e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:03/March-2025 Impact Factor- 8.187 www.irjmets.com

AN IMPLEMENTATION OF ASSET MANAGEMENT SYSTEM USING PREVENTIVE MAINTENANCE MODEL

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DOI: https://www.doi.org/10.56726/IRJMETS70213

ABSTRACT

An Asset Management System (AMS) is a structured approach to tracking, monitoring, and maintaining static and portable electromechanical machines within an organization. This system ensures efficient resource allocation, reduces downtime, and optimizes asset utilization by providing a centralized platform for asset registration, tracking, and maintenance. The AMS enables real-time monitoring, preventive maintenance scheduling, and historical data analysis to enhance operational efficiency. It supports user authentication, asset categorization, and automated report generation for better decision-making. Additionally, the system ensures compliance with industry standards, improves cost efficiency, and enhances asset lifecycle management. By implementing AMS, organizations can achieve optimized asset performance, reduced maintenance costs, and improved asset reliability.

Keywords: Asset Utilization, Automated Reports, Lifecycle Management, Preventive Maintenance.

I. INTRODUCTION

The implementation of an Asset Management System (AMS) for static and portable electromechanical machines involves integrating advanced tracking, monitoring, and maintenance mechanisms to enhance asset utilization and lifecycle management. The process begins with asset registration, where each machine is assigned a unique identifier for streamlined tracking. A centralized database is deployed to store real-time data, enabling automated condition monitoring and predictive maintenance scheduling. Role-based access control (RBAC) ensures secure data access, preventing unauthorized modifications. Furthermore, the system incorporates automated reporting and analytics for asset performance evaluation, depreciation calculation, and cost optimization. Integration with cloud platforms and IoT-enabled sensors (if applicable in future scope) enhances remote monitoring and data synchronization. The AMS ensures efficient resource allocation, reduced downtime, and optimized decision-making, leading to improved operational reliability and asset longevity.

II. METHODOLOGY

The implementation of an Asset Management System (AMS) for static and portable electromechanical machines requires a structured approach to ensure efficient tracking, monitoring, and lifecycle management. Below is a detailed methodology:

Phase 1 Requirement Analysis

Identify and classify assets based on their types, such as static (fixed machinery) and portable (movable tools).Understand operational workflows, maintenance schedules, and user roles. Define system objectives, including asset tracking, condition monitoring, and predictive maintenance. Conduct stakeholder discussions to gather functional and non-functional requirements.

Phase 2 System Design

Develop a modular and scalable system architecture that includes a user interface, asset database, and analytics module. Implement role-based access control (RBAC) to ensure data security, with different access levels for administrators, technicians, and users. Define communication protocols for real-time asset tracking and monitoring. Use UML diagrams such as use case diagrams, sequence diagrams, and flowcharts to outline system behaviour.

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Phase 3 Database Development

Design a relational database (MySQL) to store asset details, maintenance logs, service history, and user records. Implement data normalization techniques to optimize database performance. Integrate a backup and recovery mechanism to prevent data loss. Enable efficient querying using SQL commands for retrieving asset lifecycle data.

Phase 4 Application Development

Develop a web-based or desktop application using frameworks such as Flask for Python. Implement RESTful APIs to enable communication between the frontend, backend, and database. Develop a responsive UI/UX using Bootstrap for seamless interaction. Implement dashboards to provide insights on asset status, maintenance schedules, and usage patterns.

Phase 5 Testing and Validation

Conduct unit testing to verify individual components and functions. Perform integration testing to ensure smooth communication between the database, backend, and frontend. Execute system testing to validate the performance, scalability, and security of the AMS. Carry out user acceptance testing (UAT) to ensure that the system meets stakeholder requirements before deployment.

Phase 6 Deployment and Maintenance

Deploy the AMS on a secure cloud environment (AWS, Azure, or Google Cloud) or an on-premise server based on business needs. Implement continuous monitoring tools to track system performance and identify potential issues. Provide regular updates and patches to improve security, fix bugs, and enhance system functionality. Offer user training sessions and create documentation to guide employees on system usage.

III. MODELING AND ANALYSIS

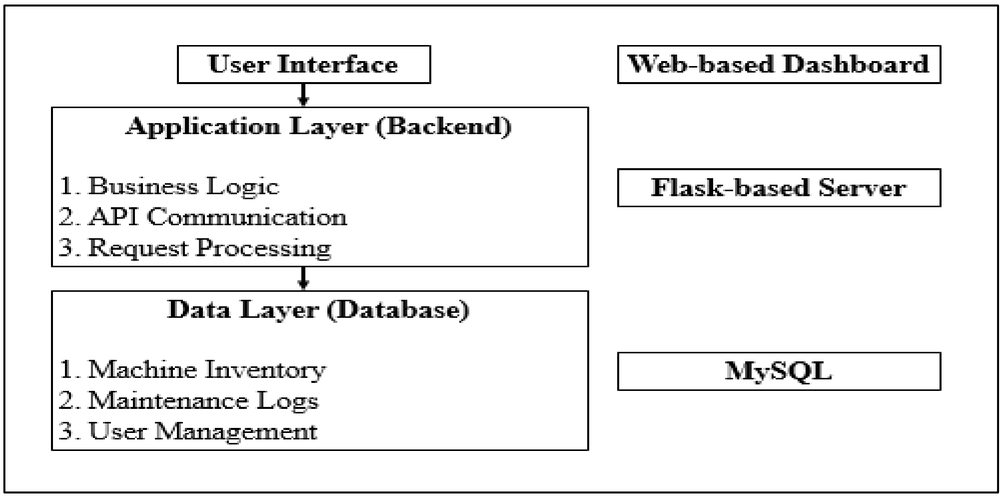

Figure 1: Architecture Diagram

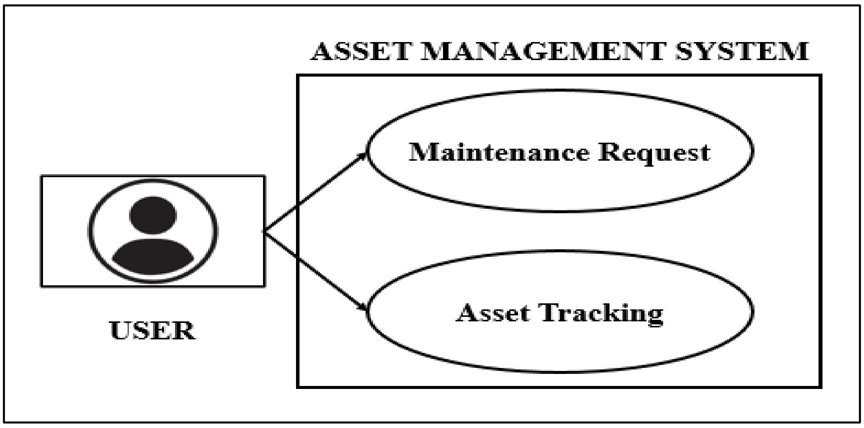

Figure 2: Use Case Diagram

IV. RESULTS AND DISCUSSION

The Modular Design of the Asset Management System (AMS) divides the system into independent functional units that work together to efficiently manage both static and portable electromechanical assets. Each module has a specific responsibility, ensuring system scalability, maintainability, and ease of integration.

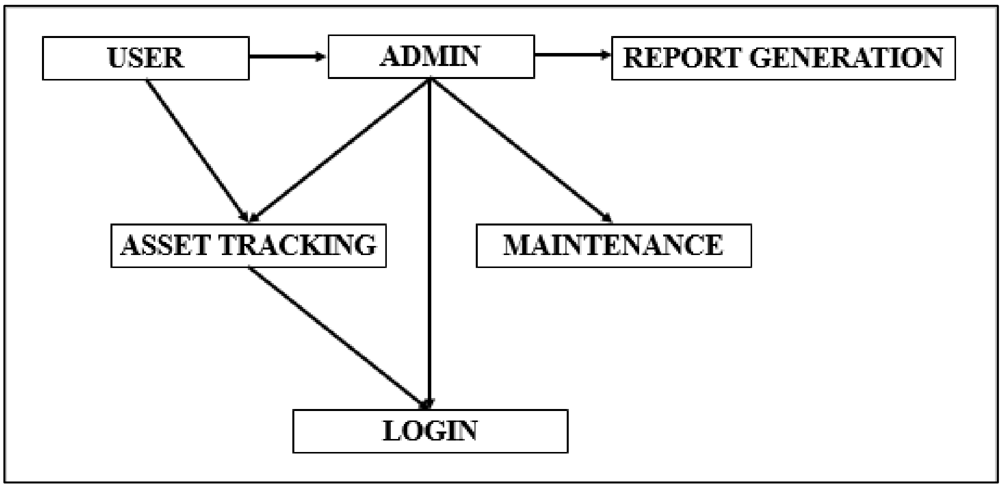

Figure 1. Modular Design Diagram

1. **User Management Module**
   - Handles authentication and authorization for different users (Admin, User).
   - Defines roles, permissions, and access levels.
2. **Asset Registration Module**
   - Records details of all assets, including type, location, and specifications.
   - Assigns unique asset tags for identification.
3. **Asset Tracking Module**
   - Monitors asset movement and operational status.
   - Logs real-time asset updates, ownership transfers, and utilization reports.
4. **Maintenance & Scheduling Module**
   - Manages preventive and corrective maintenance schedules.
   - Sends alerts and notifications for service due dates.
5. **Report & Analytics Module**
   - Generates reports on asset lifecycle, depreciation, and maintenance history.
   - Provides data-driven insights for asset optimization.
6. **Integration & Security Module**
   - Ensures data encryption, access control, and secure API integration.
   - Supports interoperability with ERP, IoT, and cloud platforms (if required in future scope).

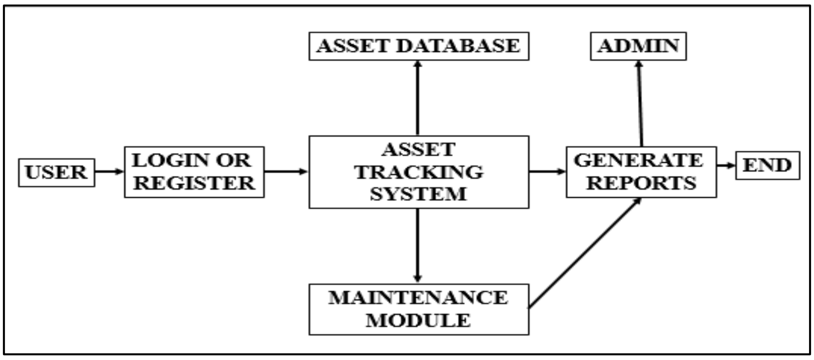

Figure 2: Data Flow Diagram

The Data Flow Diagram (DFD) of the Asset Management System illustrates how data moves through various system components. It begins with user authentication, where employees or administrators log in to access the system. Once authenticated, users can enter, modify, or delete asset records, with all data stored in a central database. The system enables real-time asset tracking, allowing users to monitor asset status, location, and condition. Additionally, maintenance requests can be generated for faulty assets, and service history is logged for future reference. The system also provides report generation features, offering insights into asset utilization and maintenance schedules. Finally, users can securely log out after completing their tasks, ensuring data security and system integrity.

V. CONCLUSION

The Asset Management System (AMS) for Static and Portable Electromechanical Machines provides a structured and efficient approach to asset tracking, maintenance management, and resource optimization. By leveraging a SQL-based database, predictive maintenance techniques, and role-based user access, the system enhances operational efficiency while ensuring data security and scalability. The predictive maintenance feature minimizes unexpected failures, optimizing machine uptime and reducing overall maintenance costs. Furthermore, its adaptability across industries, from manufacturing to transportation, makes it a versatile tool for asset-intensive organizations. Despite its strengths, the AMS relies on manual data entry, which can introduce human errors and require strict adherence to data protocols. Future enhancements, such as automated data collection and AI-driven analytics, could further improve accuracy and decision-making capabilities. Nonetheless, this system serves as a cost-effective and practical solution for organizations looking to enhance their asset management strategies without the need for IoT infrastructure.

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