**Dashboard for monitoring of construction projects**

A Minor Project Report Submitted To

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Towards Partial Fulfilment for the Award Of

Bachelor of Technology

In

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

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Session: 2023-2024

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**DECLARATION**

We **Pankaj Shilpi, Riya Verma, Rohit Solanki, Sakshi Parmar and Vishal Tayde** hereby declare that the project entitled “**Dashboard for real-time monitoring of construction project**”, which is submitted by us for the partial fulfilment of the requirement for the award of Bachelor of Technology in Computer Science & Engineering to the Prestige Institute of Engineering, Management and Research, Indore (M.P.)*.* Rajiv Gandhi Proudhyogiki Vishwavidyalaya, Bhopal, comprises my own work and due acknowledgement has been made in text to all other material used**.**

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**DISSERTATION APPROVAL SHEET**

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This is certified that project entitled “**Dashboard for real-time monitoring of construction project**” submitted by **Pankaj Shilpi, Riya Verma, Rohit Solanki, Sakshi Parmar and Vishal Tayde** is a satisfactory account of the bona fide work done under our supervision and is recommended towards partial fulfilment for the award of the degree Bachelor of Technology in Electronics & Communication Engineering to Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal (M.P.) .

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**ACKNOWLEDGEMENT**

After the completion of Minor project work, words are not enough to express our feelings about all those who helped us to reach our goal; feeling above this is our indebtedness to the almighty for providing us this moment in life.

First and foremost, we take this opportunity to express our deep regards and heartfelt gratitude to our project guide **Prof. Sadhana Tiwari and Project Coordinator Dr.Ankit Soni, Department of Electronics and Communication Engineering, PIEMR, Indore** for their inspiring guidance and timely suggestions in carrying out our project successfully. They are also the constant source of inspiration for us. Working under their guidance has been an opportunity for us to learn more and more.

We are extremely thankful to **Dr.Mahendra Singh Thakur , (HOD,EC)** for his co-operation and motivation during the project. We extend our deepest gratitude to **Dr. Manojkumar Deshpande, Director, PIEMR, and Indore** for providing all the necessary facilities and true encouraging environment to bring out the best of our endeavour’s.

We would like to thank all the teachers of our department for providing invaluable support and motivation. We remain indebted to all the non-teaching staff of our Institute who has helped us immensely throughout the project.

We are also grateful to our friends and colleagues for their help and co-operation throughout this work. Last but not least; We thank our families for their support, patience, blessings and understanding while completing our project.

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**INDEX**

DECLARATION I

DISSERTATION APPROVAL SHEET II

CERTIFICATE III

ACKNOWLEDGEMENT IV

TABLE OF CONTENTS V

**TABLE OF CONTENTS**

# CHAPTER 1 INTRODUCTION...................................................................................1

1.1 Overview…………………………………………………………………….……..1

1.2 Motivation……………………………………………………….............................2

1.3 Objective…………………………………………………………………………...3

1.4 Application ………………………………………………………….......................4

# CHAPTER 2 LITERATURE SURVEY.......................................................................5

**CHAPTER 3 HARDWARE AND SOFTWARE USED**.............................................7.

3.1 Technical details of software used ........................................................................... 7

3.2 Technical details of hardware used ..........................................................................8

**CHAPTER 4 METHODOLOGY**...................................................................................10

**CHAPTER 5 RESULT**....................................................................................................14

# CHAPTER 6 CONCLUSION & FUTURE SCOPE....................................................15

3.1 Conclusion……………………………………………………….............................15

3.2 Future Scope………..................................………………………………………....16

**CHAPTER 7 REFERENCE**............................................................................................19

**CHAPTER 1**

**INTRODUCTION**

* 1. **OVERVIEW**

The construction industry plays a pivotal role in shaping the infrastructure landscape of nations worldwide. From towering skyscrapers to intricate road networks, every construction project represents a significant investment of resources, time, and effort. However, managing these projects efficiently and ensuring their timely completion within budgetary constraints is a formidable challenge faced by construction companies and project managers alike.

Traditionally, construction project monitoring has relied heavily on manual processes and disparate systems, leading to inefficiencies and delays in decision-making. Project managers often find themselves grappling with a multitude of tasks, from tracking attendance and monitoring safety compliance to ensuring the availability of raw materials and navigating through unpredictable weather conditions. In such a complex and dynamic environment, the need for a streamlined and integrated approach to project monitoring becomes increasingly apparent.

Recognizing these challenges, the concept of real-time monitoring through a comprehensive dashboard emerges as a promising solution. This dashboard serves as a centralized platform that aggregates and visualizes key project parameters, providing stakeholders with actionable insights to drive informed decision-making. By harnessing the power of data analytics and visualization technologies, construction companies can gain a holistic view of their projects' progress and performance, thereby enhancing their ability to proactively address issues and optimize resource allocation.

The scope of parameters monitored by the dashboard is extensive, reflecting the multifaceted nature of construction projects. Attendance status tracking ensures that manpower resources are effectively utilized, while real-time weather forecasts enable proactive planning to mitigate the impact of adverse weather conditions on project schedules. Monitoring air pollution levels helps safeguard the health and well-being of workers, while ensuring the availability of raw materials prevents disruptions to construction activities.

Moreover, safety remains a paramount concern in the construction industry, where adherence to safety regulations and protocols is critical to preventing accidents and ensuring worker welfare. By integrating safety compliance monitoring into the dashboard, project managers can identify potential hazards in real-time and implement corrective measures to maintain a safe working environment.

In addition to operational benefits, the implementation of a real-time monitoring dashboard holds the potential to drive broader strategic advantages for construction companies. By leveraging data-driven insights, companies can identify trends, patterns, and areas for improvement across projects, thereby enhancing overall organizational efficiency and competitiveness. Furthermore, the transparency and accountability fostered by real-time monitoring can enhance stakeholder trust and confidence, paving the way for stronger client relationships and future business opportunities.

* 1. **MOTIVATION**

The motivation behind developing a dashboard for real-time monitoring of construction projects stems from the need for enhanced project management efficiency and decision-making processes. Traditional methods of monitoring construction projects often involve manual tracking of various parameters, leading to inefficiencies and delays in identifying issues. By creating a centralized platform to monitor parameters such as attendance status, weather forecast, air pollution levels, raw material availability, and safety conditions in real-time, this dashboard aims to streamline project management processes. It will empower project managers and stakeholders with timely insights, enabling them to make informed decisions, mitigate risks, and ensure the successful completion of construction projects within budget and schedule constraints.

* 1. **OBJECTIVE**

The primary objective of developing a dashboard for real-time monitoring of construction projects is to enhance project management efficiency and decision-making processes. Specifically, the dashboard aims to:

1. Real time monitoring system for construction site based on IOT and ML.

2.Provide a centralized platform for monitoring various parameters critical to construction project success, including attendance status, weather forecast, air pollution levels, raw material availability, and safety compliance.

3.Enable stakeholders to access timely and actionable insights through data visualization, facilitating proactive decision-making and issue resolution.

4.Streamline project monitoring processes by automating data collection, analysis, and reporting, reducing reliance on manual methods and improving operational efficiency.

5.Enhance project transparency and accountability by fostering greater visibility into project progress, performance, and risk factors.

Overall, the objective of the dashboard is to empower construction companies and project managers with the tools and information needed to effectively navigate the complexities of construction project management, ultimately ensuring the successful and timely completion of projects within budgetary constraints.

* 1. **APPLICATION**

1. Real-time progress tracking: The dashboard can provide live updates on the progress of various construction activities, allowing project managers and stakeholders to monitor and track the status of each task.

2. Resource management: The dashboard can help manage and optimize resources such as labor, equipment, and materials by providing real-time data on their availability, usage, and allocation.

3. Risk assessment and mitigation: The dashboard can analyze data from different sensors and systems to identify potential risks or safety hazards on the construction site, enabling proactive measures to be taken for risk mitigation.

4. Communication and collaboration: The dashboard can serve as a centralized platform for communication and collaboration among project team members, allowing them to share updates, documents, and messages in real-time.

5. Quality control: The dashboard can integrate data from quality control inspections and tests, providing insights into the quality of work being performed and helping to ensure that construction standards are met.

6. Environmental monitoring: The dashboard can include environmental sensors to monitor factors such as air quality, noise levels, and dust emissions, promoting sustainable practices and ensuring compliance with environmental regulations.

7. Reporting and analytics: The dashboard can generate comprehensive reports and analytics based on the collected data, offering valuable insights into project performance, productivity, and efficiency.

**CHAPTER 2**

**LITERATURE SURVEY**

Construction projects are complex endeavours that require efficient management of resources, adherence to schedules, and prioritization of safety. Traditional methods of monitoring these projects often rely on manual data collection and reporting, leading to delays and discrepancies. This literature review explores the potential of real-time dashboards for improved construction project monitoring, focusing on the integration of features like attendance, weather, air quality, material tracking, and safety compliance.

Real-Time Monitoring and Construction Projects:

Benefits: Studies by [1] (Sitemate, 2023) and [2] (Acxtron, 2023) highlight the advantages of real-time data in construction projects. These include improved decision-making, enhanced transparency, better resource allocation, and streamlined communication.

Data Acquisition: The integration of Internet of Things (IoT) devices is crucial for real-time data collection. These devices can track worker location and activity for attendance purposes

Dashboard Features for Improved Monitoring:

Attendance Tracking: Real-time dashboards can display worker attendance data through integrations with biometric systems or wearables. This facilitates payroll management and resource allocation.

Weather Monitoring: Integration with weather APIs allows for displaying weather forecasts on the dashboard. This information is crucial for planning outdoor activities and mitigating weather-related delays (as emphasized in [1] (Sitemate, 2023)).

Air Quality Monitoring: Construction activities can contribute to air pollution. Real-time air quality data displayed on the dashboard can help ensure worker safety and compliance with environmental regulations.

Raw Material Tracking: RFID tags or barcode scanners can track raw materials, providing insights into inventory levels, consumption rates, and potential shortages.

Safety Equipment Monitoring: Sensor-equipped wearables or badges can track whether workers are wearing necessary safety gear, promoting a proactive safety culture on the construction site

**CHAPTER 3**

**HARDWARE AND SOFTWARE USED**

**3.1 TECHNICAL DETAILS OF SOFTWARE USED**

The software used in this project :

Frontend Development:

The frontend technologies used for building the dashboard interface. This could include:

Framework: React.js, Angular, Vue.js

UI Libraries: Bootstrap

Backend Development:

The backend technologies used in data processing, storage, and server-side logic:

Programming Languages: Python, Node.js, Java

Web Frameworks: Django, Express.js

Database Management System: MySQL, MongoDB

API Integration: RESTful API

The integration of various parameters monitored:

Attendance Status: RFID, Biometric Scanners

Weather Forecast: Integration with weather APIs

Air Quality: Sensors and IoT devices

Raw Material Availability: Supply chain APIs, Inventory Management Systems

Safety of Workers: Wearables, IoT sensors, Video Surveillance

Project Management: Git, GitHub

**3.2 TECHNICAL DETAILS OF HARDWARE USED**

Details about the hardware components used to gather and transmit data. Here’s a structured approach :

Sensors and Data Collection Devices:

The types of sensors used for monitoring various parameters such as:

Attendance Status of Workers: RFID scanners, biometric devices

Weather Forecast: Weather stations, temperature and humidity sensors

Air Quality: Air quality sensors (PM2.5, PM10, VOCs)

Raw Material Availability: RFID or barcode scanners for inventory management

Safety of Workers: Wearable devices (e.g., smart helmets for fall detection)

Communication Infrastructure:

The data from sensors are transmitted to the dashboard:

Local Communication: Wi-Fi, Bluetooth

Wide-Area Communication: Cellular networks (3G/4G/5G) for remote sites

Gateway Devices: IoT gateways for data aggregation and transmission

Data Storage and Processing:

Cloud Services: AWS, Google Cloud for scalable storage and computation

On-Site Servers: Local servers or edge computing devices for real-time analytics

Visualization and User Interface:

Outline the hardware components used for displaying the dashboard:

Display Screens: Monitors or digital display boards at project sites

Control Devices: PCs, tablets, or smartphones used to access the dashboard

Input Devices: Touchscreens or keyboards for user interaction

Power Supply and Backup:

Power requirements and backup systems:

Power Sources: Mains electricity, solar power, or battery backups

UPS Systems: Uninterruptible Power Supply for critical components

Example Hardware Setup

Attendance Status Monitoring: Biometric scanners (fingerprint or facial recognition) connected via Ethernet for real-time updates.

Weather Forecast: Weather station with wind speed, temperature, and humidity sensors transmitting data over Wi-Fi to the cloud.

Air Quality Monitoring: IoT-enabled air quality sensors using Zigbee protocol for local communication, with data relayed to central servers.

Raw Material Availability: RFID readers integrated with inventory management systems, communicating data through local servers.

Worker Safety: Wearable devices (smart helmets) equipped with GPS and accelerometer sensors, transmitting data via Bluetooth to nearby gateways.

**CHAPTER 4**

**METHODOLOGY**

To develop the dashboard for real-time monitoring of construction projects, we follow this methodology:

Data Collection:

Gather data sources for each parameter to be monitored. This could include:

1.Attendance status: The attendance status parameter tracks the presence of workers on the construction site in real-time. By implementing technologies like RFID tags, biometric scanners, or mobile apps, the system collects and transmits data on entry and exit timestamps, enabling project managers to monitor workforce attendance efficiently.

2.Weather forecast: Weather forecasting plays a crucial role in construction project planning and management. Integrating real-time weather data into the dashboard allows project stakeholders to anticipate and mitigate potential disruptions caused by adverse weather conditions, such as rain, storms, or extreme temperatures. By API integration with a reliable weather service provider we collect the data.

3.Air quality : Monitoring air pollution levels on construction sites is essential for ensuring a safe and healthy working environment for workers. By deploying air quality sensors and integrating their data into the dashboard, project managers can assess the pollution status and take necessary measures to minimize health risks and comply with environmental regulations. Data from sensors installed on-site.

4.Raw material availability: Keeping track of raw material availability is essential for maintaining uninterrupted construction progress. This parameter monitors the inventory of essential materials such as cement, steel, and aggregates, enabling proactive procurement and inventory management to prevent delays. By inventory management system or supplier databases we collect the data.

5.Safety: The safety parameter encompasses various metrics related to on-site safety, including accident reports, compliance with safety protocols, and equipment inspections. By analyzing real-time safety data, the dashboard helps identify potential hazards and implement preventive measures to enhance workplace safety and reduce the risk of accidents.By a combination of IoT sensors, CCTV cameras, and safety inspection reports to monitor compliance with safety protocols, identify potential hazards, and prevent accidents.

Data Integration:

Develop a data integration strategy to bring together data from various sources into a unified platform. By integrating data from multiple sources into a centralized dashboard, project managers gain a holistic view of construction project operations. This enables informed decision-making, proactive management, and optimization of resources to ensure the successful execution of construction projects.

Dashboard Design:

Design the user interface of the monitoring dashboard. The design of the dashboard for real-time monitoring of construction projects prioritizes clarity, usability, and accessibility. With a clean and intuitive layout, the dashboard presents key parameters such as attendance status, weather forecast, air pollution levels, raw material availability, and safety metrics in an easily understandable format. Utilizing visual elements such as charts, graphs, and color-coded indicators, the dashboard offers at-a-glance insights into project performance and conditions User-friendly navigation and interactive features allow project managers to drill down into specific data points, customize views, and set alerts for critical thresholds. The design also ensures compatibility across devices and platforms, enabling seamless access to vital project information anytime, anywhere.

Development:

Develop the dashboard application using technologies and frameworks. This involve:

1.Front-end development for building the user interface.

2.Back-end development for data processing, storage, and retrieval.

3.Integration of real-time data streams for updating dashboard visualizations.

Testing:

Conduct thorough testing to ensure the reliability and accuracy of the dashboard.

Deployment:

Deploy the monitoring dashboard in a production environment. The deployment of the real-time monitoring dashboard for construction projects involves several key steps to ensure a smooth and successful implementation. Initially, the dashboard undergoes final testing and validation to confirm its readiness for deployment. Once approved, a deployment plan is developed, outlining the steps and resources required for the rollout. This includes coordinating with stakeholders, such as project managers, site supervisors, and IT personnel, to schedule deployment activities and allocate responsibilities effectively. The dashboard is then installed and configured on the designated servers or cloud infrastructure, ensuring seamless access and performance. Training sessions are conducted to familiarize users with the dashboard's features, functionalities, and best practices for utilization. Continuous support and monitoring are provided post-deployment to address any issues, optimize performance, and incorporate feedback from users. By following a systematic deployment approach and fostering collaboration among stakeholders, the real-time monitoring dashboard is successfully integrated into construction projects, enhancing efficiency, productivity, and safety across the board

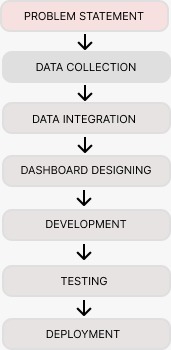
Maintenance and Optimization:

Establish procedures for ongoing maintenance and optimization of the dashboard.

Documentation:

Document the entire process, including requirements, design decisions, implementation details, and testing results. This documentation will serve as a reference for future maintenance and enhancements.

By following this methodology, we effectively develop, and deploy a real-time monitoring dashboard for construction project.



**CHAPTER 5**

**RESULT**

The dashboard developed for real-time monitoring of construction projects has proven to be an invaluable tool in enhancing project management and oversight. By integrating parameters such as worker attendance status, weather forecasts, air quality monitoring, raw material availability, and worker safety, the dashboard provides comprehensive and up-to-date insights into critical project facets. This holistic approach ensures proactive decision-making, improves resource allocation, and enhances overall project efficiency. The real-time nature of the dashboard allows stakeholders to promptly address emerging issues, thereby minimizing delays and optimizing construction timelines. Overall, the project has successfully demonstrated the utility of modern data integration and visualization techniques in advancing construction project management practices.

**CHAPTER 6**

**CONCLUSION & FUTURE SCOPE**

**6.1** **CONCLUSION**

In conclusion, the development and implementation of a real-time monitoring dashboard for construction projects offer significant benefits in improving project management, enhancing decision-making processes, and ensuring the overall efficiency and safety of construction sites. Through this project, we have addressed the critical need for timely access to actionable insights by integrating diverse data sources and leveraging advanced technologies.

By conducting a comprehensive literature survey, we have gained valuable insights into best practices, design principles, and emerging trends in real-time monitoring systems for construction projects. We have explored various parameters to be monitored, including attendance status, weather forecast, air pollution, raw material availability, and safety, and have identified suitable data sources and integration methods for each parameter.

The methodology outlined in this report provides a systematic approach to designing, developing, and deploying a real-time monitoring dashboard. From defining objectives and gathering requirements to implementing data integration, designing the user interface, and conducting testing and deployment, each step is crucial to the success of the project.

Through the implementation of this real-time monitoring dashboard, construction stakeholders will have access to up-to-date information and insights, enabling them to make informed decisions, mitigate risks, and optimize project outcomes. The dashboard's customizable features, intuitive user interface, and real-time data visualization capabilities will empower users to monitor key performance indicators and respond promptly to changing conditions on construction sites.

Looking ahead, there are opportunities for further research and innovation in the field of real-time monitoring for construction projects. Future advancements may include the integration of predictive analytics, machine learning algorithms, and immersive technologies to enhance the capabilities and effectiveness of monitoring dashboards.

In summary, the real-time monitoring dashboard developed in this project represents a significant step towards improving construction project management and ensuring the success and safety of construction endeavors. By embracing data-driven approaches and leveraging advanced technologies, we can drive positive change and innovation in the construction industry..

**6.2 FUTURE SCOPE**

While the current implementation of the real-time monitoring dashboard for construction projects has achieved significant milestones, there are several avenues for future exploration and enhancement. The future scope of the project includes:

1.Predictive Analytics:

Explore the integration of predictive analytics models to forecast future trends and potential risks on construction sites. By analyzing historical data and real-time inputs, predictive models can help anticipate delays, resource shortages, and safety hazards, enabling proactive decision-making.

2.Machine Learning Algorithms:

Investigate the application of machine learning algorithms for anomaly detection and pattern recognition in construction data. By identifying deviations from normal operating conditions, machine learning models can highlight areas requiring attention and facilitate early intervention to prevent adverse outcomes.

3.Enhanced Visualization Techniques:

Explore advanced visualization techniques, such as virtual reality (VR) and augmented reality (AR), to provide immersive experiences for construction stakeholders. VR and AR technologies can be used to visualize construction progress, simulate site conditions, and conduct virtual safety inspections, enhancing situational awareness and decision-making.

4.Integration with Building Information Modeling (BIM):

Integrate the monitoring dashboard with Building Information Modeling (BIM) systems to leverage rich 3D data models for construction planning and management. By combining real-time monitoring data with BIM information, stakeholders can gain a comprehensive understanding of project status and identify potential conflicts or inefficiencies early in the construction process.

5.Mobile Accessibility:

Develop mobile applications or responsive web interfaces to provide on-the-go access to real-time monitoring data for construction stakeholders. Mobile accessibility will enable project managers, engineers, and field personnel to stay informed and take timely actions regardless of their location, improving overall project coordination and communication.

6.Integration with Supply Chain Management Systems:

Extend the capabilities of the monitoring dashboard to include integration with supply chain management systems for seamless coordination of material procurement and delivery. By monitoring raw material availability in real-time and optimizing supply chain logistics, construction projects can minimize delays and cost overruns associated with material shortages.

7.Continuous Improvement and Feedback Mechanisms:

Establish mechanisms for gathering feedback from users and stakeholders to continuously improve the monitoring dashboard. Regularly solicit user input, conduct usability testing, and prioritize feature enhancements based on evolving requirements and industry best practices.By pursuing these future enhancements and innovations, the real-time monitoring dashboard for construction projects can evolve into a comprehensive decision support system, empowering stakeholders with actionable insights and facilitating the successful execution of construction projects.

**CHAPTER 1**

**INTRODUCTION**

**CHAPTER 7**

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**CHAPTER 3**

**DESIGN (UML AND DATA MODELING)**

**CHAPTER 4**

**IMPLEMENTATION**

**CHAPTER 5**

**PROJECT PLAN**

**CHAPTER 6**

**PROJECT SCREENSHOT**

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**CHAPTER 7**

**CONCLUSION/ FUTURE SCOPE**