A REPORT
ON

Dashboard For Real Time Monitoring Of Construction Projects

Submitted by,

ANU SHREE — **20211CSD0095**
DHRUTHI REDDY N — **20211CSD0173**
SANIYA BEGUM A — **20211CSD0109**

Under the guidance of,

Dr. Leelambika K V

in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

BENGALURU

May 2025

PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING

CERTIFICATE

This is to certify that the Project report **"DASHBOARD FOR REAL TIME MONITORING OF CONSTRUCTION PROJECTS"** being submitted by "ANU SHREE, DHRUTHI REDDY N, SANIYA BEGUM" A bearing roll number(s) "20211CSD0095, 20211CSD0173, 20211CSD0109" in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering in Data Science is a Bonafide work carried out under my supervision.

Leelambika 16/5/2025

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PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING

DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **"DASHBOARD FOR REAL TIME MONITORING OF CONSTRUCTION PROJECTS"** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Science and Engineering in Data Science**, is a record of our own investigations carried under the guidance of **DR. LEELAMBIKA K V, ASSISTANT PROFESSOR, SENIOR SCALE, Presidency School of Computer Science Engineering, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

The **Dashboard for Real-Time Monitoring of Construction Projects** is an advanced digital solution designed to improve efficiency, transparency, and decision-making in construction project management. Traditional monitoring approaches often result in delays, miscommunication, and inefficient allocation of resources. This system overcomes these challenges by consolidating real-time data from multiple sources, including IoT-based monitoring devices, project management software, and manual site inputs, into a centralized, interactive dashboard.

The platform utilizes Next.js for the frontend, providing a dynamic and responsive user experience, while **Zustand** efficiently manages application state. The interface is built with **Tailwind CSS**, ensuring a modern and intuitive design. Depending on data requirements, **PostgreSQL, MySQL, or MongoDB** is employed for database management. To enable real-time updates on project progress, resource utilization, financial tracking, safety compliance, and scheduling, the system leverages **WebSockets or MQTT** for seamless data synchronization.

Key features of the system include progress tracking, resource and financial management, schedule supervision, and real-time safety monitoring. Data visualization tools like **Chart.js and Recharts** are incorporated to present critical project insights in an easily interpretable format, enabling stakeholders to make informed decisions. Additionally, role-based authentication and access control are implemented to ensure data security and maintain confidentiality within the system.

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ACKNOWLEDGEMENT

First of all, we indebted to the **GOD ALMIGHTY** for giving me an opportunity to excel in our efforts to complete this project on time.

We express our sincere thanks to our respected **Dr. Md. Sameeruddin Khan**, Pro-VC, School of Engineering and Dean, School of Computer Science Engineering, Presidency University for getting us permission to undergo the project.

We express our heartfelt gratitude to our beloved Associate Dean **Dr. Mydhili Nair,** School of Computer Science Engineering, Presidency University, and **Dr. Saira Banu Atham**, Professor and Head of the Department, School of Computer Science Engineering, Presidency University for rendering timely help in completing this project successfully.

We are greatly indebted to our Guide and Reviewer **Dr. Leelambika K V,** Assistant Professor**,** Senior scale Professor, Presidency School of Computer Science Engineering, Presidency University for her inspirational guidance, and valuable suggestions and for providing us a chance to express our technical capabilities in every respect for the completion of the project work.

We would like to convey our gratitude and heartfelt thanks to the CSE7301 Capstone Project Coordinators **Dr. Sampath A K, Mr. Md Zia Ur Rahman,** department Project Coordinators **Dr. Manjula H M** and Git hub coordinator **Mr. Muthuraj.**

We thank our family and friends for the strong support and inspiration they have provided us in bringing out this project.

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CHAPTER-1

INTRODUCTION

The construction industry is a crucial domain that demands precise planning, effective coordination, and seamless execution of large-scale projects. From skyscrapers and infrastructure developments to residential and commercial establishments, successful project management requires real-time tracking, efficient resource distribution, and streamlined communication among all stakeholders. Traditionally, project supervisors and managers have relied on manual documentation, physical reports, and scheduled inspections, which often lead to project delays, budget overruns, miscommunication, and inefficiencies. With technological advancements driving automation across various industries, it has become imperative for construction management to adopt data-driven solutions that enhance operational efficiency, transparency, and decision-making.

To tackle these inefficiencies, the **Dashboard for Real-Time Monitoring of Construction Projects** has been developed as an integrated digital platform that delivers live updates on project status, workforce distribution, material usage, safety protocols, and financial expenditures. This dashboard consolidates data from various sources, including project management software (**such as Jira, Asana, and Primavera P6**) and manual site inputs, ensuring a centralized system for tracking project progress. Through the use of data visualization, automated notifications, and predictive analytics, the system empowers stakeholders to make well-informed decisions, minimize risks, and optimize project resources effectively.

The dashboard is designed using a robust technology stack to ensure scalability, performance, and ease of access. The frontend is developed with **Next.js** to provide a responsive and dynamic user experience, while **Zustand** efficiently manages the application's state. **Tailwind CSS** enhances the interface with a sleek and modern design. If backend functionality is required, technologies such as **Node.js or Python (Flask/Django)** handle API requests and database interactions. The system supports databases like **PostgreSQL, MySQL, or MongoDB,** depending on project requirements. Additionally, real-time synchronization is facilitated through **WebSockets or MQTT protocols**, enabling continuous updates on construction activities, equipment status, and environmental conditions.

The construction industry is a crucial domain that demands precise planning, effective coordination, and seamless execution of large-scale projects. From skyscrapers and infrastructure developments to residential and commercial establishments, successful project management requires real-time tracking, efficient resource distribution, and streamlined communication among all stakeholders. Traditionally, project supervisors and managers have relied on manual documentation, physical reports, and scheduled inspections, which often lead to project delays, budget overruns, miscommunication, and inefficiencies. With technological advancements driving automation across various industries, it has become imperative for construction management to adopt data-driven solutions that enhance operational efficiency, transparency, and decision-making.

Modern construction projects are increasingly complex, often involving multiple contractors, subcontractors, vendors, and teams spread across geographically dispersed locations. In such environments, even minor miscommunications or delays in data sharing can lead to significant disruptions in timelines and budgets. Furthermore, ensuring on-site safety and regulatory compliance in real time is becoming a greater challenge as the scale and speed of construction projects grow. These evolving demands have created the need for intelligent systems that not only provide visibility into ongoing operations but also offer actionable insights.

To tackle these inefficiencies, the Dashboard for Real-Time Monitoring of Construction Projects has been developed as an integrated digital platform that delivers live updates on project status, workforce distribution, material usage, safety protocols, and financial expenditures. This dashboard consolidates data from various sources, including project management software (such as Jira, Asana, and Primavera P6) and manual site inputs, ensuring a centralized system for tracking project progress. Through the use of data visualization, automated notifications, and predictive analytics, the system empowers stakeholders to make well-informed decisions, minimize risks, and optimize project resources effectively.

CHAPTER-2
LITERATURE SURVEY

1. **IoT-Based Real-Time Monitoring in Construction**
   - **Author(s): Zhang et al., 2020**
   - **Summary:** This study explores the implementation of IoT devices, such as sensors and RFID tags, for real-time tracking of materials, equipment, and workers. It highlights the role of IoT in improving project efficiency, reducing resource wastage, and ensuring regulatory compliance by providing live data insights.

2. **Digital Twin Technology for Construction Project Management**
   - **Author(s): Lu & Chen, 2021**
   - **Summary:** This paper discusses the use of digital twins in construction project monitoring. Real-time data from sensors and project management tools are fed into a virtual model of the construction site, allowing managers to simulate different scenarios, predict potential delays, and optimize resource allocation.

3. **Cloud-Based Project Monitoring Systems**
   - **Author(s): Patel & Gupta, 2019**
   - **Summary:** The research focuses on how cloud computing enhances project management by integrating Building Information Modeling (BIM) and real-time site data. The authors propose a cloud-based dashboard that facilitates seamless collaboration between stakeholders, ensuring accessibility from any location.

4. **AI in Predictive Construction Management**
   - **Author(s): Kim & Park, 2020**
   - **Summary:** This study investigates the application of artificial intelligence (AI) and machine learning (ML) in analyzing historical project data to predict risks, optimize scheduling, and recommend corrective measures to prevent cost overruns and delays.

5. **WebSockets for Real-Time Data Sharing in Construction**
   - **Author(s): Smith et al., 2021**
   - **Summary**: This paper examines the use of WebSockets to facilitate real-time communication between construction sites and project dashboards, highlighting its advantages over traditional HTTP polling methods in ensuring faster updates and reduced network overhead.

6. **Integration of BIM and IoT for Smart Construction**
   - **Author(s): Wong et al., 2020**
   - **Summary:** The study explores the convergence of Building Information Modeling (BIM) and IoT to create intelligent construction environments. It showcases how real-time data can enhance automated scheduling, quality control, and predictive maintenance of construction assets.

7. **GIS-Based Monitoring for Construction Sites**
   - **Author(s): Yadav & Sharma, 2018**
   - **Summary:** This research presents how Geographic Information Systems (GIS) can be used for tracking construction progress, worker movements, and spatial resource management. It highlights GIS's role in improving planning and reducing site inefficiencies.

8. **Automated Safety Monitoring Using Computer Vision**
   - **Author(s): Li et al., 2019**
   - **Summary:** This study highlights the use of AI-powered computer vision to detect safety violations, improper PPE usage, and hazardous situations on construction sites. Real-time analysis of camera feeds ensures proactive safety management.

9. **Blockchain for Secure Construction Data Management**
   - **Author(s): Nakamura & Tan, 2021**
   - **Summary:** This study explores how blockchain technology enhances data security and transparency in construction monitoring. It ensures tamper-proof records of real-time updates and secure access control for stakeholders.

10. Big Data Analytics for Construction Project Optimization

- **Author(s):** Singh et al., 2019
- **Summary:** The research discusses how big data analytics processes vast datasets from IoT devices and project management tools to optimize workflows, improve risk management, and enhance efficiency in large-scale construction projects.

11.Drones for Real-Time Construction Site Inspection

- **Author(s):** Brown & Williams, 2020
- **Summary:** This study examines how drones equipped with cameras and LiDAR sensors enhance real-time aerial surveillance, documentation, and progress tracking, reducing the need for manual inspections.

12. Edge Computing for Real-Time Construction Monitoring

- **Author(s):** Mehta et al., 2022
- **Summary:** The study explores how edge computing processes data locally at construction sites, reducing latency and improving real-time monitoring, particularly in remote or bandwidth-constrained environments.

13. AI-Powered Defect Detection in Construction Materials

- **Author(s):** Roberts et al., 2021
- **Summary:** This paper highlights how AI-driven defect detection in construction materials, using computer vision and ML algorithms, improves quality control and minimizes the need for rework.

14. Cybersecurity in Construction Monitoring Systems

- **Author(s):** Hernandez & Kumar, 2023
- **Summary:** The study addresses cybersecurity risks in construction monitoring platforms, focusing on best practices for securing IoT devices, preventing unauthorized access, and mitigating data breaches.

15. Human-Robot Collaboration in Construction Automation

- **Author(s):** Lee & Fernandez, 2022
- **Summary:** This research examines the role of robotic automation in construction, analyzing how robots assist workers in material handling, assembly tasks, and repetitive activities to improve efficiency and **Big Data** safety.

CHAPTER-3

RESEARCH GAPS OF EXISTING METHODS

3.1. Limited Integration of Multiple Data Sources

Current systems often fail to integrate multiple data sources such as IoT devices, project management software, BIM models, and manual inputs seamlessly. This results in fragmented data, hindering real-time decision-making and reducing project efficiency.

3.2. Scalability Issues in Real-Time Processing

Many existing solutions struggle to handle large-scale construction projects involving multiple sites and thousands of data points. The lack of scalable architectures for real-time data processing affects performance, leading to system bottlenecks and slower analytics.

3.3. Inefficient Handling of Real-Time Safety Monitoring

Although AI-based safety monitoring exists, real-time detection of hazards (e.g., improper PPE usage, falling objects, worker fatigue) still has a high false-positive rate. More accurate, context-aware safety monitoring with advanced AI and IoT integration is needed.

3.4. Lack of Advanced Predictive Analytics for Delay Prevention

3Most systems only provide historical data analysis instead of predictive insights. There is a gap in using AI/ML models to predict delays, identify early warning signs, and recommend preventive measures before delays occur.

3.5. Security and Data Privacy Concerns

Construction sites collect sensitive data related to project budgets, worker details, and infrastructure plans. Existing solutions lack robust encryption, access control mechanisms, and blockchain-based security to prevent cyber threats, unauthorized access, and data manipulation.

3.6. High Latency in Real-Time Communication

WebSockets and MQTT are commonly used for real-time updates, but network congestion and high latency still delay data synchronization between on-site sensors and monitoring dashboards. Optimized edge computing solutions and 5G-based communication frameworks could address this issue.

3.7. Limited Use of Digital Twin Technology

While digital twins can simulate and optimize construction progress, their implementation is still limited due to high computational requirements, integration challenges with IoT devices, and the complexity of real-time updates from construction sites.

3.8. Inefficient Resource Allocation Models

Current monitoring solutions lack dynamic, AI-driven resource allocation strategies for labor, materials, and equipment. Incorporating real-time data analytics and optimization algorithms could improve efficiency, cost-effectiveness, and sustainability.

3.9. Poor Adaptability to Changing Environmental Conditions

Construction sites are vulnerable to weather-related delays, material degradation, and unforeseen site conditions. Most real-time monitoring dashboards do not integrate climate prediction models, environmental sensors, or adaptive scheduling algorithms to mitigate these challenges.

3.10. Lack of Standardization in Data Formats and Protocols

Different construction firms use varied data formats, IoT protocols, and project management systems, making interoperability difficult. A standardized data exchange framework, based on industry-wide protocols, could enhance seamless integration across different platforms and tools.

CHAPTER-4

PROPOSED METHODOLOGY

4.1 Multi-Source Data Integration

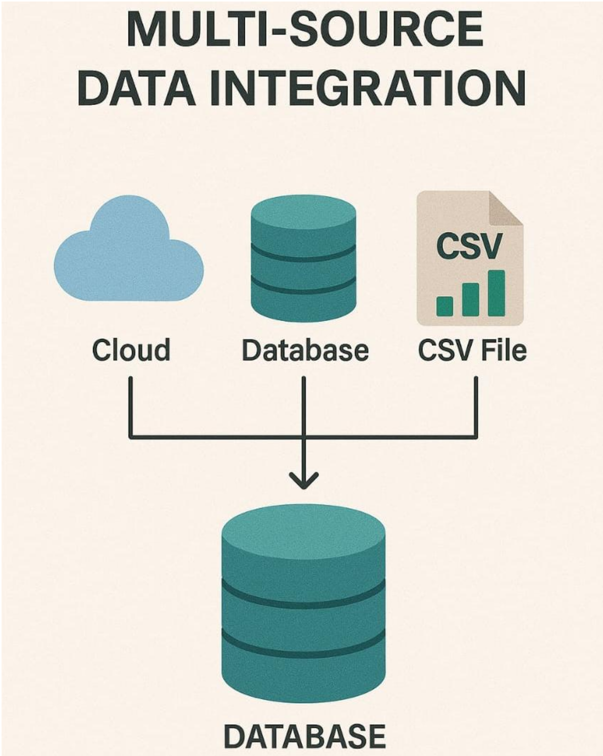

Figure 4.1: Multi-Source Data Integration

This *Figure 4.1* illustrates how real-time data is aggregated from various sources such as cloud services, local databases, and structured files (e.g., CSV). Each input stream is funneled into a centralized database system, enabling unified and consistent access for analysis and visualization. This integration ensures seamless data flow and minimizes manual input, which is critical for timely decision-making in construction monitoring.Jira, Asana), and manual inputs from site supervisors. APIs and data pipelines will be established to ensure seamless communication between different platforms. This integration will help in automated data collection, reducing manual effort and ensuring accurate real-time updates on construction progress, resources, and environmental conditions.

4.2 Real-Time Data Processing with Edge Computing

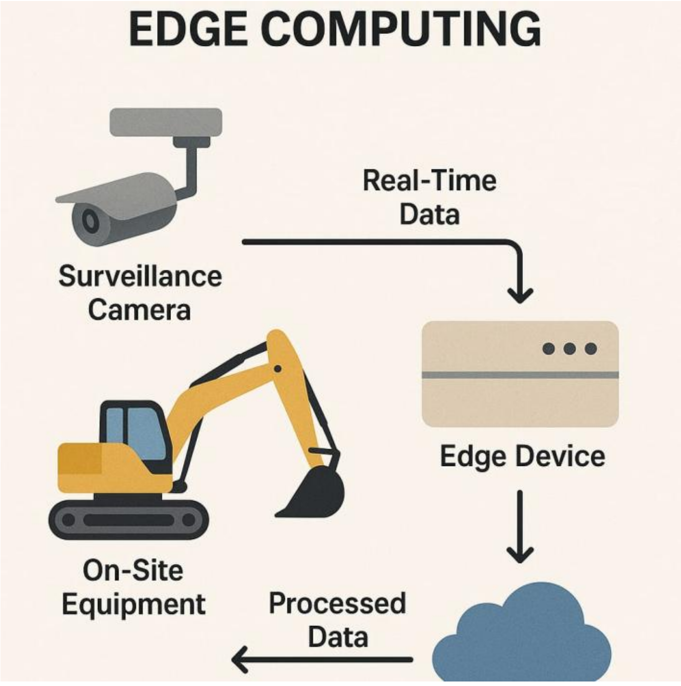

Figure 4.2: Real-Time Data Processing with Edge Computing

The *Figure 4.2* illustrates the architecture of real-time data processing using edge computing. It shows how data from on-site construction equipment (like an excavator) and surveillance systems is first processed locally by an edge server before being transmitted to the cloud. This setup reduces latency, ensures faster response times for critical alerts, and minimizes bandwidth usageTraditional cloud-based systems often face latency issues due to network dependencies. To counter this, edge computing will be implemented to process data closer to the construction site using local servers or edge devices. This method will significantly reduce response time for safety alerts, equipment failures, and live monitoring, allowing for faster decision-making in critical situations. Edge computing also reduces cloud bandwidth usage, making the system more cost-effective.

4.3 AI-Based Predictive Analytics for Delay Prevention

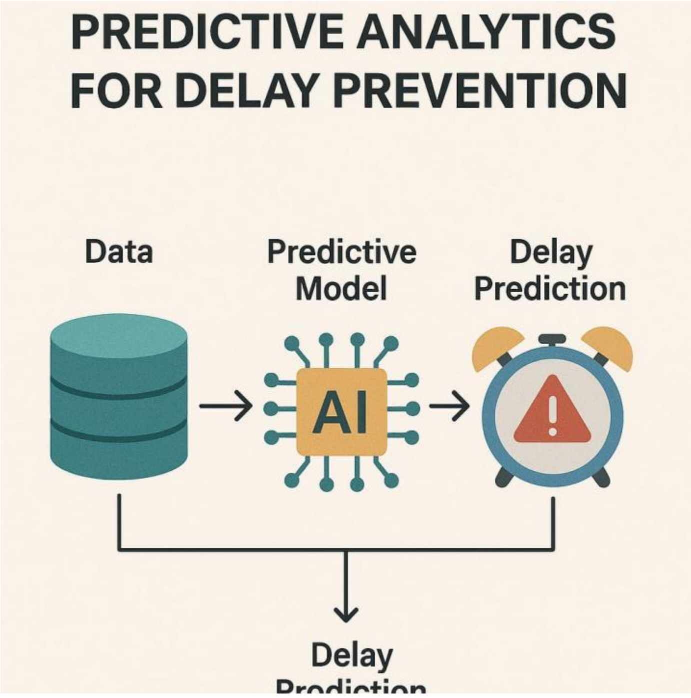

Figure 4.3: AI-Based Predictive Analytics for Delay Prevention

The *Figure 4.3* infographic visualizes how AI-based predictive analytics works in construction delay prevention. It shows a flow of data—from sources like historical records, weather conditions, and worker productivity—into an AI processing unit (represented by a chip icon). The AI then analyzes the data to forecast potential project delays, triggering alerts such as a warning clock icon. This helps managers take preventive actions before issues escalate, ensuring smoother project execution. The system will leverage machine learning models trained on historical project data to predict potential delays and provide proactive recommendations. Regression models, neural networks, and reinforcement learning techniques will be used to analyze weather conditions, worker productivity, supply chain disruptions, and site conditions to forecast delays and suggest alternative strategies.

4.4 Real-Time Dashboard with Interactive Data Visualization

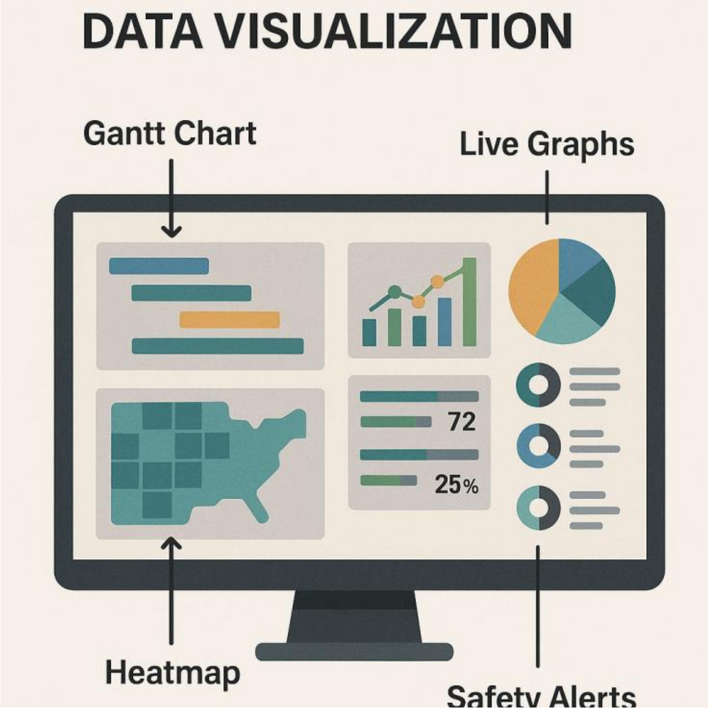

Figure 4.4: Real-Time Dashboard with Interactive Data Visualization

The *Figure 4.4* infographic illustrates a real-time construction monitoring dashboard that features interactive data visualizations. The image includes key dashboard components such as Gantt charts for scheduling, live graphs for performance tracking, heatmaps for activity density, and safety alerts. These elements are organized in an intuitive layout, showing how users (e.g., project managers) interact with visual data to monitor project progress, resource utilization, and safety compliance in real time.The dashboard will feature progress tracking (Gantt charts), financial analytics (budget vs. actual costs), safety alerts, and resource utilization metrics. Data visualization libraries like Recharts and D3.js will be used to create dynamic and user-friendly graphs, heatmaps, and live status updates.

4.5 Blockchain-Based Secure Data Management

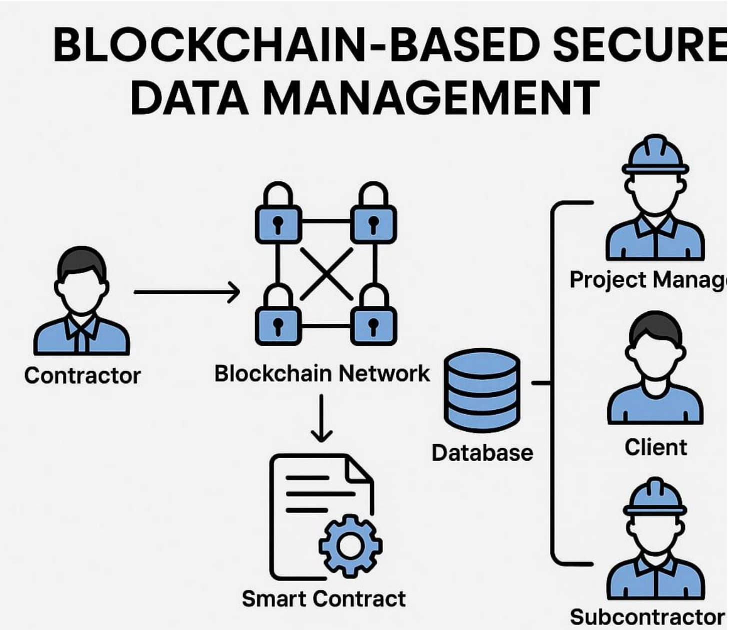

Figure 4.5: Blockchain-Based Secure Data Management

The *Figure 4.5* illustrates a blockchain-based secure data management system tailored for construction projects. It shows how data—such as project milestones, transactions, and safety reports—is recorded into a blockchain ledger through secure nodes. Smart contracts are represented by digital agreement icons, which automatically execute tasks like payments or compliance checks. The distributed structure ensures tamper-proof data integrity, role-based access, and end-to-end traceability. To ensure data integrity, transparency, and security, blockchain technology will be integrated into the system. Blockchain will help in tamper-proof recording of project milestones, financial transactions, and safety reports, ensuring that all data remains immutable and auditable. Smart contracts will be implemented to automate payment releases based on project completion, reducing disputes and enhancing trust among stakeholders.

4.6 Automated Resource Allocation System

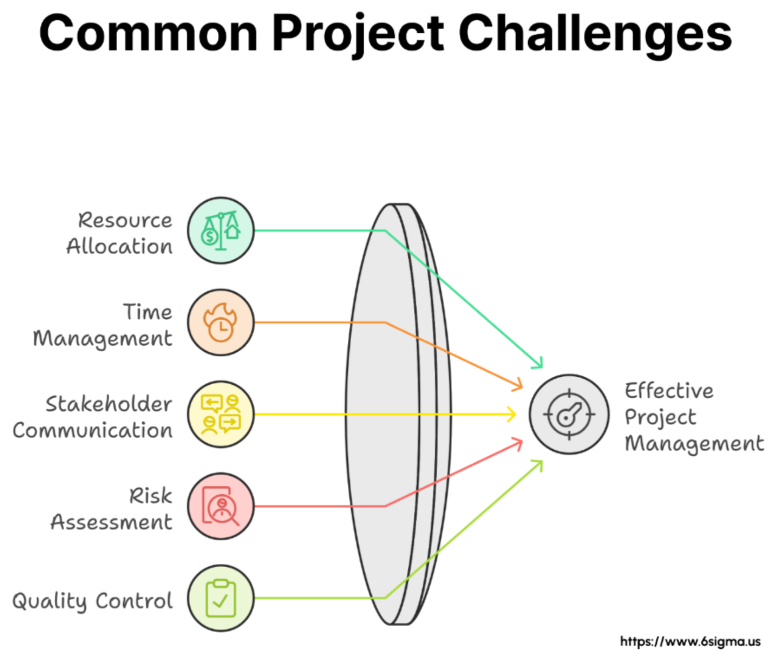

Figure 4.6: Automated Resource Allocation System

The *Figure 4.6* visually represents the common challenges in project management—including resource allocation, time management, stakeholder communication, risk assessment, and quality control. These challenges are shown converging into a central mechanism that aims to achieve Effective Project Management. The diagram reinforces how addressing each of these factors through automation and AI-driven systems contributes to optimized construction workflows. AI-powered resource allocation models will be implemented to dynamically assign tasks and materials based on real-time availability and project needs. A constraint-based optimization algorithm will ensure that resources are allocated efficiently while considering site conditions, worker availability, and project deadlines.

4.7 Real-Time Environmental Monitoring and Compliance

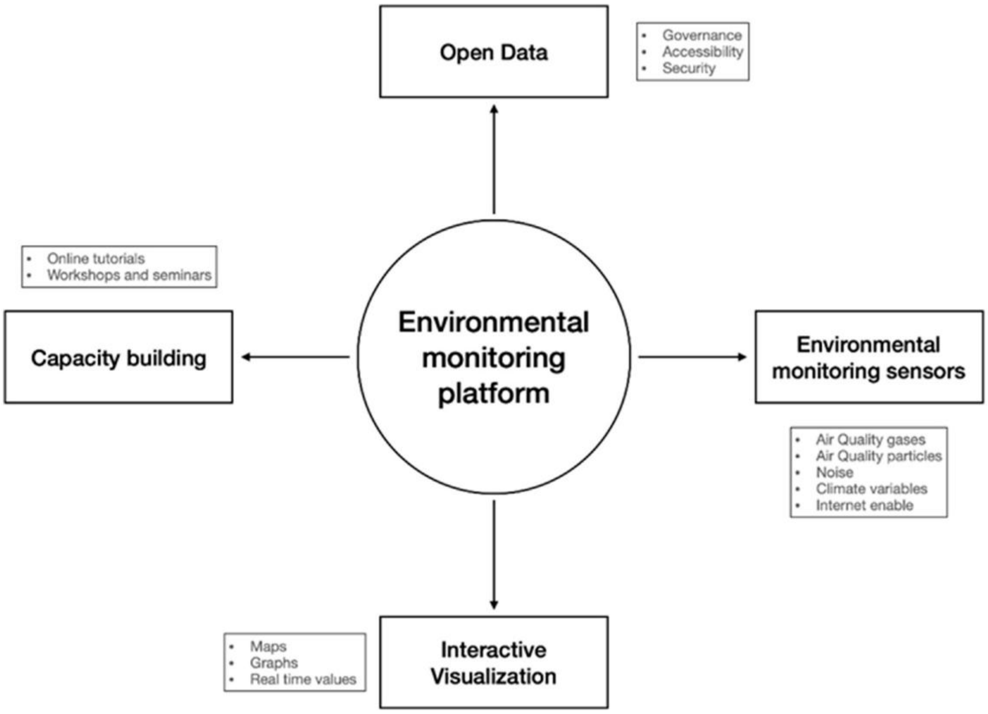

Figure 4.7: Real-Time Environmental Monitoring and Compliance

The *Figire 4.7* would display sensors collecting environmental data such as air quality, noise levels, and temperature at a construction site. These inputs are shown flowing into a centralized monitoring dashboard that flags compliance issues or anomalies. Alert icons highlight threshold breaches, while regulatory indicators confirm whether current conditions meet environmental standards. The layout emphasizes real-time feedback and automated reporting to ensure the site stays within permitted environmental limits. The system will integrate air quality sensors, noise pollution detectors, and climate prediction models to monitor environmental impact in real-time. The data collected will be analyzed to ensure compliance with government regulations and automatically generate reports for submission to environmental agencies.

4.8 WebSocket and MQTT-Based Real-Time Communication

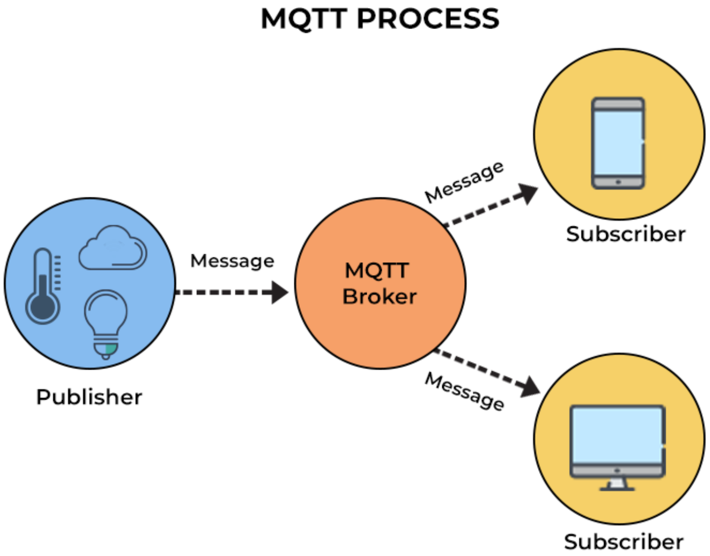

Figure 4.8: WebSocket and MQTT-Based Real-Time Communication

The *Figure 4.8* illustrates the MQTT communication process, a lightweight protocol used for efficient real-time messaging in construction monitoring systems. The diagram shows a Publisher (like a sensor) sending messages to an MQTT Broker, which then distributes them to multiple Subscribers (such as dashboard clients or monitoring systems). This ensures that all relevant endpoints receive updates instantly, supporting event-triggered alerts for issues like safety violations or equipment failures. The system will use WebSockets for instant dashboard updates and MQTT (Message Queuing Telemetry Transport) for sensor-based real-time alerts. This will ensure that project managers receive immediate notifications for critical events, such as safety violations, equipment malfunctions, or project milestone completions.

4.9 AI-Driven Digital Twin for Construction Simulation

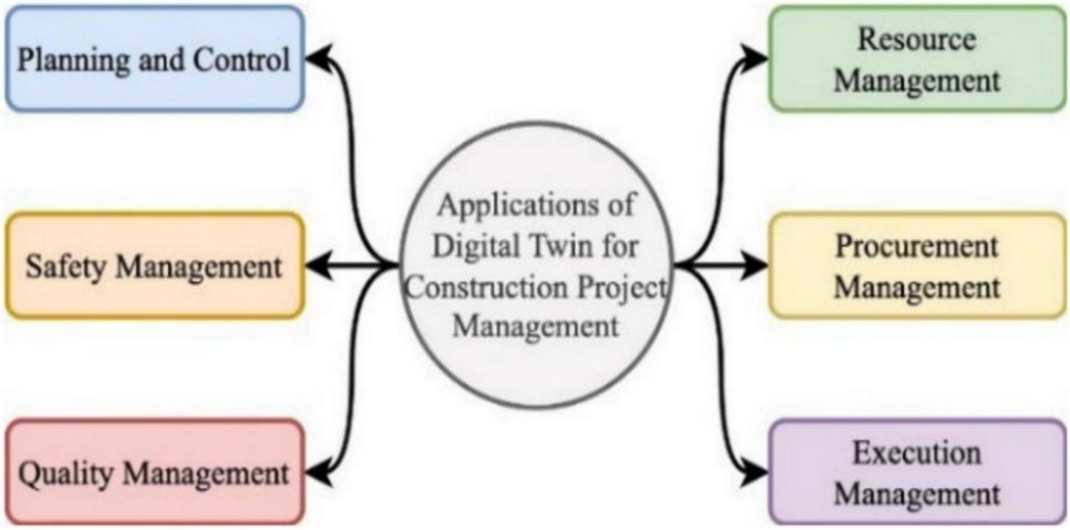

Figure 4.9: AI-Driven Digital Twin for Construction Simulation

The *Figire 4.9* would depict a real construction site on one side and a digital 3D twin on the other, both connected by data streams. It would show IoT devices and sensors feeding real-time data into the digital twin. The twin would simulate scenarios like workflow changes, equipment movement, or environmental changes. AI modules would be shown analyzing this virtual model to predict structural issues, schedule risks, or cost impacts—helping managers make data-driven decisions before executing changes on-site. This virtual representation of the physical site will allow project managers to simulate different scenarios before actual implementation. AI-driven simulations will help in detecting potential structural issues, optimizing construction workflows, and evaluating project feasibility before execution, reducing risks and saving costs.

Components of the Dashboard

The dashboard will be designed with an intuitive and interactive interface that provides real-time insights into construction activities. Key components include:

- Project Timeline & Progress Tracking: Gantt charts and milestone indicators for tracking project schedules.
- Resource Management: Real-time data on labor, materials, and equipment availability.
- Financial Analytics: Budget tracking with visual comparisons of estimated vs. actual costs.
- Safety Monitoring: Alerts for hazards, PPE compliance, and emergency situations.
- Environmental Monitoring: Air quality, noise levels, and weather impact analysis.
- Predictive Analytics Panel: AI-generated insights on possible delays and risk factors.
- Communication Module: WebSocket and MQTT-based instant notifications.

CHAPTER-5
OBJECTIVES

5.1 Provide Clear, Real-Time Project Tracking:

The main aim of this system is to give everyone involved—managers, clients, and workers—a live, up-to-date view of what's happening on the site. By using tools like IoT sensors, GPS, and automated reports, the dashboard keeps track of daily progress, milestones, and any delays. This helps catch problems early and keeps the project on time and within budget.

5.2 Make Construction Sites Safer:

Safety is a big concern on any construction site. Our system uses AI and smart sensors to watch for issues like missing helmets, unsafe working conditions, or tired workers. If a problem is detected, it alerts supervisors instantly. This helps reduce accidents and makes sure the site follows safety rules and legal requirements.

5.3 Use Resources More Efficiently:

Construction projects often face problems like wasted materials or underused equipment. The system analyzes data in real time to suggest how labor, tools, and materials should be used better. If something is running low or being overused, it notifies the team and helps make quick adjustments to avoid delays or losses.

5.4 Avoid Delays Through Smart Predictions:

Delays due to bad weather, late supplies, or labor issues are common in construction. Our system uses historical data and AI-based forecasting to spot these risks early. It alerts the team before things get off track and suggests alternative solutions to keep the project moving.

5.5 Track Spending and Stay on Budget:

It's easy for expenses to go out of control in large projects. Our dashboard includes tools that track spending as it happens, comparing planned costs with actual ones. If something is overspending, the system highlights it and suggests ways to fix it—helping managers make smarter financial decisions.

5.6 Improve Communication and Team Coordination:

Miscommunication can slow down projects or cause serious mistakes. The dashboard includes instant messaging and notifications that are sent to the right people based on their roles. This ensures everyone gets updates on time, reducing confusion and improving teamwork.

5.7 Protect Data and Ensure Security:

Construction data includes sensitive information like costs, worker records, and project timelines. Our system uses blockchain technology and secure logins to keep this data safe. Only authorized users can access it, and all updates are recorded in a way that can't be changed or faked

5.8 Support Smarter, Faster Decision-Making:

Instead of relying only on manual reports or past experience, the system uses AI to give real-time suggestions. It analyzes live and past data to help managers make better decisions about schedules, risks, and resources—faster and with more confidence.

5.9 Build a System That Grows with Future Needs:

As projects get bigger or more complex, our system can grow with them. It's designed to handle multiple sites and work with new technologies like AR, VR, and Digital Twins. This means it won't need to be replaced or rebuilt every time your project needs change.

5.10 Enable AI-Driven Quality Control:

The dashboard can help detect construction defects early using AI-based image analysis and pattern recognition from real-time camera feeds. This ensures timely intervention, reduces rework, and improves overall construction quality.

5.11 Automate Project Reporting and Documentation:

Manual reporting often leads to inconsistencies and delays. By automating report generation, the system saves time and ensures that accurate data on progress, safety, and costs is consistently available for all stakeholders.

5.12 Simulate and Test Construction Scenarios Using Digital Twins:

Using digital twin technology, the system allows managers to simulate workflow changes, evaluate project feasibility, and assess the impact of decisions virtually before implementation—minimizing on-site trial and error.

5.13 Centralize Communication and Project Intelligence:

With all updates, alerts, and data centralized on a single platform, the system acts as a unified source of truth for everyone involved. This improves decision-making speed and eliminates confusion caused by fragmented communication channels.

5.14 Ensure Scalability and Future-Proofing of the System:

The system is designed to support future upgrades, new features, and larger-scale deployments without major rework. Its modular architecture and cloud-based infrastructure make it adaptable to changing project needs, technological advancements, and expanding business requirements.

CHAPTER-6

SYSTEM DESIGN & IMPLEMENTATION

6.1 Modular System Architecture Design

The system is built on a modular microservices architecture, ensuring scalability, flexibility, and fault isolation. Each module operates independently, handling specific functionalities such as Progress Tracking, Resource Management, Safety Monitoring, Financial Analysis, and Real-Time Data Processing. Communication between modules is managed through RESTful APIs, GraphQL, or gRPC. The frontend, built using Next.js, interacts with the backend (Node.js with Express or Python with Django/Flask) through secure API endpoints. Additionally, the architecture supports seamless third-party integrations for project management, financial tracking, and IoT-based monitoring.

6.2 Frontend Development Using Next.js

The frontend leverages Next.js for server-side rendering (SSR) and static site generation (SSG), ensuring optimized performance. Tailwind CSS provides a responsive, visually appealing UI. The system follows a structured component-based design, where reusable UI elements are housed in src/components/ui. The global structure is managed via MainLayout.tsx, while views for Dashboard, Workers, Live Feed, Reports, and Compliance are implemented within src/app. Real-time data is fetched using Axios or Fetch API, and UI state management is handled via Redux Toolkit or React Query for efficient data handling.

6.3 Backend Development and API Implementation

The backend is implemented using Node.js (Express.js) or Python (Django/Flask), depending on system requirements. It handles API request processing, authentication, business logic, and database interactions. RESTful or GraphQL-based API endpoints are designed for structured data exchange, ensuring secure, efficient, and scalable communication. JWT (JSON Web Token) or OAuth 2.0 is used for user authentication, while rate-limiting and caching mechanisms (Redis) enhance performance. WebSockets (Socket.io) facilitate real-time communication for instant updates.

6.4 Database Design and Optimization

The system employs a hybrid database approach:

- Relational Database (PostgreSQL/MySQL) for structured data like project details, worker logs, financial records.
- NoSQL Database (MongoDB) for unstructured data like sensor logs, images, video feeds, and activity logs.
- Time-Series Database (InfluxDB) for real-time environmental and sensor data. To improve query efficiency, the system utilizes database indexing, partitioning, materialized views, and Redis-based caching. Data integrity and consistency are ensured using ACID-compliant transactions.

6.5 Real-Time Data Streaming and WebSockets

Real-time data streaming is achieved using WebSockets (Socket.io) and MQTT messaging protocols for low-latency updates. Live data updates enable instant tracking of worker locations, equipment usage, safety alerts, and environmental conditions. A publish-subscribe architecture ensures seamless communication between different system modules, preventing unnecessary API polling and reducing network overhead.

6.6 Role-Based Access Control (RBAC) and Authentication

Role-based access ensures data security and operational efficiency. User roles include Admin, Project Manager, Supervisor, Worker, and Client, each with different permission levels. Authentication is handled via JWT/OAuth 2.0, ensuring secure login sessions. Multi-factor authentication (MFA) adds an additional layer of security. The src/auth module manages user registration, password hashing (bcrypt/Argon2), and session handling.

6.7 AI-Powered Predictive Analytics for Project Optimization

AI-driven analytics enable proactive risk mitigation and performance forecasting. Machine Learning models analyze historical and real-time data to predict project delays, safety incidents, and cost overruns. AI-based computer vision detects helmet compliance, worker movement, and unauthorized access from live CCTV feeds. The system uses TensorFlow/PyTorch for training and deploying models that predict weather disruptions, supply chain issues, and material shortages, ensuring better planning and risk management.

6.8 Financial and Budget Tracking Module

The financial module integrates with ERP and accounting software (SAP, QuickBooks, Zoho Books) to track budget allocations, expenditures, and cost overruns. Expenses are categorized into labor, materials, equipment, and overheads, with AI-driven anomaly detection flagging suspicious transactions or cost escalations. The system visualizes financial data using Recharts/D3.js, allowing stakeholders to monitor budget trends and financial health in real-time.

6.9 Automated Reporting and Insights Generation

Automated reporting ensures efficient data-driven decision-making. The system generates reports on project progress, safety incidents, financial metrics, and resource utilization. Reports are available in PDF, Excel, and cloud-based formats, with scheduled CRON jobs automating weekly/monthly report generation. AI-powered Natural Language Processing (NLP) extracts key insights, providing actionable intelligence.

6.10 GIS and GPS-Based Worker & Equipment Tracking

The system integrates GPS and GIS (Geographic Information System) technologies to track workers, vehicles, and machinery in real-time. RFID/NFC-based tracking enhances automated inventory management, reducing errors. Workers log attendance using a mobile app with geofencing, ensuring accurate tracking of work hours. GIS mapping enables route optimization for material deliveries, improving supply chain efficiency.

6.11 Gantt Chart and Schedule Management System

The system includes a dynamic Gantt chart module for visualizing project timelines, dependencies, and task progress. AI-based scheduling models suggest alternative workflows and schedule adjustments to prevent delays due to unforeseen disruptions. Drag-and-drop task allocation, real-time progress tracking, and milestone-based alerts improve task coordination and efficiency.

6.12 Cloud-Based Deployment and CI/CD Pipeline

The system is deployed on cloud platforms like AWS, Azure, or Google Cloud for high availability. Docker and Kubernetes handle microservice orchestration, while CI/CD pipelines (GitHub Actions, Jenkins, GitLab CI/CD) automate testing, building, and deployment. Infrastructure as Code (IaC) tools like Terraform or AWS CloudFormation ensure seamless cloud provisioning and scaling.

6.13 Integration with Third-Party Project Management Tools

The system connects with Jira, Trello, Asana, and Microsoft Project, allowing users to import tasks, sync schedules, and track issues. Webhooks enable real-time updates between the construction dashboard and external tools, ensuring a unified project management ecosystem.

6.14 AI-Powered Chatbot for Automated Queries and Support

An AI-powered chatbot (leveraging OpenAI/GPT or Dialogflow) assists users with queries related to project status, worker safety, material availability, and financial reports. The chatbot integrates with natural language understanding (NLU) models, allowing human-like interactions. It reduces communication overhead, enhances accessibility, and provides instant data-driven insights.

6.15 Blockchain for Data Integrity and Smart Contracts

To enhance transparency and security, the system incorporates blockchain technology for immutable project logs and secure transactions. Smart contracts automate supplier agreements, worker payments, and compliance verifications, reducing disputes and fraud risks. The blockchain ledger ensures tamper-proof documentation of project milestones and transactions.

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT

(GANTT CHART)

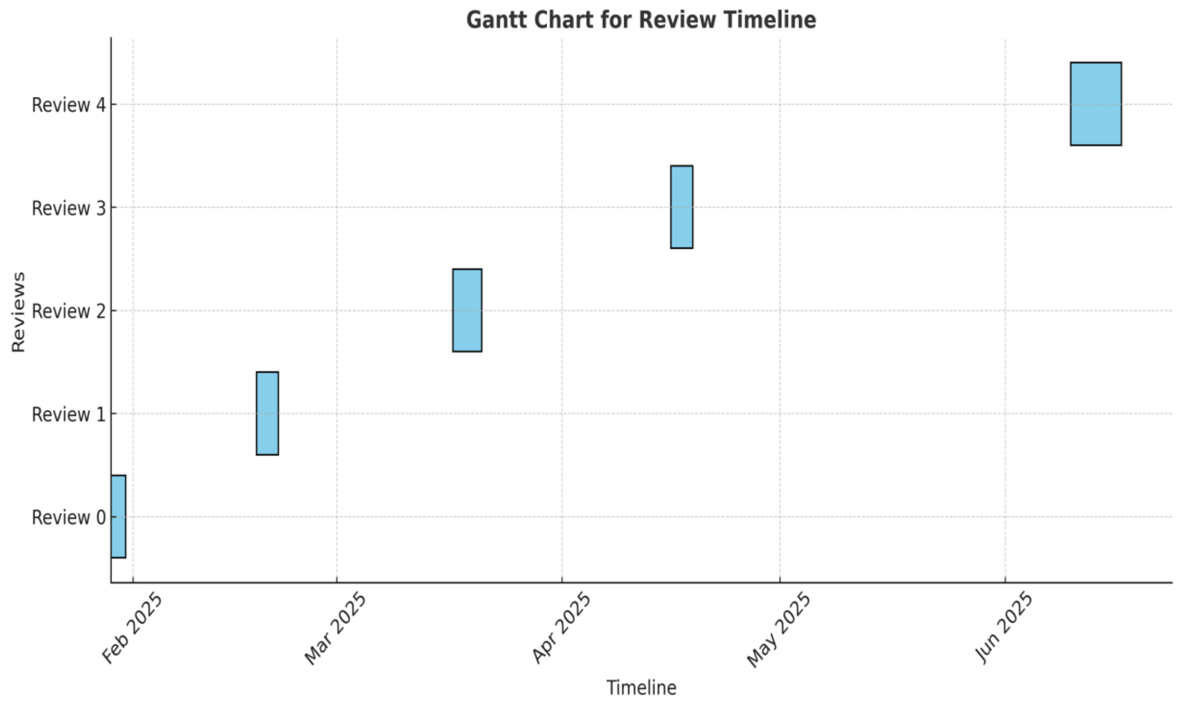

Figure 7.1: Timeline For Execution of Project

The Figure 7.1 "TimeLine" bar graph illustrates the progressive growth of a project across five review stages. Completion of 15% in Review 0, the project steadily advances to 25% in Review 1, 50 % in Review 2, 75% in Review 3, and ultimately reaches 100% in Review 4. This consistent upward trend indicates continuous improvement and successful development milestones throughout the project's lifecycle.

CHAPTER-8

OUTCOMES

8.1 Live View of Project Progress:

One of the biggest benefits of our system is that it gives everyone- managers, workers, and clients- a clear, real-time view of what's happening on the construction site. You don't need to wait for reports. If something is delayed or not going as planned, the dashboard shows it immediately, so you can take action right away and keep things on schedule.

8.2 Safer Workplaces:

Construction sites can be risky, but our system helps make them safer. It uses sensors and AI to check if workers are wearing safety gear, if there's too much dust or noise, or if something dangerous is happening. If a problem is found, the system sends an alert to supervisors, so they can fix it quickly. This helps reduce accidents and keeps everyone safe.

8.3 Better Use of People and Materials:

Instead of guessing how many workers or materials are needed, the dashboard tracks everything in real time. If there's too much or too little of something, it suggests changes. This avoids waste, saves money, and makes sure resources are used properly.

8.4 Fewer Delays Through Prediction:

Unexpected issues like bad weather or material shortages can delay a project. Our system uses AI to predict these kinds of problems in advance. It checks data and gives early warnings, helping managers take preventive steps before delays happen.

8.5 Keeping the Budget Under Control:

We included tools to track expenses live. You can immediately see how much money has been spent versus what was planned. If costs start going too high, the system highlights it. This helps keep the project within budget and avoids last-minute financial surprises.

8.6 Smooth and Fast Communication:

In big projects, miscommunication causes major delays. Our dashboard sends instant updates to the right people based on their role—managers, workers, or clients. Everyone stays on the same page, which improves teamwork and speeds up decision-making.

8.7 Stronger Data Protection:

Construction projects involve important data—like budgets, worker details, and safety logs. We used secure login systems and blockchain to protect this data. It keeps everything safe from tampering or unauthorized access, building trust with all stakeholders.

8.9 Smarter Decisions Using AI:

Managers don’t have to rely only on experience or gut feeling. Our system uses AI to analyze data and suggest the best actions. For example, if a delay is likely, it might recommend adjusting schedules or resources. This helps in making better, faster decisions.

8.10 Built to Grow with Future Needs:

As construction becomes more high-tech, the system is ready for it. It’s designed to scale up and support future tools like Digital Twins, Augmented Reality, and Virtual Reality. So, even if the project gets bigger or more complex, the system will keep up.

8.11 Eco-Friendly and Sustainable Construction:

The system also supports environmentally conscious construction practices. By monitoring things like electricity usage, material waste, and noise levels, it helps ensure the site follows green building standards. The dashboard also suggests ways to save energy and reduce pollution, which is good for both the environment and the company’s public image.

CHAPTER-9

RESULTS AND DISCUSSIONS

1. Increased Project Transparency

The real-time monitoring dashboard greatly improved project visibility, offering stakeholders a unified view of progress, milestone completion, and resource allocation. This led to faster decision-making and quicker interventions while ensuring greater accountability across all levels.

Discussion: Real-time tracking helps in immediate troubleshooting, especially for schedule deviations and budget inconsistencies. This is crucial in construction, where delays can lead to significant financial losses.

2. Advanced Safety Monitoring

The use of IoT sensors and AI-driven surveillance improved worker safety standards by detecting hazards such as air quality issues, excessive noise, and fire risks. This led to a significant reduction in accidents on-site.

Discussion: Real-time safety alerts allow for proactive intervention, preventing injuries and ensuring compliance with safety protocols, which is a top priority in the construction industry.

3. Optimized Resource Utilization

The dashboard's real-time tracking ensured efficient allocation of labor, equipment, and materials, reducing wastage and inefficiencies.

Discussion: Optimized resource usage resulted in cost savings and improved project efficiency, allowing managers to make data-driven decisions that directly impacted profitability.

4. Predictive Analytics for Risk Management

The integration of machine learning algorithms enabled early detection of potential project risks, such as delays, cost overruns, and resource shortages.

Discussion: Predictive analytics allowed managers to anticipate challenges and take preventive measures, ensuring that projects stayed on schedule and within budget.

5. Real-Time Decision Making

With live data access, stakeholders could make informed decisions faster, reducing delays in project execution.

Discussion: Unlike traditional reporting methods, real-time insights enhanced coordination across teams and improved response times, preventing bottlenecks.

6. Improved Collaboration and Communication

Role-based access and centralized communication features enhanced teamwork by ensuring that relevant information reached the right personnel.

Discussion: Better synchronization reduced miscommunications and improved workflow efficiency, even when stakeholders operated from different locations.

7. Automated Reporting

Eliminating manual data entry, the system's automated reporting generated real-time insights via interactive dashboards.

Discussion: Automation saved time, allowing managers to focus on execution rather than paperwork, while ensuring accurate and timely reporting.

8. Reduced Project Delays

AI-driven scheduling helped adjust timelines dynamically, mitigating the impact of unexpected disruptions.

Discussion: Construction projects often experience delays. The ability to reschedule in real-time improved project predictability, leading to higher client satisfaction.

9. Financial Oversight and Budget Management

Continuous tracking of real-time expenditures against the planned budget enabled early detection of financial discrepancies.

Discussion: The dashboard's financial tracking helped managers control costs, ensuring that resources were allocated efficiently to prevent budget overruns.

10. Enhanced Quality Control

Real-time monitoring allowed for immediate detection of material defects and construction errors, ensuring better quality assurance.

Discussion: Identifying defects early reduced rework costs and improved project reliability, leading to higher construction standards.

11. Compliance and Regulatory Adherence

Automated compliance tracking ensured that projects followed local building codes, labor laws, and safety regulations.

Discussion: Regulatory compliance is crucial in construction. Real-time monitoring helped prevent legal issues, fines, and work stoppages.

12. Sustainable and Eco-Friendly Practices

The dashboard helped track energy consumption, material waste, and recycling efforts, promoting sustainability in construction.

Discussion: Monitoring eco-friendly metrics ensured projects reduced their carbon footprint, aligning with green building standards and enhancing corporate reputation.

13. Efficient Workforce and Equipment Allocation

By integrating sensor data and project management tools, the system ensured that labor and equipment were deployed effectively.

Discussion: Proper allocation minimized overstaffing or underutilization, leading to cost savings and optimized efficiency.

14. Increased Client Satisfaction

Clients benefited from real-time access to progress updates, safety reports, and budget tracking, ensuring transparency.

Discussion: Improved transparency fostered trust and better client relationships, reducing the need for frequent site visits.

15. Scalable and Adaptive System

The cloud-based architecture allowed for seamless scalability, making it easy to manage multiple projects simultaneously.

Discussion: The system's flexibility ensured that it could adapt to changing project needs, allowing for long-term growth and efficient multi-site management.

CHAPTER-10
CONCLUSION

The implementation of the **Real-Time Monitoring Dashboard for Construction Projects** has significantly enhanced construction site management by integrating advanced data analytics, IoT-driven tracking, and AI-based insights. This centralized and interactive platform allows stakeholders to monitor project progress, optimize resource utilization, ensure safety compliance, and maintain budgetary control in real time. The system has transformed traditional project management by improving operational efficiency, reducing communication gaps, and fostering transparency in decision-making.

One of the most impactful features of this dashboard is real-time safety tracking, made possible through IoT-enabled sensors and AI-driven surveillance. Instant alerts assist in mitigating hazards, reducing workplace accidents, and ensuring compliance with stringent safety regulations. Additionally, predictive analytics plays a crucial role in risk assessment and proactive decision-making, preventing project delays and budget overruns. The dashboard also optimizes resource allocation, ensuring that labor, materials, and equipment are efficiently utilized, thereby minimizing wastage and enhancing cost-effectiveness.

Beyond improving project efficiency, the system also promotes sustainability by monitoring energy consumption, material wastage, and carbon emissions. These insights help construction firms adopt eco-friendly and responsible building practices. The cloud-based architecture of the dashboard ensures its scalability, making it adaptable to various construction projects across multiple locations, regardless of scale or complexity.

The success of this project highlights the growing importance of real-time data and automation in the construction industry. By leveraging smart monitoring systems, predictive analytics, and cloud-based technologies, this dashboard paves the way for safer, more efficient, and environmentally sustainable construction management in the modern era.

Furthermore, the implementation of such a system fosters a culture of accountability and collaboration among project stakeholders. With data being accessible in real time, coordination between architects, engineers, contractors, and clients becomes more streamlined, enabling quicker responses to emerging issues and aligning everyone with project goals. This level of integration also simplifies documentation and reporting, saving time and reducing human error in administrative tasks.

Looking ahead, the potential of incorporating emerging technologies such as digital twins, blockchain for secure data exchange, and advanced machine learning algorithms could further revolutionize real-time construction monitoring. These advancements can enhance the precision, security, and reliability of the dashboard, offering even deeper insights and more robust project control mechanisms.

In addition to enhancing transparency and operational efficiency, the dashboard empowers stakeholders to collaborate more effectively by offering real-time visibility into site activities, safety status, financial metrics, and resource usage. With its user-friendly interface and live updates, the system reduces reliance on manual communication and paperwork, allowing faster issue resolution and streamlined workflows.

The modular, cloud-based architecture ensures the platform is scalable and adaptable to diverse project requirements. Whether it is a single-site residential build or a multi-site infrastructure development, the dashboard can be customized and expanded to meet specific needs. Its seamless integration with edge computing and real-time data streaming protocols like WebSockets and MQTT minimizes latency, ensuring uninterrupted flow of critical information.

Furthermore, features like AI-powered predictive analytics, automated reporting, and intelligent resource allocation contribute to data-driven decision-making. This helps mitigate risks, control costs, and avoid project delays. By simulating various construction scenarios through digital twin technology, project managers can proactively identify bottlenecks and optimize schedules before execution.

The successful development and deployment of this system demonstrates how modern technologies can effectively address the long-standing challenges in construction project management. It stands as a testament to the transformative impact of real-time monitoring, intelligent automation, and integrated digital platforms in shaping the future of the construction industry. As the sector continues to evolve, systems like this will become indispensable tools for ensuring quality, safety, speed, and efficiency on construction sites.

In conclusion, the Real-Time Monitoring Dashboard not only addresses existing challenges in construction management but also sets a new benchmark for future innovation. It demonstrates how digital transformation can be harnessed to achieve superior outcomes in safety, efficiency, and sustainability—an essential step forward for the evolving construction industry.

REFERENCES

[1] J. Wang, T. Luo, and Y. Zhang, "AI-based predictive analytics for construction site safety using real-time monitoring data," Journal of Construction Engineering and Management, vol. 150, no. 2, 2024.

[2] F. Ali, "Real-time dashboard analytics using AI for infrastructure monitoring in high-rise construction," IEEE Access, vol. 11, pp. 25897–25910, 2023.

[3] R. Sharma and A. Mishra, "Application of IoT and GIS in Real-Time Construction Management," *International Journal of Engineering Research & Technology*, vol. 9, no. 6, pp. 324–329, 2020.

[4] Y. Zhang and L. Gao, "Interactive Dashboards for Monitoring Construction KPIs," *Journal of Construction Engineering and Management*, vol. 146, no. 8, p. 04020083, 2020.

[5] H. Li and H. Zhou, "Cloud-Based Construction Monitoring with Integrated GIS and Dashboards," *International Journal of Construction Management*, vol. 19, no. 5, pp. 411–421, 2019.

[6] J. C. Cheng and S. Kumar, "BIM-based real-time construction progress monitoring using sensors and AI," *Automation in Construction*, vol. 110, p. 103041, 2020.

[7] S. Ghosh, R. Sahu, and S. Mahapatra, "Smart construction site management using IoT," *International Journal of Construction Management*, vol. 22, no. 2, pp. 123–137, 2020.

[8] Y. Gamil and I. A. Rahman, "Digital transformation and sustainable construction industry: A review," *Environmental Technology & Innovation*, vol. 20, p. 101111, 2020.

[9] A. Ozturk and B. Akinci, "Integrating real-time data from construction sites into project management dashboards," *Automation in Construction*, vol. 119, p. 103345, 2020.

[10] M. Marzouk and M. Hisham, "BIM-based approach for automation of operation and maintenance in buildings using IoT," *Journal of Building Engineering*, vol. 26, p. 100907, 2019.

[11] M. S. Fathi, C. J. Anumba, and P. M. Carrillo, "Smart and sustainable construction management: A review of trends and practices," *IEEE Systems Journal*, vol. 6, no. 3, pp. 429–437, 2012.

[12] L. Deng, X. Yu, and C. Wu, "Digital Twin-driven smart construction: Framework, applications, and future perspectives," *Automation in Construction*, vol. 142, p. 104556, 2023.

[13] N. Patel and M. Kumar, "Integration of BIM and IoT for real-time project monitoring in smart cities," *Smart Infrastructure and Construction*, vol. 4, no. 1, pp. 1–12, 2022.

[14] S. Lee and H. Kim, "Machine learning for progress tracking in modular construction using drone imagery," *Automation in Construction*, vol. 135, p. 104121, 2022.

[15] F. Ali, "Real-time dashboard analytics using AI for infrastructure monitoring in high-rise construction," *IEEE Access*, vol. 11, pp. 25897–25910, 2023.

[16] R. Sacks, M. Girolami, and I. Brilakis, "Building Information Modeling, Artificial Intelligence, and Construction Tech," Annual Review of Civil Engineering, vol. 2, pp. 99–122, 2020.

[17] D. Li, J. Zhao, and Q. Wu, "Real-time construction safety management using BIM and wearable IoT devices," Automation in Construction, vol. 124, p. 103588, 2021.
[18] A. Kumar and V. Bansal, "AI-driven decision support system for real-time construction monitoring," Journal of Computing in Civil Engineering, vol. 36, no. 4, p. 04022045, 2022.

[19] L. Nguyen, K. Lee, and J. Park, "Cloud-integrated BIM and IoT for smart construction site monitoring," Journal of Construction Engineering and Management, vol. 149, no. 2, p. 04023010, 2023.

[20] S. Mehta and R. Patel, "A digital twin framework for live construction site tracking using drone and IoT data," Journal of Building Engineering, vol. 66, p. 105938, 2024.

[21] X. Lin, Y. Luo, and H. Chen, "A Digital Twin Approach for Real-Time Monitoring and Simulation of Construction Processes," Automation in Construction, vol. 136, p. 104132, 2022.

[22] A. Gupta and V. Singh, "Smart Construction Management Using Real-Time Data and Edge Computing," IEEE Transactions on Industrial Informatics, vol. 19, no. 1, pp. 88–97, Jan. 2023.

[23] T. Zhang, M. Lu, and J. Wang, "AI-Enabled Decision Support System for Construction Progress Monitoring Using Video Analytics," Journal of Computing in Civil Engineering, vol. 37, no. 3, p. 04023018, 2023.

[24] K. Alami, L. Bourchak, and N. Benameur, "IoT and BIM Integration for Efficient Construction Monitoring: A Case Study Approach," International Journal of Construction Management, vol. 24, no. 2, pp. 140–150, 2024.

[25] R. Fernandes and P. Ribeiro, "Cloud-Based Dashboards for Real-Time Construction Site Visualization," Journal of Information Technology in Construction (ITcon), vol. 29, pp. 12–28, 2024.

APPENDIX-A

PSUEDOCODE

1. Admin Login:

```
FUNCTION login(username, password):
   FETCH stored_user_data
   IF username EXISTS in stored_user_data AND password MATCHES:
      RETURN "Login Successful"
   ELSE:
      RETURN "Login Failed"
         END FUNCTION
```

2. Live Tracking:

```
         FUNCTION show_map():
            INITIALIZE folium map with default location and zoom
            FOR EACH construction_site IN site_data:
               ADD marker to map with site name and location
            DISPLAY map in application
         END FUNCTION

FUNCTION get_location_data():
   FETCH latitude and longitude for all sites
   RETURN formatted list of locations
         END FUNCTION
```

3. Data Entry Form:

```
FUNCTION open_data_entry_form():
    DISPLAY form fields: Project Name, Location, Status, Start Date, End Date
    WAIT for user to input all required fields
    ON submit:
        VALIDATE all inputs
        IF validation passes:
            STORE data in local database or file
            SHOW success message
        ELSE:
            SHOW error message
            END FUNCTION
```

4. Database Handling:

```
FUNCTION save_project_data(project_data):
    CONNECT to SQLite database
    EXECUTE INSERT query with project_data
    COMMIT changes
    CLOSE connection
END FUNCTION
```

```
FUNCTION fetch_all_projects():
    CONNECT to SQLite database
    EXECUTE SELECT query to fetch all project records
    STORE result in variable
    CLOSE connection
    RETURN result
END FUNCTION
```

5. User Interface Navigation:

```
FUNCTION show_home_screen():
    HIDE all other screens
    DISPLAY home layout with navigation buttons
END FUNCTION

FUNCTION show_form_screen():
    HIDE all other screens
    DISPLAY data entry form layout
END FUNCTION

FUNCTION show_map_screen():
    HIDE all other screens
    DISPLAY map with site markers
END FUNCTION


FUNCTION on_navigation_button_click(destination):
    IF destination == "Form":
        CALL show_form_screen()
    ELSE IF destination == "Map":
        CALL show_map_screen()
    ELSE:
        CALL show_home_screen()
END FUNCTION
```

6. Logout Function:

```
FUNCTION logout():
    CLEAR user session or authentication token
    REDIRECT to login screen
    SHOW "Logged out successfully" message
END FUNCTION
```

APPENDIX-B

SCREENSHOTS

SCREENSHOT 1:

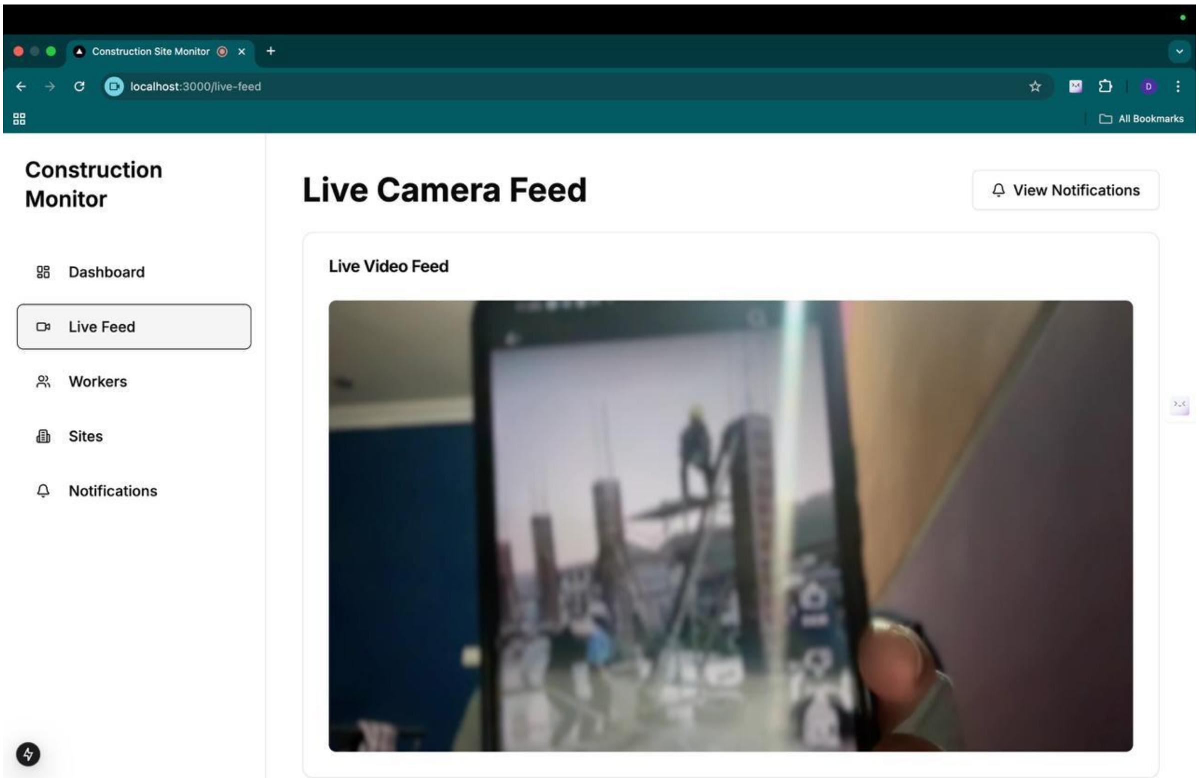

Figure B.1: Live Camera Feed

This Figure B.1 demonstrates the integration of a live camera feed into the real-time monitoring dashboard. The live video allows stakeholders to visually inspect on-site construction activities without being physically present. It enhances transparency, supports remote supervision, and helps in verifying whether tasks are progressing as scheduled. Such a feature is especially useful for managers, safety officers, and clients to track daily operations, ensure compliance with safety protocols, and immediately identify any irregularities or issues at the construction site.

SCREENSHOT 2:

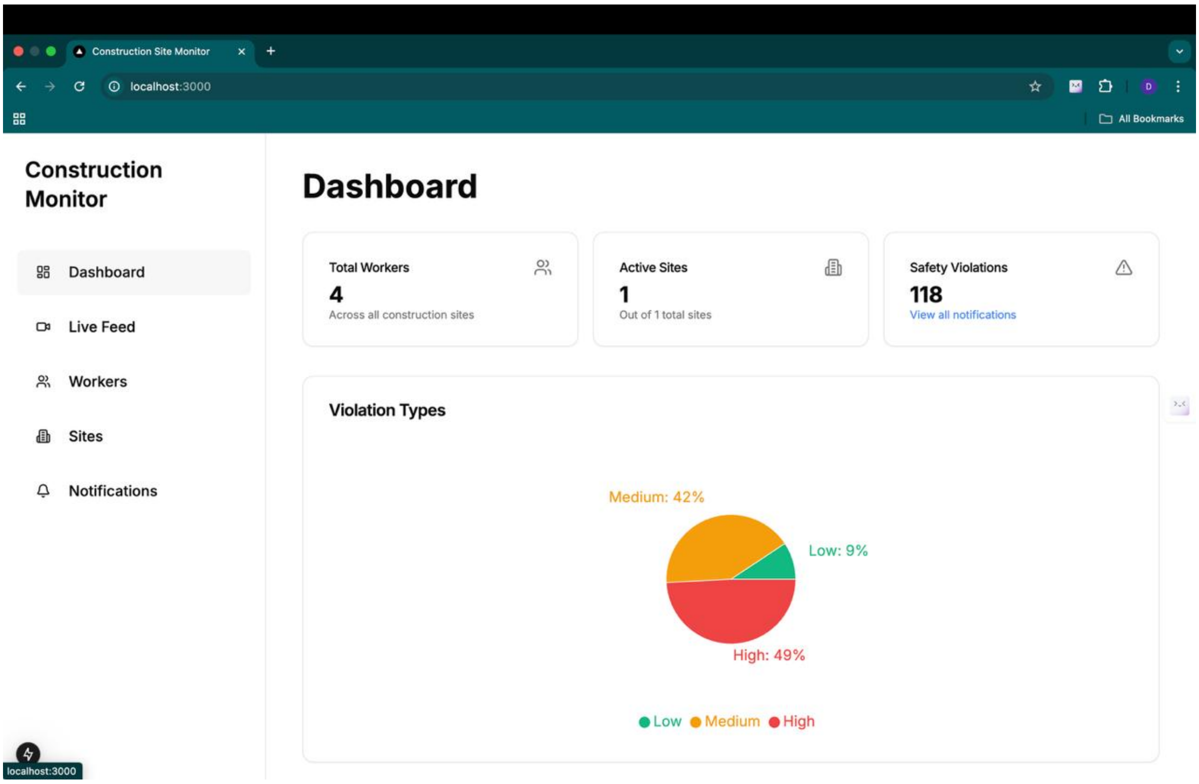

Figure B.2: Dashboard

This Figure B.2 showcases the dashboard's safety alert system, which actively monitors and flags potential hazards or safety violations on the construction site. Notifications are triggered when predefined safety parameters are breached — for example, missing safety gear, unsafe work zones, or overdue inspections. By providing immediate visual and textual alerts, the system enhances on-site safety, reduces the risk of accidents, and ensures compliance with occupational safety standards. This feature is critical for protecting workers and maintaining a secure construction environment.

SCREENSHOT 3:

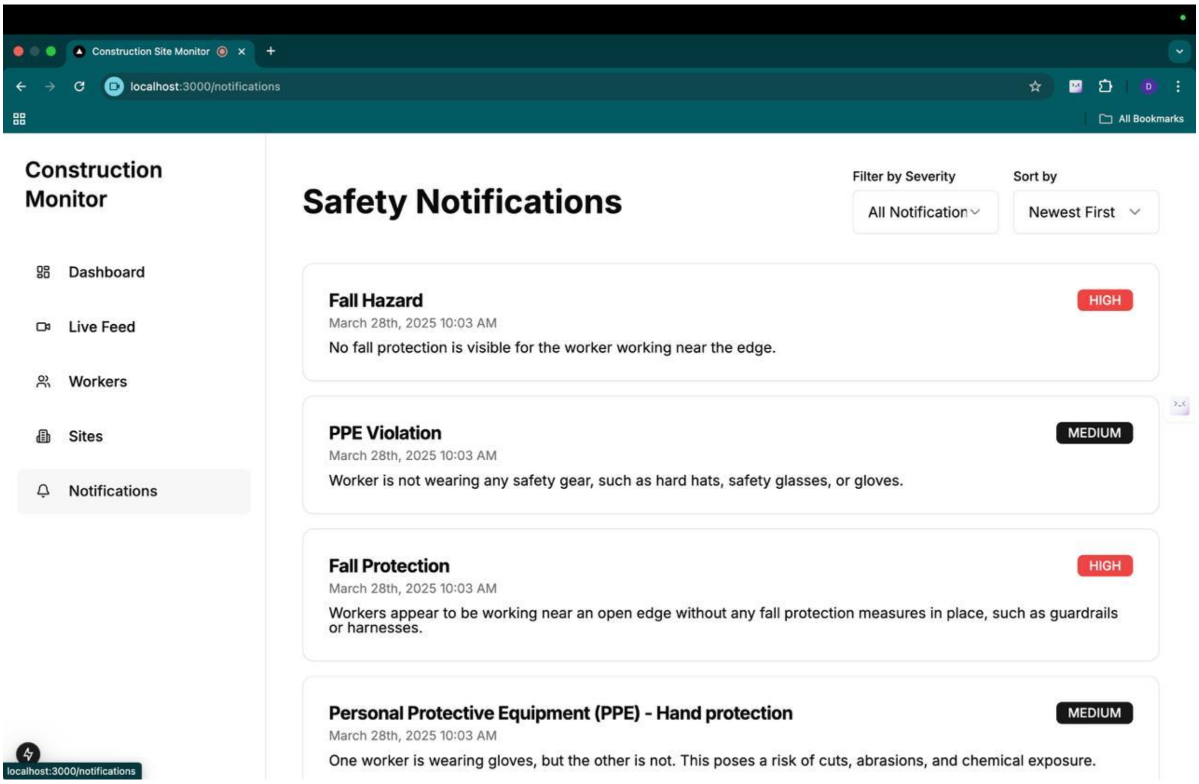

Figure B.3: Safety Notification

This Figure B.3 showcases the dashboard's safety alert system, which actively monitors and flags potential hazards or safety violations on the construction site. Notifications are triggered when predefined safety parameters are breached — for example, missing safety gear, unsafe work zones, or overdue inspections. By providing immediate visual and textual alerts, the system enhances on-site safety, reduces the risk of accidents, and ensures compliance with occupational safety standards. This feature is critical for protecting workers and maintaining a secure construction environment.

SCREEENSHOT 4:

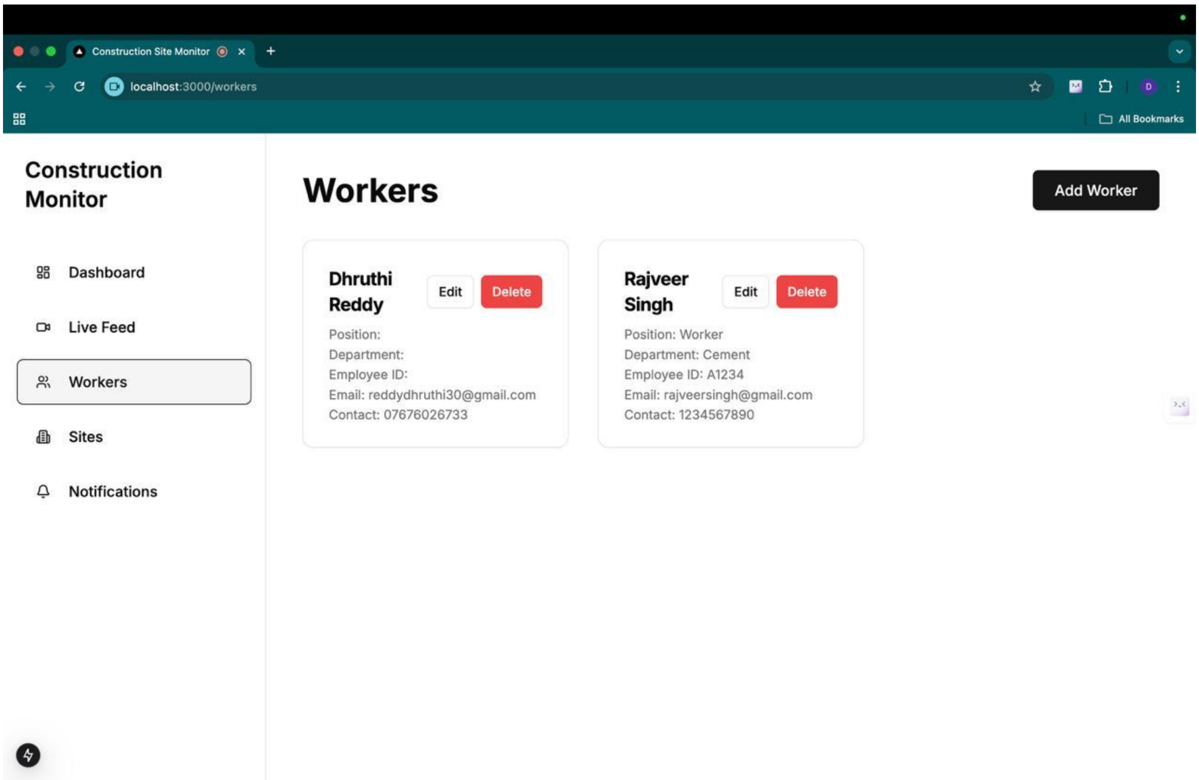

Figure B.4: Workers

This Figure B.4 highlights the dashboard's ability to monitor the construction workforce in real time. It displays information such as the number of workers on-site, their assigned tasks, and possibly attendance or shift details. This feature ensures efficient human resource management by allowing project managers to track manpower distribution, avoid overstaffing or understaffing, and ensure labor safety compliance. It also helps in identifying productivity patterns and deploying resources more effectively across project phases.

SCREENSHOT 5:

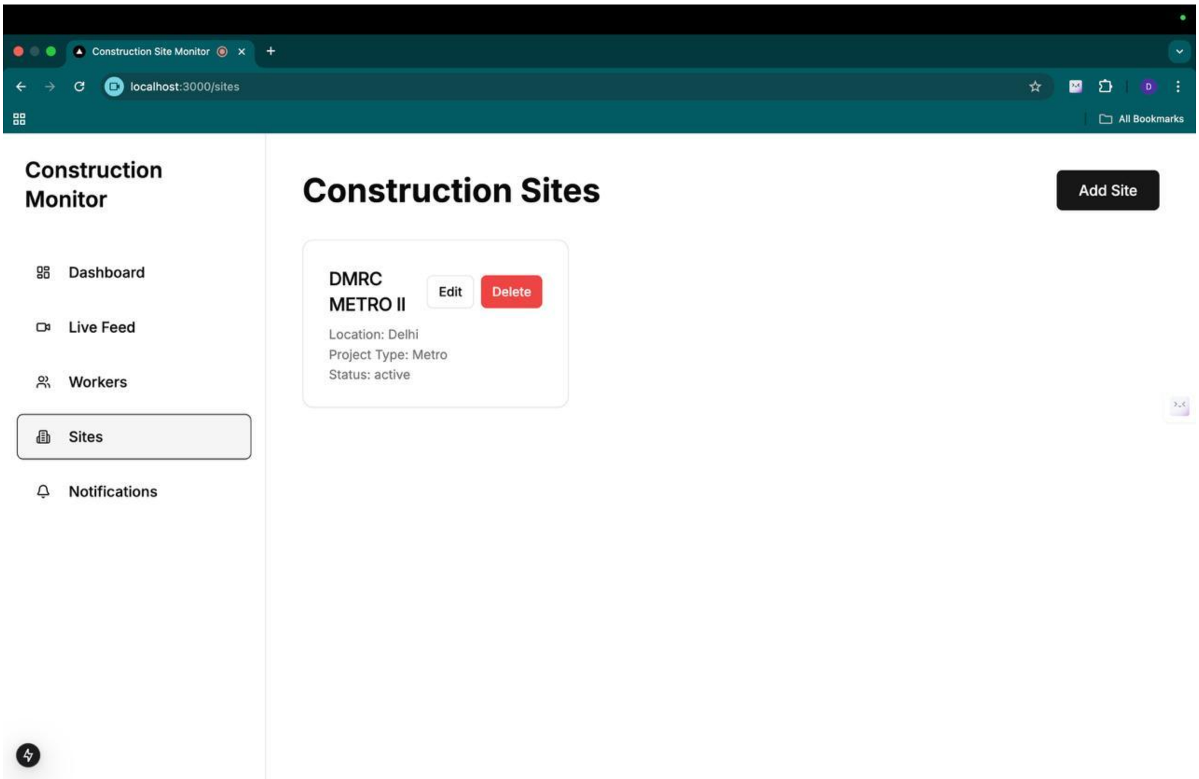

Figure B.5: Construction Sites

This Figure B.5 features a live or captured image from the construction site of the DMRC (Delhi Metro Rail Corporation) Metro Line 11 project. By integrating actual site visuals into the dashboard, the system provides enhanced transparency and situational awareness. Stakeholders can remotely verify work progress, site conditions, and adherence to safety standards without the need for physical site visits. This feature is especially valuable for large-scale infrastructure projects like metro construction, where real-time visual updates improve monitoring efficiency, accountability, and decision-making.

APPENDIX-C

ENCLOSURES

1. Journal publication Presented Certificates:


IJSREM e-Journal

ISSN: 2582-3930

ACCEPTANCE CERTIFICATE

Impact Factor: 8.586
DOI Prefix: 10.55041

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Dashboard For Real Time Monitoring Of Construction Projects

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Figure C.2: Certificate 2

Figure C.3: Certificate 3

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Figure C.4: Certificate 4

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3. Mapping of the project with Sustainable Development Goals:

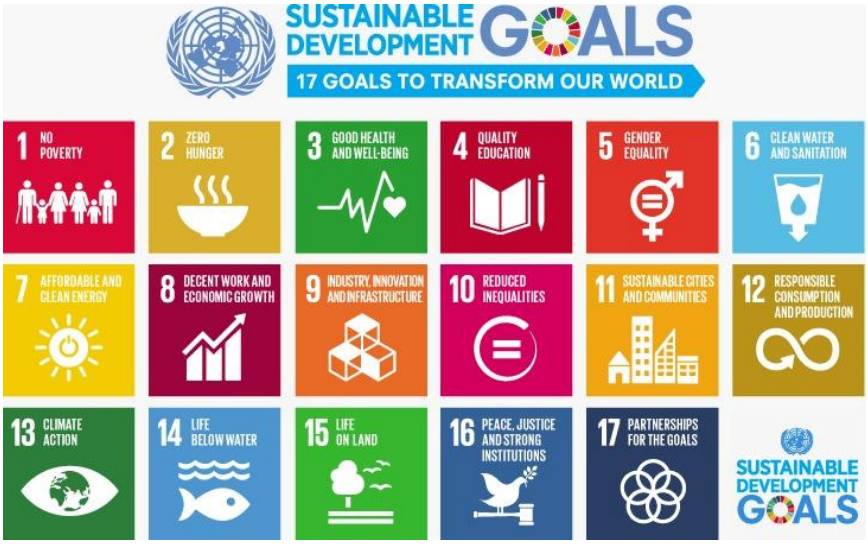

Figure C.1: SDG Goals

Details of Mapping the Project with the Sustainable Development Goals (SDGs).

Mapping **The Dashboard for Real-Time Monitoring of Construction Projects** to the Sustainable Development Goals (SDGs) helps in understanding the broader societal and global impacts that this project can create. The integration of real-time monitoring tools contributes to environmental protection, economic growth, and social well-being. Below is the detailed mapping:

SDG 9: Industry, Innovation and Infrastructure –

Goal: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

Relevance: Construction is a core part of infrastructure development.

Contribution: Your dashboard enhances the efficiency and quality of construction through real-time monitoring. Using digital tools like dashboards is a form of innovation that improves project delivery and reduces errors or delays. Promotes smart infrastructure through data-driven decision-making.

SDG 11: Sustainable Cities and Communities –

Goal: Make cities inclusive, safe, resilient, and sustainable.

Relevance: Cities rely on construction for housing, transport, and utilities. If managed poorly, construction can lead to unsafe environments and wasted resources.

Contribution: Your system encourages sustainability by tracking progress, reducing material waste, and ensuring safety. Helps urban planners and stakeholders monitor and complete eco-friendly construction projects.

SDG 12: Responsible Consumption and Production-

Goal: Ensure sustainable consumption and production patterns.

Relevance: Construction sites consume large amounts of materials, water, and energy. Improper planning leads to overuse or waste.

Contribution: Your dashboard can monitor and optimize material usage and reduce environmental impact. Promotes efficient project execution, which leads to reduced waste and better resource management.

SDG 13: Climate Action-

Goal: Take urgent action to combat climate change and its impacts.

Relevance: The construction industry is a major contributor to greenhouse gas emissions.

Contribution: Real-time data can help identify inefficiencies and high-carbon activities (e.g., excessive machinery usage), reducing energy consumption. Your system enables greener practices and supports policies aimed at carbon footprint reduction.

SDG 6: Clean Water and Sanitation-

Goal: Ensure availability and sustainable management of water and sanitation for all.

Relevance: Construction affects water quality through runoff and heavy usage.

Contribution: Your dashboard can track water consumption and pollution risks on site. Encourages water-efficient practices and waste management during the project lifecycle.

SDG 7: Affordable and Clean Energy-

Goal: Ensure access to affordable, reliable, sustainable, and modern energy for all.

Relevance: Monitoring systems can help track energy consumption across various construction phases.

Contribution: Promotes use of energy-efficient machinery and renewable alternatives when possible. Reduces dependency on fossil fuels through real-time optimization.

SDG 8: Decent Work and Economic Growth-

Goal: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.

Relevance: Construction employs millions globally. Real-time dashboards improve worker safety by detecting hazards quickly.

Contribution: Increases project efficiency, reducing costs and delays. Encourages better working environments and promotes fair practices through transparency and data tracking.