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# System Development for Designing, Building, and Maintaining Website-Based Building Infrastructure

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**Abstract**− Advances in information technology are driving digital transformation in building infrastructure management, which was previously carried out conventionally and fragmented. Unintegrated building design, construction, and maintenance processes often lead to various problems, such as information delays, coordination difficulties between stakeholders, low operational efficiency, and suboptimal decision-making. This research aims to develop a website-based system capable of supporting integrated building infrastructure management throughout the building's lifecycle, from design, construction, and maintenance. The research method used is a Research and Development (R&D) approach with a System Development Life Cycle (SDLC) approach, encompassing the stages of needs analysis, system design, implementation, and testing. The system was developed using web technology and designed to provide features for building data management, design documentation, construction progress monitoring, maintenance recording, and dashboard-based reporting. System testing was conducted using a black-box method to ensure all functions operate according to user requirements. The results of the study indicate that the developed website-based system can increase data management efficiency, improve coordination between relevant parties, and provide accurate and real-time information to support decision-making. This system also simplifies the documentation and tracking of building construction and maintenance activities. Thus, the developed system is expected to be an effective digital solution in supporting the transformation of building infrastructure management and become the basis for further development towards the smart building concept.

**Keywords**: Information Systems, Building Infrastructure, Website, Building Management, System Development

## 1. INTRODUCTION

Advances in information technology have driven a digital transformation in the management of physical assets, including building infrastructure, which was previously managed conventionally and fragmented (Laudon & Laudon, 2021). Website-based information systems are a key solution because they provide centralized, real-time, and cross-stakeholder data access (Adejola, 2024). In the context of building management, digitalization is necessary to address the complexities of the building lifecycle, which encompasses the design, construction, and maintenance stages.

Building infrastructure is a long-term asset that requires structured management to maintain optimal, safe, and sustainable function (Chen et al., 2023). Failure to manage design and construction data often leads to cost overruns, project delays, and reduced building quality (Bilal et al., 2022). Therefore, a system capable of digitally and systematically integrating the entire building management process is necessary.

The building design process, which still relies on separate documents, makes it difficult to track design changes and make technical decisions (Volk et al., 2021). A website-based system allows for centralized storage of design documents, allowing them to be accessed and updated efficiently by relevant parties (Supiansyah et al., 2024). This improves data consistency and reduces design misinterpretation.

During the construction phase, coordination between project stakeholders is a major challenge, especially in large-scale and complex projects (Krisdiyanto et al., 2024). A web-based information system can support real-time monitoring of work progress, quality control, and reporting of construction activities (Qadir et al., 2025). This allows for more transparent and accountable project management

Building maintenance is an often overlooked phase, despite its significant impact on building lifespan and operational costs (Motamedi et al., 2021). Without a proper record-keeping system, maintenance activities become reactive and unplanned (Soetjipto et al., 2023). A website-based system allows for systematic recording of maintenance history, maintenance scheduling, and damage reporting.

The integration of Building Information Modeling (BIM) technology with web-based systems further enhances the effectiveness of building management (Putra & Junaid, 2025). BIM provides a digital representation of a building that supports information management throughout its lifecycle (Wati et al., 2023). When integrated with web-based systems, BIM data can be utilized collaboratively and sustainably.

In addition to BIM, the use of the Internet of Things (IoT) in building management is also growing, particularly for automated building condition monitoring (Syuhada et al., 2025). The integration of IoT with web-based

systems allows building managers to obtain real-time data on environmental and facility conditions (Ehab et al., 2024). This supports the concept of efficient and adaptive smart buildings.

Several studies have shown that implementing digital systems in infrastructure management can improve operational efficiency and reduce maintenance costs (Pandiangan et al., 2024). Web-based systems also improve the quality of decision-making because information is presented in a structured and easily analyzed manner (Putra & Dewi, 2023). Furthermore, digitalization supports transparency and accountability in public asset management.

Despite its significant benefits, the adoption of digital systems in building management still faces various challenges, such as limited human resources and organizational readiness (Nyqvist, 2025). Therefore, the system developed must have an easy-to-use interface and be flexible to user needs (Utomo, 2025).

Based on this description, this research focuses on the development of a website-based system that supports the integrated design, construction, and maintenance of building infrastructure. This system is expected to be an effective digital solution to support the transformation of building infrastructure management.

## 2. RESEARCH METHODOLOGY

The research method used is Research and Development (R&D) with a System Development Life Cycle (SDLC) approach. The research stages include:

### 2.1 Requirements Analysis

Identifying system user needs, including functional and non-functional requirements for building infrastructure management.

### 2.2 System Design

Designing the system architecture, database, and website-based user interface using UML diagrams.

### 2.3 System Implementation

Developing the system using web technologies such as HTML, CSS, JavaScript, and server-side programming languages and databases.

### 2.4 System Testing

Conducting functional testing using black-box methods to ensure all features function as required.

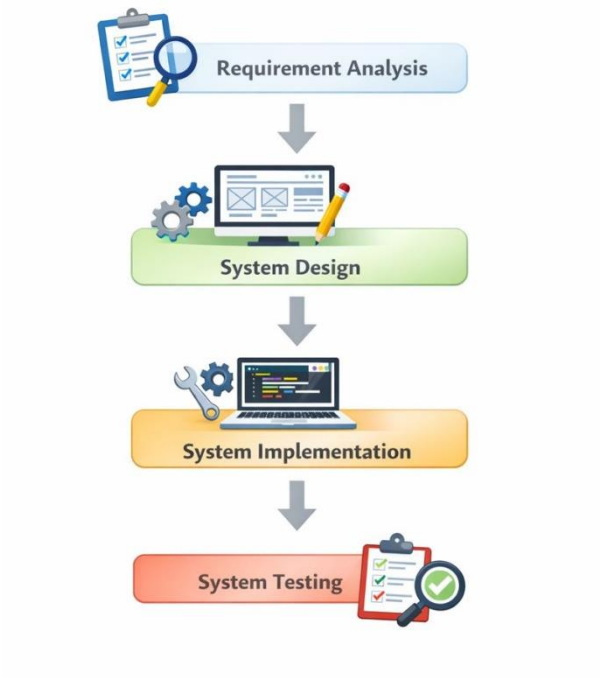


**Figure 1.** Research Flow

Figure 1 This section describes the system development stages used in this research, adopting the System Development Life Cycle (SDLC) approach. The research flow is structured systematically and sequentially to ensure that the developed website-based system is capable of meeting the design, construction, and maintenance needs of building infrastructure.

# 3. RESULTS AND DISCUSSION

The research results show that the developed website-based system is capable of integrating building design, construction, and maintenance data into a single platform. The system provides building data management, construction progress monitoring, maintenance recording, and dashboard-based reporting.

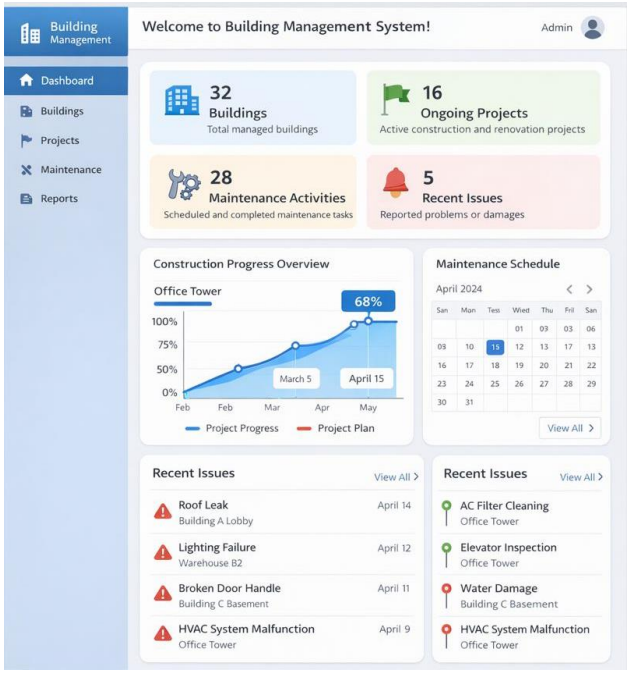


**Figure 2.** Building Infrastructure Management System Website View

Figure 2 The website displays the interface of a Web-Based Building Infrastructure Management System designed to support the integrated design, construction, and maintenance processes of buildings. The system interface is designed with a simple and informative design for ease of use by various stakeholders, such as administrators, building managers, and technical teams.

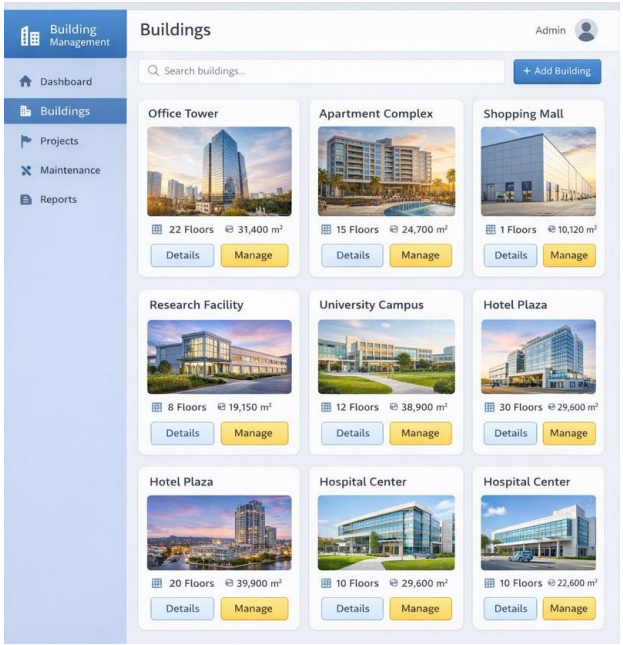


**Figure 3.** Buildings Menu Display in the Website-Based Building Management System

Figure 3 The Buildings display shows the building data management module interface in the Website-Based Building Management System. This module serves as an information center for storing, displaying, and managing data for each building registered in the system in a structured and integrated manner.

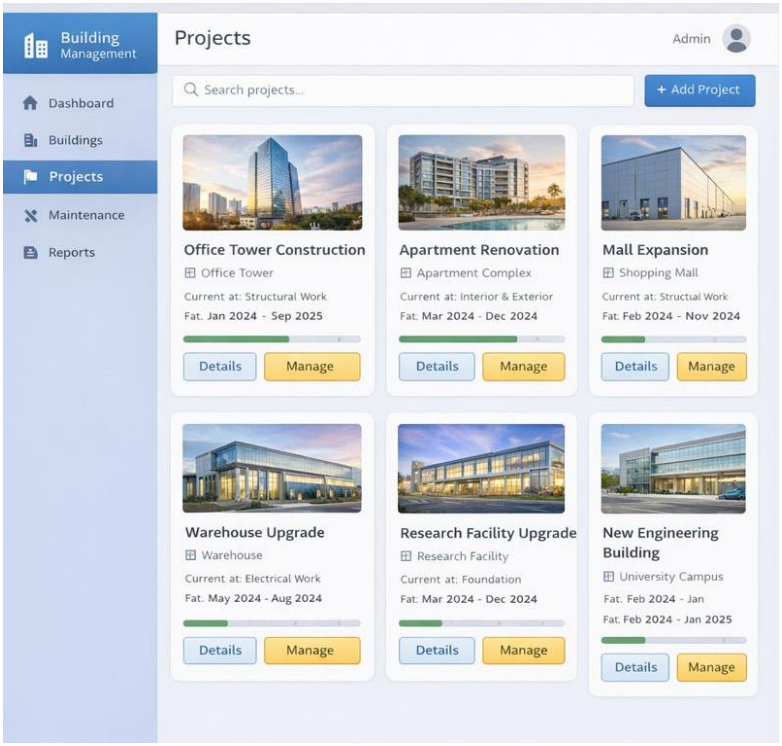


**Figure 4.** Projects Menu Display in the Website-Based Building Infrastructure Management System

Figure 4 The Projects menu display shows the interface for the building construction and renovation project management module in the Web-Based Building Infrastructure Management System. This module serves to manage all project activities in a structured manner, from planning and implementation to monitoring construction progress.

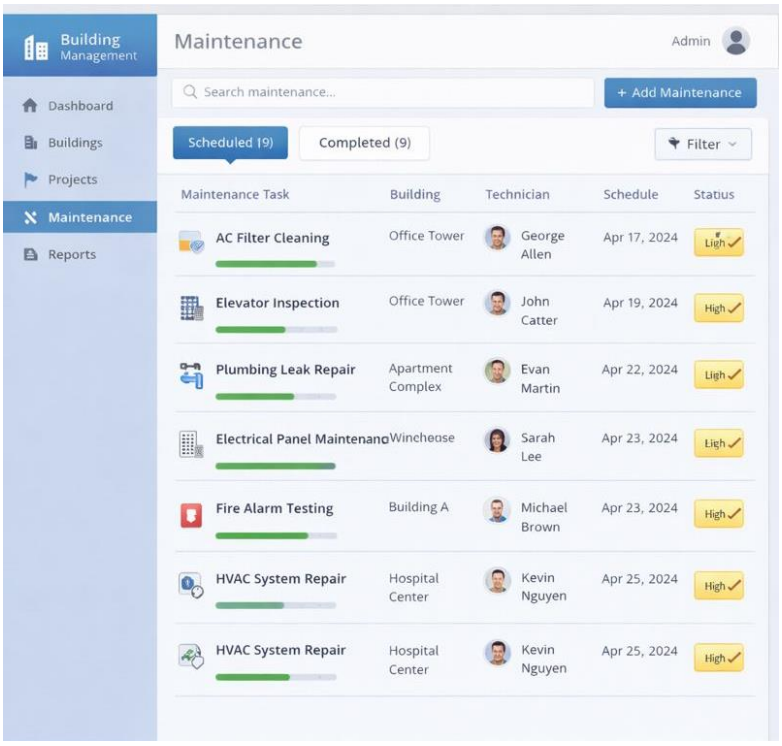


**Figure 5.** The Maintenance Menu Display in the Website-Based Building Infrastructure Management System

Figure 5 The Maintenance menu display shows the interface for the building infrastructure maintenance and care management module in the Website-Based Building Infrastructure Management System. This module is designed to support the systematic and integrated recording, scheduling, and monitoring of building maintenance activities.

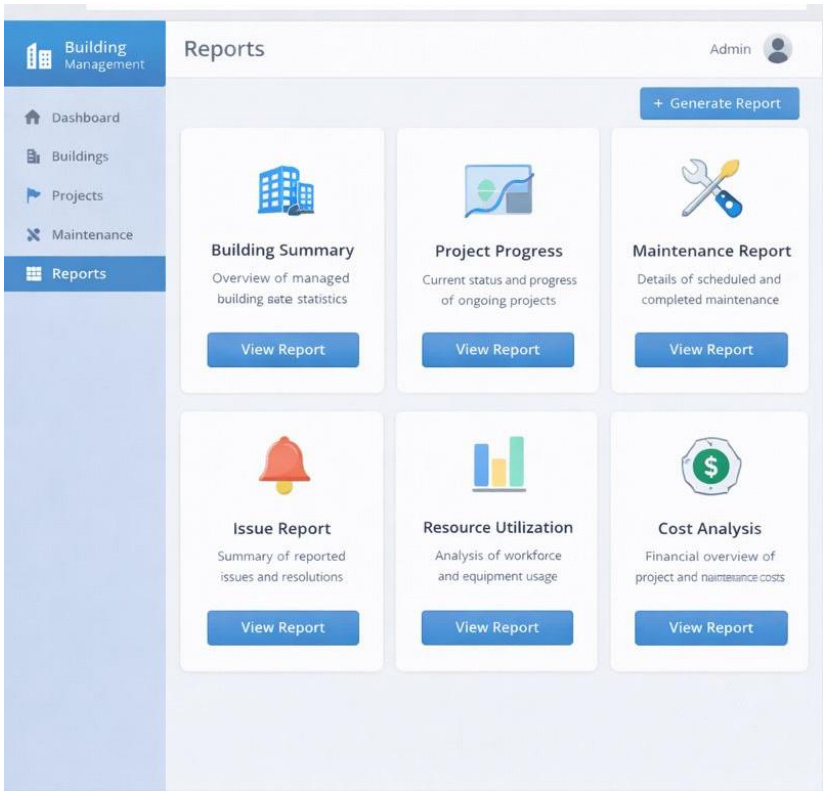


**Figure 6.** Reports Menu Display in the Web-Based Building Infrastructure Management System

Figure 6 Reports Menu Display in the Web-Based Building Infrastructure Management System, designed to support data analysis, evaluation, and decision-making processes. This module serves as a centralized component for summarizing and visualizing information generated from other system modules, such as Buildings, Projects, and Maintenance.

**Table 1.** Black Box Testing Results of the Web-Based Building Infrastructure Management System

| Module | Test Case | Test Scenario | Expected Result | Actual Result | Status |
|---|---|---|---|---|---|
| Login | Valid Login | User enters correct username and password | System successfully redirects user to dashboard | System redirects to dashboard | Pass |
| Login | Invalid Login | User enters incorrect username or password | System displays error notification | Error message displayed | Pass |
| Dashboard | Data Visualization | User accesses dashboard page | Summary cards and charts are displayed correctly | Data displayed correctly | Pass |
| Buildings | Add Building Data | User inputs valid building information and saves | Building data stored and displayed in list | Data saved and displayed | Pass |
| Buildings | Edit Building Data | User updates existing building information | Updated data is saved and reflected | Data updated successfully | Pass |
| Projects | Add New Project | User adds a new project with complete details | Project appears in project list | Project displayed correctly | Pass |
| Projects | Project Progress Update | User updates project progress percentage | Progress bar updates accordingly | Progress updated correctly | Pass |
| Maintenance | Schedule Maintenance | User creates maintenance schedule | Maintenance record saved and listed | Data saved successfully | Pass |
| Maintenance | Update Maintenance Status | User changes maintenance status (ongoing/completed) | Status updated in system | Status updated correctly | Pass |
| Maintenance | View Maintenance History | User views maintenance history | Maintenance history displayed | History displayed correctly | Pass |

| Module | Test Case | Test Scenario | Expected Result | Actual Result | Status |
|---|---|---|---|---|---|
| Reports | Generate Report | User selects filter and generates report | Report generated based on selected criteria | Report generated correctly | Pass |
| Reports | Export Report | User exports report to PDF/Excel | File downloaded successfully | File downloaded | Pass |
| Navigation | Sidebar Navigation | User clicks sidebar menu items | System navigates to selected module | Navigation works correctly | Pass |
| Search | Search Data | User searches building/project data | Relevant data displayed | Search results correct | Pass |
| Logout | Logout System | User clicks logout button | System logs out and returns to login page | Logout successful | Pass |

The black box testing results demonstrate that all core system functionalities operated in accordance with the specified requirements. Each tested module—Login, Dashboard, Buildings, Projects, Maintenance, and Reports—successfully processed user inputs and produced the expected outputs without functional errors. The testing confirms that the system is reliable, user-friendly, and ready for implementation as a web-based solution for managing building infrastructure development and maintenance.

## 4. CONCLUSION

This study has successfully developed a web-based system for designing, constructing, and maintaining building infrastructure to address the challenges of conventional infrastructure management, which is often fragmented, manual, and inefficient. The proposed system integrates key functional modules, including Buildings, Projects, Maintenance, and Reports, into a unified platform that enables structured data management, real-time monitoring, and systematic documentation of infrastructure activities. The research methodology involved requirement analysis, system design, implementation, and black box testing to evaluate system functionality. The testing results demonstrate that all core features operate according to the defined specifications, with each module producing the expected outputs in response to user inputs. These findings indicate that the system is reliable, functional, and suitable for practical implementation in managing building infrastructure operations. The implementation of this web-based system provides significant benefits, particularly in improving operational efficiency, data accuracy, and transparency. Through centralized data storage and interactive dashboards, stakeholders can monitor project progress, schedule maintenance activities, and generate comprehensive reports to support data-driven decision-making. The reporting module further enhances accountability by offering analytical insights and exportable documentation for evaluation and auditing purposes.

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