external tools and other systems.

Discussion

The evaluation results confirm that the system successfully fulfills its goals of enhancing document management and automating monitoring of violations and penalties. The high usability score highlights the effectiveness of developing a simple yet efficient interface a key aim of the project. Strong security ratings reflect the importance of protecting MENRO's sensitive environmental and legal data. The relatively lower scores in reliability and compatibility suggest areas for future improvement, such as supporting wider device types or integrating with other LGU systems. Despite these, the system overall demon strates strong performance, accuracy, and stability suitable for MENRO's day-to-day operations.

Conclusion

The MENRO Monitoring and Management System achieved its core objectives by providing a user-friendly interface that simplifies document handling and record management. A digital system for generating, storing, and tracking apprehension receipts, violations, and penalties. Based on the ISO/IEC 25010 evaluation, the system is functional, secure, and highly usable. Minor enhancements in compatibility and reliability will further improve its performance. Overall, the system significantly strengthens MENRO's environmental monitoring capabilities and supports more transparent and efficient governance.

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