Journals.Telkomuniversity.ac.id

Journal of Software Engineering and Multimedia **(JASMED)**

Vol. 3 No. 2 (2025) | eISSN:3025-6372 |
https//doi.org/10.20895/jasmed.v3i2.10135

Full Paper

Design and Development of a Web-Based Project Monitoring System Using the Prototype Method

Sherly Ratna Musva[1*],
Universitas Riau, Pekanbaru, Indonesia,
ravasherly373@gmail.com
Dian Ramadhani[2],
Universitas Riau, Pekanbaru, Indonesia
dianramadhani@lecturer.unri.ac.id

*Corresponding Author

ABSTRACT

EMP Bentu Ltd – EMP Korinci Baru Ltd is a company operating in the natural gas sector and currently managing multiple on-site projects that require continuous monitoring. The project supervision process still relies on WhatsApp and email, resulting in fragmented communication, limited traceability of progress, and unstructured documentation management. These limitations hinder timely validation of vendor reports and complicate decision-making, highlighting the need for a centralized and systematic monitoring solution. This research aims to design and develop a web-based project monitoring system that provides real-time, structured, and integrated oversight of project activities. The Prototype development model was applied through iterative cycles consisting of requirement identification, rapid design, prototype construction, user evaluation, and refinement based on feedback. The resulting system integrates essential features such as project phase and activity management, vendor reporting modules, progress visualization through charts, a Gantt-based scheduling interface, and daily report approval workflows. System evaluation based on the ISO 25010 quality model demonstrates that the application improves the accuracy, accessibility, and timeliness of project monitoring across functional suitability, usability, performance efficiency, and security attributes. The implementation of this system is expected to enhance operational transparency and support faster, data-driven decision-making within the company. The study contributes a practical software solution tailored for energy-sector project environments, emphasizing the value of prototype-based development for user-centered system design.

KEYWORDS

Web-based application; Monitoring; Prototype; Report; EMP Bentu Ltd-EMP Korinci Baru Ltd

Musva. S. R , Ramadhani. D. (2025). Design and Development of a Web-Based Project Monitoring System Using the Prototype Method. jasmed, 3(2), pp. 101-110. https//doi.org/10.20895/jasmed.v3i2.10135

Article Submitted 14/11/2025. Revision uploaded 28/12/2025. Accepted 30/12/2025.

1. INTRODUCTION

Digital transformation has become a strategic necessity across various industries, including the oil and gas sector, where operational complexity demands accurate, timely, and well-structured information management. Modern organizations increasingly rely on digital systems to improve coordination, enhance data accuracy, and support rapid decision-making processes [1]. In project-based environments, such as upstream oil and gas operations, monitoring progress is a critical activity because delays, miscommunication, or undocumented work can directly affect cost, safety, and operational continuity [2]. As industries evolve toward more integrated digital ecosystems, project monitoring systems must also adapt to ensure transparency, efficiency, and real-time information flow.

In the operational context of EMP Bentu Ltd – EMP Korinci Baru Ltd, project monitoring plays an essential role due to the involvement of multiple technical units and external vendors. Based on field observations and interviews conducted with project supervisors and divisional staff, the company still relies heavily on WhatsApp groups and email to manage daily monitoring activities. Although these tools facilitate fast communication, they do not provide structured data management, centralized documentation, or systematic tracking of progress. Daily reports submitted by vendors are often buried under unrelated messages, while documentation files remain scattered across personal devices, creating risks of data loss, duplication, and delays in validation. The absence of a dedicated monitoring information system results in inefficiencies that hinder timely decision-making in a fast-paced industrial environment.

The challenges experienced by EMP Bentu Ltd – EMP Korinci Baru Ltd reflect broader findings in the literature, which highlight that manual or informal monitoring mechanisms reduce organizational visibility, slow down evaluation processes, and increase the likelihood of miscommunication [3]. Digital systems, on the other hand, have been shown to improve coordination, record-keeping, and workflow clarity across project activities [4]. Rahmi et al. [5] demonstrated in a workplace-based study that implementing a web-based information system can significantly increase efficiency, streamline documentation, and reduce reliance on unstructured communication channels. Their work illustrates how system development in real industrial settings provides measurable operational benefits—strengthening the argument that similar digital solutions are essential for companies operating in complex environments such as oil and gas.

Previous studies on project monitoring systems indicate that many existing applications address only limited aspects of monitoring, such as basic project data recording or progress reporting, without integrating documentation management, approval workflows, and real-time schedule visualization within a single system. For example, Maya and Setiyadi [6] focused on digitalizing project information but lacked visual progress indicators. Other systems incorporated progress charts but did not support status tracking or documentation management [7]. Some more comprehensive solutions included documentation and project status information but still did not provide real-time visual tracking of scheduled activities through tools such as Gantt charts [8]. These gaps suggest the need for a more holistic system capable of integrating data recording, vendor reporting, timeline visualization, documentation uploads, and approval workflows within a unified interface.

To address the limitations of existing approaches, this research proposes the design and development of a web-based project monitoring application tailored to the operational needs of EMP Bentu Ltd – EMP Korinci Baru Ltd. A web-based platform was selected because it offers broad device compatibility, requires no installation, and supports easy access for users across divisions and locations. The system integrates key features needed in project supervision, including centralized project data storage, historical activity logs, percentage-based progress visualization, Gantt chart-based scheduling, and daily reporting modules with documentation uploads. An approval mechanism for supervisors is also provided to ensure that submitted reports undergo verification before being recorded as valid project progress.

The Prototype method was chosen as the development approach because of its iterative nature and its suitability for systems requiring continuous user feedback. This method allows early evaluation of system designs, enabling revisions to be made before full-scale implementation. Such an approach reduces development risks and ensures that the final system aligns closely with real operational needs. Kurozy et al. [9] also highlight that the Prototype model enhances system relevance and usability by promoting early interaction between developers and users.

Based on the issues identified and the gaps observed within previous research, the primary research question of this study is: How can a web-based project monitoring system be designed and developed to provide structured, centralized, and real-time supervision of project activities at EMP Bentu Ltd – EMP Korinci Baru Ltd? This research aims to develop a system that improves monitoring efficiency, enhances documentation organization, reduces miscommunication, and supports better decision-making across project activities. Through a structured approach combining field analysis, iterative prototyping, and evaluation, this study contributes both practically and academically to the development of project monitoring solutions in industrial environments.

2. METHODS

This study employs the Research and Development (R&D) approach to design, develop, and evaluate a web-based project monitoring system tailored to the operational needs of EMP Bentu Ltd – EMP Korinci Baru Ltd. The R&D method emphasizes the creation of a functional product followed by iterative refinement based on field validation. The methodological process includes data collection, requirement analysis, system design, prototyping, and system evaluation.

A. Data Collection Methods

Three primary techniques were used to obtain empirical data and understand the existing workflow within the company: interviews, observations, and literature review.

1. Interviews.
   Semi-structured interviews were conducted with advisors and members of several divisions within EMP Bentu Ltd – EMP Korinci Baru Ltd. The interviews focused on identifying the current project monitoring practices, challenges associated with scattered communication, and user expectations for a more structured system.
2. Observations.
   Field observations were carried out to examine how project monitoring activities were executed in real operational environments. The findings indicated that monitoring relied heavily on WhatsApp and email, resulting in fragmented communication, inconsistent documentation, and difficulties tracking project progress across multiple teams.
3. Literature Review.
   Theoretical foundations and supporting concepts were collected from books, academic journals, and relevant studies on digital project monitoring systems. Prior research served as comparative benchmarks and guided the selection of the Prototype development model.

B. System Development Method: Prototype Model

The system development process uses the Prototype Method, which supports iterative refinement based on continuous user involvement. This approach is well-suited for environments where requirements evolve during development. The stages implemented in this research follow the sequence illustrated in Figure 1.

1. Communication
   Researchers conducted discussions with stakeholders to gather detailed requirements related to project tracking, progress visualization, documentation management, approval workflows, and user access levels.
2. Quick Plan
   Functional and non-functional requirements were summarized, covering system features (project listing, task monitoring, report submission, Gantt chart, approval system) and technical specifications (performance, usability, security).
3. Quick Design Modeling
   Initial design artifacts were produced, including use case diagrams, ERD, mock-up interfaces, and preliminary navigation structures. These models provided a conceptual overview of how the system would function.
4. Construction of Prototype
   A functional prototype was developed using Laravel, MySQL, HTML, CSS, JavaScript, and Bootstrap. This phase involved implementing core features and preparing the prototype for user evaluation.
5. Deployment, Delivery, and Feedback

The prototype was tested by users to gather feedback regarding usability, functionality, and interface clarity. User input was used to refine the system before full implementation.

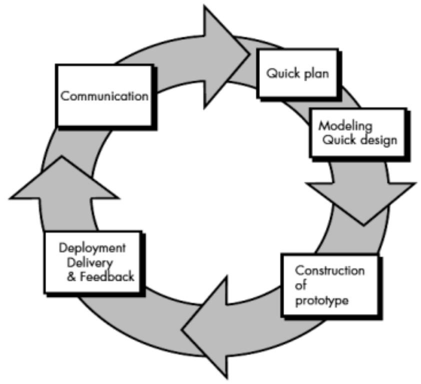

Figure 1 System Development Process Using the Prototype Method.

C. Technical Tools and Implementation Environment

System development was carried out using the following tools:

1. Frontend: HTML, CSS, JavaScript, Bootstrap
2. Backend: Laravel Framework
3. Database: MySQL
4. Local Server: Laragon
5. Versioning & Documentation: Git and manual documentation
6. Browser-based deployment: Accessible across PC and laptop environments

These tools were selected to ensure compatibility with the company's infrastructure and to support efficient, scalable development.

D. System Evaluation

System evaluation was conducted using the ISO 25010 quality model to assess the overall quality of the developed application. Eight respondents representing functional system users participated in the evaluation process. The assessment covered key quality characteristics, including functional suitability, performance efficiency, usability, reliability, security, portability, and maintainability. Feedback gathered during this phase was used to refine the system and validate whether the final implementation met the operational needs of EMP Bentu Ltd – EMP Korinci Baru Ltd.

1. Functional Suitability
   Evaluated using test cases and the Guttman scale (pass/fail). Functional accuracy was measured using:
   $$X = \frac{I}{P} \text{ x } 100\% \quad (1)$$
   where I = passed test cases, P = total test cases.
2. Reliability
   Tested using SonarQube, which detects code-level bugs and classifies reliability into ratings A–E based on bug severity.
3. Usability
   Assessed using the Computer System Usability Questionnaire (CSUQ) with a 1–7 scale. Evaluated dimensions include System Usefulness (SysUse), Information Quality (InfoQual), Interface Quality (IntQual), and Overall Satisfaction.
4. Performance Efficiency
   Measured using Google PageSpeed, which evaluates page loading performance with scoring ranges: 0–49 (poor), 50–89 (moderate), and 90–100 (excellent).
5. Maintainability
   Assessed through SonarQube remediation time, rated as: A (≤5%), B (6–10%), C (11–20%), D (21–50%), E (>50%).

6. Portability
   Tested across multiple browsers (Chrome, Firefox, Edge, Safari) to confirm adaptability without functional degradation.
7. Security
   Evaluated using Qualys SSL Labs, focusing on SSL/TLS configuration strength and vulnerability detection.
8. Compatibility
   Tested on different devices and screen resolutions to ensure consistent layout and system usability across platforms.

E. Summary of Methodological Flow

Overall, the research method integrates field data with iterative system development through the Prototype model. The flow ensures that:

1. System requirements reflect real organizational needs,
2. Design is validated early through user feedback, and
3. Evaluation is based on established software quality standards.

This methodological approach increases the system's relevance, reliability, and applicability in supporting structured and centralized project monitoring within industrial environments.

3. RESULT

This section presents the findings obtained from the system implementation and software quality evaluation conducted after the development of the web-based project monitoring system. All results are reported objectively without interpretation, focusing solely on the outcomes produced during testing.

A. System Implementation Results

The developed system successfully integrates core functionalities designed to support structured and centralized project monitoring at EMP Bentu Ltd – EMP Korinci Baru Ltd. Key implemented features include:

1. User login with multi-level access control

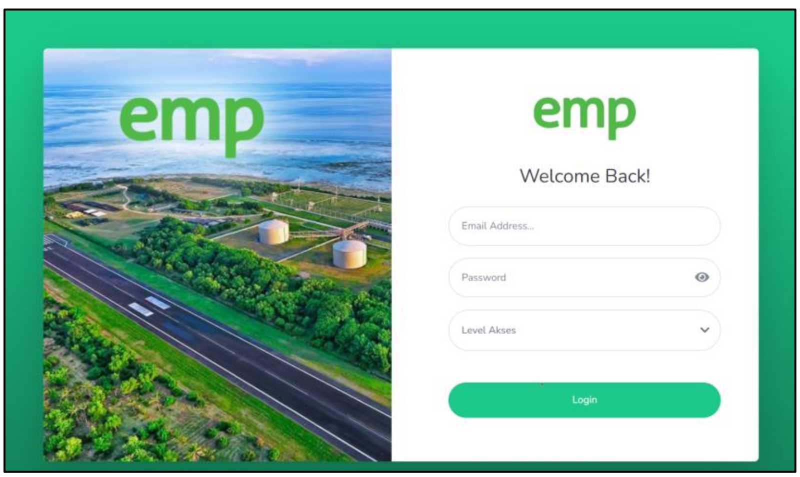

Figure 2 Login Page.

2. Project creation and project listing

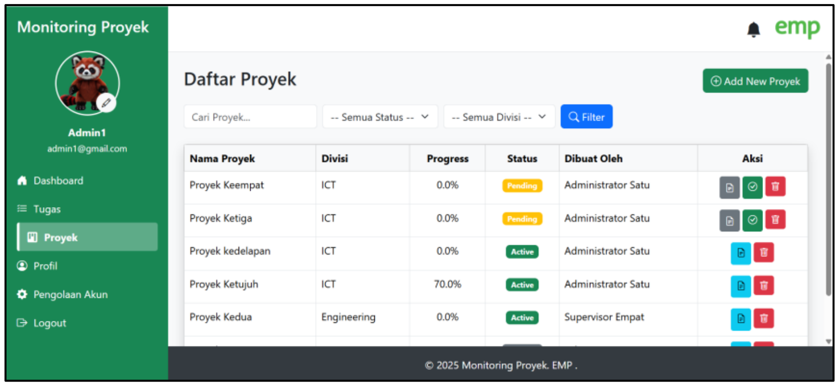

Figure 3 Project Listing.

3. Vendor task and activity reporting

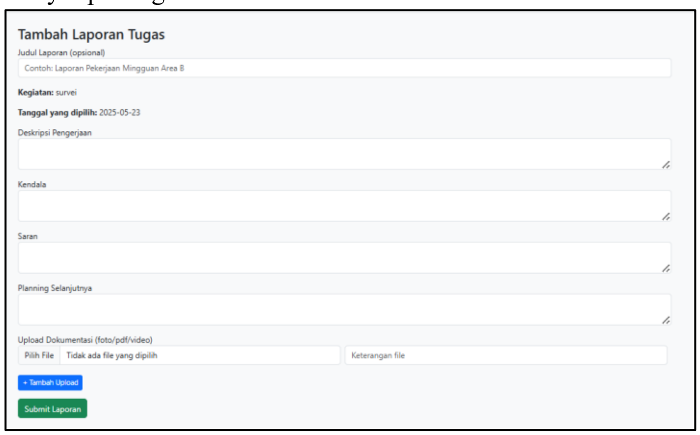

Figure 4 Reporting Project.

4. Supervisor approval workflow
5. Gantt chart visualization
6. Progress percentage chart
7. Documentation upload and storage

All features executed as intended during prototype testing and fulfilled their functional purposes based on the defined system requirements.

B. Functionality Testing

Functionality testing consisted of 35 test cases covering all system modules. Results showed:

$$X = \frac{35}{35} \text{ x } 100\% = 100\%$$

All test cases passed without errors, indicating that the system met all functional specifications.

C. Reliability Testing

Reliability evaluation using SonarQube produced a Rating C, indicating that the system operates correctly but contains several minor to moderate code-level issues requiring refinement. No critical failures occurred during functional execution.

D. Usability Testing (CSUQ)

Usability was assessed using the Computer System Usability Questionnaire (CSUQ) with 8 respondents. Scores for each category are as follows:

Table 1 Score for CSUQ

Category	Score	Interpretation
System Usefulness	93.92%	Very Feasible
Information Quality	97.50%	Very Feasible
Interface Quality	82.14%	Very Feasible

All categories achieved high usability ratings, demonstrating strong user acceptance of the system's ease of use, clarity, and functionality.

E. Performance Efficiency

Performance testing via Google PageSpeed Insights showed. Desktop score: 93 and Mobile score: 73.

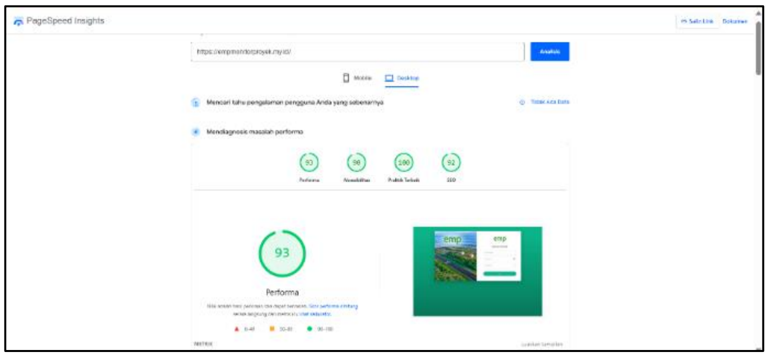

Figure 5 Desktop Performance Efficiency Test Results.

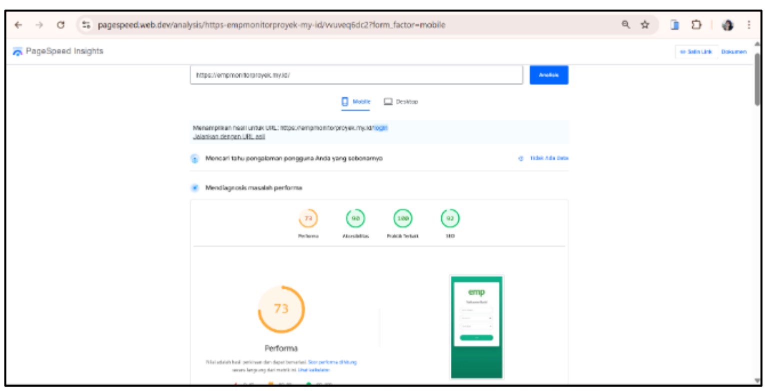

Figure 6 Mobile Performance Efficiency Test Results.

Both indicate good performance, with the system responding efficiently across device variations.

F. Maintainability Testing

Maintainability testing using SonarQube produced Rating A, signifying excellent maintainability. No critical code smells were detected, and the system can be modified or improved with minimal effort.

G. Portability Testing

Portability evaluation resulted in a 100% success rate, confirming that the system operates consistently across major web browsers without functional discrepancies.

H. Security Testing

Security assessment using Qualys SSL Labs yielded a Grade A, indicating strong protection for data transmission and proper implementation of HTTPS security configurations.

I. Compatibility Testing

Testing across 10 different devices revealed no issues related to feature accessibility or interface rendering. All modules functioned correctly on both mobile and desktop platforms. Overall, the system achieved strong performance across all ISO 25010 quality attributes and successfully fulfilled the functional requirements for structured, centralized, and real-time project monitoring.

4. DISCUSSION

The results of this study show that the development of a web-based project monitoring system using the Prototype model successfully addresses the main challenges previously identified in EMP Bentu Ltd – EMP Korinci Baru Ltd. As described in the Introduction, the company's reliance on WhatsApp and email caused fragmented documentation and unstructured supervision (Hasan et al., 2019). The implemented system provides a more organized workflow through integrated project listing, structured reporting, approval mechanisms, and visual progress representations, allowing supervisors to validate project activities more efficiently.

Compared with previous studies on project monitoring systems, this research offers several meaningful advancements. Earlier works often digitalized project information but did not provide comprehensive visualization or structured approval flows (Maya & Setiyadi, 2019; Purba et al., 2023). Other studies focused on progress visualization but lacked integrated documentation management or vendor reporting (Hambali et al., 2022). The system developed in this study integrates all these components into a single platform, including Gantt chart visualization, automated progress calculation, multi-level access, and consolidated documentation storage. These features align with recommendations in prior literature emphasizing clear communication channels, centralized data, and timely validation in industrial project environments (Waluyo & Munawar, 2017; Hilmyansyah et al., 2022).

The results of ISO 25010 evaluation further reinforce the system's contribution. High usability scores obtained through CSUQ align with findings from Lamada et al. (2020), who emphasize that usability strongly influences user acceptance in monitoring systems. Maintainability and security scores also support literature suggesting that well-structured architecture enhances long-term sustainability and system reliability (Nur et al., 2021). In addition, the system's performance and portability results demonstrate that it is capable of supporting multi-device access, a requirement highlighted by previous studies on web-based monitoring systems in distributed environments (Nazifpri & A'inunisya, 2022).

Despite these strengths, some limitations must be acknowledged. Reliability testing using SonarQube produced a Rating C, indicating the presence of minor code-level issues that require improvement. This is consistent with observations by Dako and Ridwan (2021), who note that iterative refinement is often required in early R&D-based system prototypes. The evaluation in this study also involved only eight respondents, which may limit the generalizability of usability results. Furthermore, the system has not been tested in a full-scale production environment, meaning long-term performance, scalability, and user behavioral patterns remain to be evaluated.

Future research should involve broader user testing with larger respondent groups and more diverse project scenarios. System refinements—particularly in code quality, automated notifications, analytics dashboards, and improved mobile responsiveness—are recommended to enhance reliability and usability further. Integration with enterprise platforms such as ERP or maintenance systems may also expand operational value and create more comprehensive digital ecosystems for project oversight.

Overall, this study confirms that the developed system effectively addresses the issues raised in the Introduction, aligns with existing literature on digital project monitoring, and contributes meaningful improvements while presenting a strong foundation for future development.

5. CONCLUSION

The study set out to design and develop a web-based project monitoring system that addresses the communication gaps, documentation inconsistencies, and unstructured supervision processes previously found at EMP Bentu Ltd – EMP Korinci Baru Ltd. Using the Research and Development (R&D) approach and an iterative Prototype model, this work successfully produced a functional system that centralizes project information, streamlines reporting activities, and supports real-time supervision across multiple user roles. The implemented features—such as multi-level access control, structured project management, vendor reporting, supervisor approval, progress visualization, and Gantt-based scheduling—demonstrate that the proposed system effectively meets the operational needs identified during the requirement analysis phase.

Evaluation based on the ISO 25010 software quality model further validates the system's effectiveness. The system achieved excellent functional suitability, high usability scores, strong performance efficiency, and very good maintainability, portability, and security. Although reliability testing indicated the presence of several minor issues, these did not affect functional execution and can be addressed in subsequent refinements. Overall, the results confirm that the system provides a more structured, centralized, and reliable alternative to the previously fragmented monitoring practices based on WhatsApp and email.

This research contributes to the field by demonstrating the practical application of an iterative prototyping approach in an industrial project-monitoring context, supported by comprehensive quality evaluation. The developed system can serve as a reference model for organizations with project-based operations in industrial or energy-sector environments that require structured and centralized project monitoring. Future work may explore expanding system capabilities, such as automated notifications, integration with mobile platforms, real-time analytics dashboards, or broader usability testing with larger participant groups to strengthen generalizability.

6. ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to EMP Bentu Ltd – EMP Korinci Baru Ltd for providing access, data, and valuable insights that greatly supported this research. The authors also extend appreciation to all respondents and staff members who participated in interviews, observations, and system evaluations throughout the development of the project monitoring system. Additionally, the authors thank the Department of Informatics Engineering, Universitas Riau, for its academic guidance and institutional support during the completion of this study.

7. REFERENCE

[1] Waluyo, A., & Munawar, A. (2017). Perancangan aplikasi monitoring penerimaan dan pelaksanaan proyek berbasis web dengan metode prototyping pada PT. Fas Jawara. Jurnal SISFOKOM, 6(1), 20–26.

[2] Hasan, R., Nugroho, A., & Setiawan, B. (2019). Efektivitas Pemantauan Proyek dalam Meningkatkan Koordinasi Tim pada Industri Migas. Jurnal Manajemen Proyek, 8(2), 112–120.

[3] Purwanto, E., Utomo, C., & Permatasari, H. (2019). Prototype sistem informasi monitoring penjualan. Jurnal Teknologi Informasi dan Ilmu Komputer (JTIIK), 9(4), 761–768.

[4] Hilmyansyah, M., Malabay, M., Simorangkir, H., & Yulhendri. (2022). Implementasi metode Scrum pada pembangunan sistem informasi monitoring progress proyek berbasis web. Jurnal IKRAITH-Informatika, 6(3), 30–40.

[4] Anisa, Rahmi, & Ramadhani, Dian. (2025).Design and Development of a makeup Artist data Management Application. Jurnal IJERSE, 5(2), 158–167.

[6] Maya Lestari, & Setiyadi, D. (2019). Sistem informasi monitoring perkembangan proyek dalam bidang konstruksi berbasis web pada CV Jaya Makmur Bekasi. Jurnal Mahasiswa Bina Insani, 3(2), 109–122.

[7] Hambali, H., Samsumar, L. D., & Wijayanto, P. (2022). Perancangan sistem informasi manajemen proyek berbasis website menggunakan CodeIgniter pada Mataram Web. Explore, 12(1), 30–40. [10] M. S. Lamada, A. S. Miru, and R. Amalia, "Pengujian Aplikasi Sistem Monitoring Perkuliahan Menggunakan Standar ISO 25010," Jurnal MediaTIK, vol. 3, no. 3, pp. 112–120, 2020, doi: 10.26858/jmtik.v3i3.15172.

[8] Purba, G. S., Putratama, V., & Choldun, M. I. (2023). Sistem informasi monitoring project berbasis website (SIMO). Improve, 15(2), 10–14.

[9] Kurozy, D. N., Pratama, R. G., & Muhammad, A. E. (2025). Penerapan Metode Prototype Pada Perancangan Sistem Pendaftaran Mahasiswa Baru. JPNM Jurnal Pustaka Nusantara Multidisiplin, 3(1). https://doi.org/10.59945/jpnm.v3i1.300

[11] R. Wijayanti, J. Sutanto, and T. Kartono, "The Impact of Integrated Project Monitoring Systems on Decision-Making in Corporate Operations," International Journal of Business and Technology Management, vol. 5, no. 3, pp. 55–68, 2021.

[12] H. Hambali, L. D. Samsumar, and P. Wijayanto, "Perancangan Sistem Informasi Manajemen Proyek Berbasis Website Menggunakan CodeIgniter," Explore: Jurnal Sistem Informasi dan Telematika, vol. 12, no. 1, pp. 30–40, 2022.
[13] R. Nur, R. Arifin, and I. Setiawan, "Evaluasi Kualitas Perangkat Lunak Menggunakan ISO 25010," Jurnal Teknik Informatika dan Sistem Informasi, vol. 7, no. 1, pp. 45–52, 2021.
[14] N. Sari and D. Wulandari, "Manajemen Proyek dan Pengelolaan Sumber Daya di Industri Migas," Jurnal Teknik Industri, vol. 23, no. 1, pp. 45–55, 2021.
[15] R. Pratiwi and I. Kholil, "Implementasi Model Prototype untuk Perancangan Sistem Informasi Project Monitoring Berbasis Web," TIN: Terapan Informatika Nusantara, vol. 5, no. 2, pp. 135–143, 2024.

8. AUTHORS

Sherly Ratna Musva was born in Duri, Riau, Indonesia on September 27, 2002. She completed her Bachelor's degree in Informatics Engineering at Universitas Riau in 2025 with a concentration in Software Engineering. Her research interests include web development, software engineering, information systems, and digital project monitoring applications. Email : ravasherly373@gmail.com

Dian Ramadhani was born in Duri, Riau, Indonesia. She completed her Bachelor's degree in Informatics Engineering in 2011 and a Master's degree from the Bandung Institute of Technology (ITB) in 2017. Her research interests include data mining, data analysis, machine learning, natural language processing, business intelligence, and decision support systems. Email : dianramadhani@lecturer.unri.ac.id