

Design and Evaluation of a Web-Based Helpdesk Ticketing System Using Extreme Programming for Improving IT Service Efficiency

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Abstract

Helpdesk solutions are essential for the proper management of IT service requests within enterprises. Nonetheless, numerous companies continue to depend on manual communication methods, such as telephone and email, resulting in protracted response times, disorganized data, and ineffective service management. This study is to create and assess a web-based helpdesk ticketing system utilizing the Extreme Programming (XP) methodology to enhance IT service efficiency. This research is executed as a case study at PT. INFOSIS-BLU, an IT service firm where the current helpdesk procedure yields an average response time of 6–8 hours and is devoid of centralized documentation. The suggested system incorporates real-time ticket monitoring, technician allocation, and centralized data management to optimize service operations. The assessment results indicate substantial enhancements, comprising a 30% augmentation in operating efficiency, a decrease in response time to below 10 minutes, and user satisfaction attaining 85%. The data demonstrate that XP is proficient in creating flexible and efficient helpdesk systems.

Keywords: Helpdesk ticketing System; Extreme programming; Web-based; IT-service management; Service efficiency.

1. Introduction

The need for effective IT service management in businesses has grown dramatically due to the quick development of information technology. The helpdesk system is a crucial element facilitating communication between users and IT support teams. Helpdesk systems facilitate the management of service requests, the resolution of technical issues, and the maintenance of service quality in an organized fashion [1], [2].

This research is executed as a case study at PT. INFOSIS-BLU, an IT service firm where the helpdesk operations are still administered manually using telephone calls, emails, and messaging applications. The average response time thus attains 6–8 hours, failing to achieve the anticipated service requirements. The lack of consolidated documentation hinders the analysis of recurring issues and the assessment of IT support staff performance. These manual methods frequently lead to significant issues, such as prolonged response times, inadequate documentation, and challenges in monitoring service requests, which adversely impact user happiness.

Notwithstanding its significance, numerous firms continue to depend on traditional helpdesk methods, such as telephone, email, or messaging systems. These manual methods frequently lead to significant issues, such as prolonged response times, inadequate documentation, and challenges in monitoring service requests [3]. Consequently, service effectiveness diminishes, adversely impacting user happiness. To address these restrictions, numerous research have suggested web-based helpdesk ticketing solutions. Studies indicate that the use of such systems can enhance service efficiency and documentation [4], as well as improve the monitoring and tracking of user requests [5]. Additional research corroborates that centralized systems facilitate enhanced service coordination and reporting [6], [7]. Nevertheless,

the majority of current research emphasizes system design and deployment, neglecting quantitative performance assessment. Moreover, agile approaches like Extreme Programming (XP) are frequently not used thoroughly across the development lifecycle [8]. This establishes a study gap in assessing how XP enhances quantifiable improvements in IT service efficiency.

This study proposes the design and evaluation of a web-based helpdesk ticketing system utilizing the Extreme Programming methodology to meet these difficulties. XP is an agile development methodology that prioritizes adaptability, iterative procedures, and close communication between developers and users. Prior studies suggest that XP enhances development velocity and flexibility, particularly in dynamic contexts [11], [12]. This project intends to create and assess a web-based helpdesk ticketing system utilizing Extreme Programming to enhance IT service efficiency. This research's primary contributions are: (1) the thorough implementation of XP in system development, (2) the quantitative assessment of system performance, and (3) the demonstration of enhancements in reaction time, efficiency, and user happiness.

2. Research Method

2.1 Research Design

This study adopts a system development research approach to design and evaluate a web-based helpdesk ticketing system using the Extreme Programming (XP) methodology. XP is an agile software development approach that emphasizes iterative development, flexibility, and continuous user involvement, making it suitable for dynamic system requirements [9], [10].

This research is conducted as a case study at PT. INFOSIS-BLU, an IT service company that currently relies on manual helpdesk processes such as telephone, email, and messaging applications. The study focuses on improving IT service efficiency through the implementation of a structured ticketing system and evaluating its performance using quantitative metrics.

2.2 Research Flow Diagram

The research process follows a structured sequence of activities as shown in Figure 1.

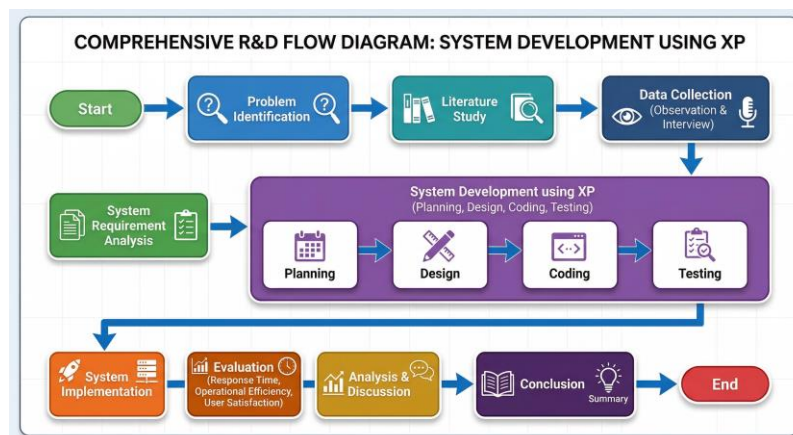


Figure 1. Research & Design Flow Diagram

This flow ensures that both system development and evaluation processes are conducted systematically and aligned with the research objectives.

2.3 Data Collection

Data collection was carried out using the following methods:

1) **Observation**

Direct observation was conducted to analyze the existing helpdesk process at PT. INFOSIS-BLU. The current system relies on manual communication channels, leading to delayed response times, unstructured workflows, and lack of documentation.

2) **Interviews**

Interviews were conducted with IT support staff to identify system requirements, operational challenges, and service priorities.

3) Literature Reviews

A literature review was conducted to support the research framework and methodology. Previous studies show that web-based helpdesk systems can improve service efficiency and tracking capabilities [4], [5].

2.4 System Development Method

This research employs the Extreme Programming (XP) software development methodology. XP was selected due to its emphasis on rapid iteration, flexibility, and continuous user involvement to accommodate dynamic system requirements. Based on this method, the system development stages in this study focus on the following phases:

1) Planning Phase

This phase focuses on identifying functional and non-functional requirements based on the limitations of the pre-existing manual helpdesk system. The detailed elaboration of the functional requirements (core functional features) designed within this system includes:

- a) Ticket Submission: A feature that facilitates users in reporting issues in a structured manner.
- b) Automatic Assignment: A feature to automatically distribute tickets to available technicians.
- c) Real-time Tracking: A feature enabling users to monitor the status of ticket handling in real time.
- d) Centralized Database: A feature to manage the documentation of issue-resolution history.
- e) Reporting and Monitoring: A feature for management to evaluate technician performance.

2) Design Phase

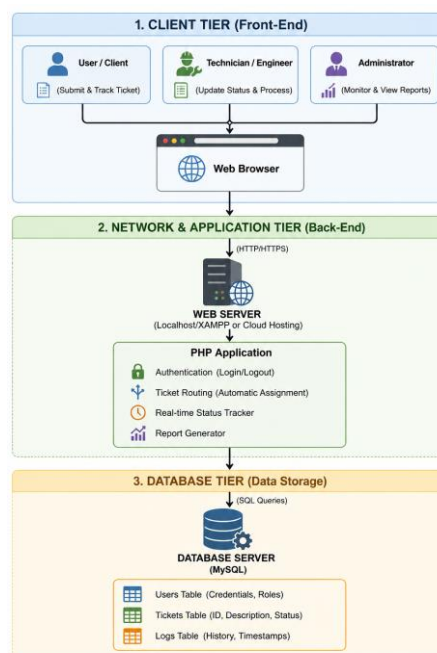


Figure 2. System Architecture Design

During this phase, the identified functional requirements are transformed into design representations. System modeling commences with the design of the System Architecture Model to provide a macro-level overview of the network architecture and data flow. The proposed web-based helpdesk ticketing system utilizes a Client-Server architecture, as illustrated in Figure 2. Users interact with the system via a web browser to submit requests, while the web server processes business logic such as ticket

assignment. The database server utilizes MySQL to centrally store user credentials, ticket history, and operational logs, ensuring real-time data synchronization. Once the system architecture is established, specific modeling proceeds using the Unified Modeling Language (UML), which encompasses Use Case Diagrams, Activity Diagrams, and Class Diagrams to detail the system's behavior and structure:

- a) **Use Case Diagram:** Illustrates the interactions between actors (User, Technician, and Administrator) and the system. Users can submit and track tickets, technicians handle assignments and update statuses, and administrators oversee reports and user management, as illustrated in Figure 3.

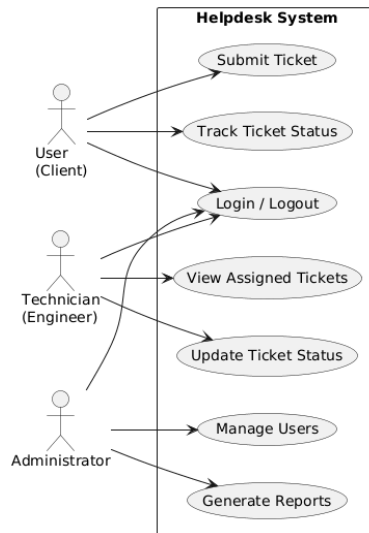


Figure 3. Use Case Diagram Helpdesk System

- b) **Activity Diagram:** Outlines the workflow of ticket resolution, starting from ticket submission by the user, followed by technician assignment, status processing, and ending with the system notifying the user once the issue is resolved, as illustrated in Figure 4.

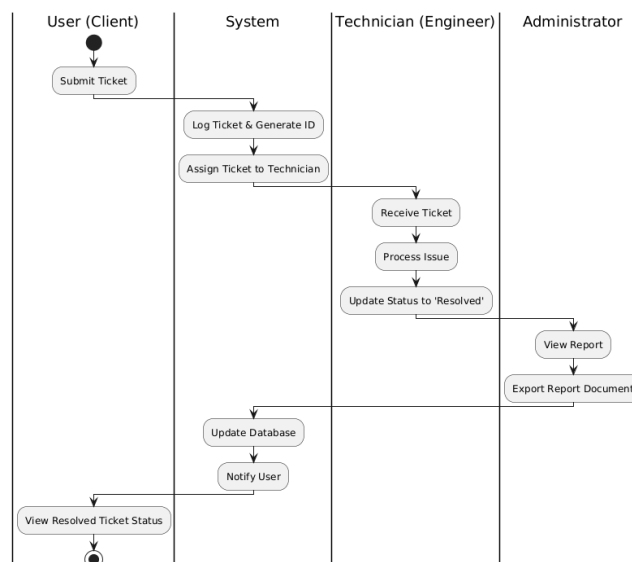


Figure 4. Activity Diagram for Helpdesk System

- c) **Class Diagram:** Represents the static structure of the database, defining essential classes such as User, Ticket, and Technician, along with their attributes and relationships to support centralized data management, as illustrated in Figure 5.

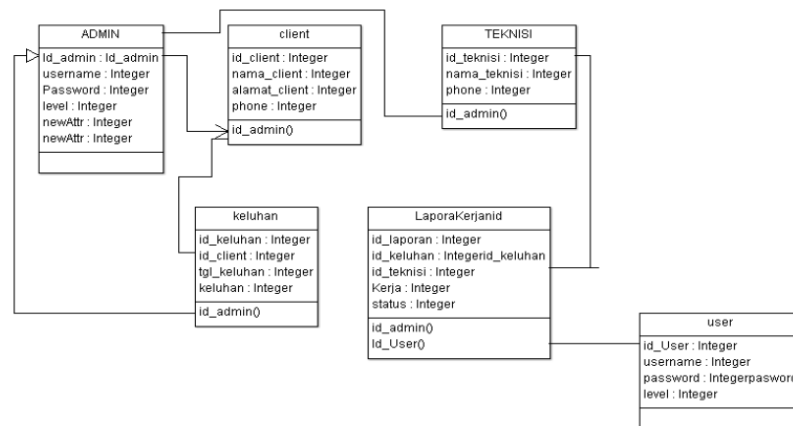


Figure 5. Class Diagram for Helpdesk System

3) Coding Phase

This phase involves the implementation of the design into programming code, wherein XP practices of incremental development and continuous integration are applied. The software tools utilized in constructing this system include:

- a) Programming Language: PHP.
- b) Database Management System (DBMS): MySQL.

4) Testing Phase

The functional testing phase of the system is conducted using the Black-box Testing technique. This technique focuses on evaluating the application's inputs and outputs to ensure that all developed features operate according to the required specifications, without examining the internal code structure. User validation is also performed to assess the system's usability level. Furthermore, service performance evaluation is conducted by measuring the metrics of Response Time (RT), Operational Efficiency (OE), and User Satisfaction (US). A comprehensive explanation regarding the testing procedure and its evaluation results will be presented in Section 3.

2.5 Evaluation Method

The system evaluation is conducted based on three key variables: response time, operational efficiency, and user satisfaction. The evaluation was conducted by comparing system performance before and after implementation based on the defined variables. The collected data were analyzed quantitatively to determine the effectiveness of the proposed system in improving IT service efficiency.

1. Response Time (RT)

$$RT = \frac{\sum_{i=1}^n (t_{response,i} - t_{request,i})}{n} \quad (1)$$

Where:

- $t_{request,i}$ = time when the ticket is submitted
- $t_{response,i}$ = time of first response
- n = total number of tickets

These variable measures the system's responsiveness in handling user requests.

2. Operational Efficiency (OE)

$$OE = \frac{T_{before} - T_{after}}{T_{before}} \times 100\% \quad (2)$$

Where:

- T_{before} = processing time before system implementation
- T_{after} = processing time after system implementation

This variable evaluates the improvement in system efficiency after implementation.

3. User Satisfaction (US)

$$US = \frac{\sum_{i=1}^n Score_i}{n \times Score_{max}} \times 100\% \tag{3}$$

Where:

- $Score_i$ = user rating score
- $Score_{max}$ = maximum possible score
- n = number of respondents

These variable measures user perception of system usability, performance, and service quality.

3 Results and Discussion

3.1 Implementation of System Features

The system was designed utilizing the Extreme Programming (XP) technique, which enabled iterative and adaptable development. The planning phase effectively identified user needs, while the design step facilitated accurate system modeling via UML.

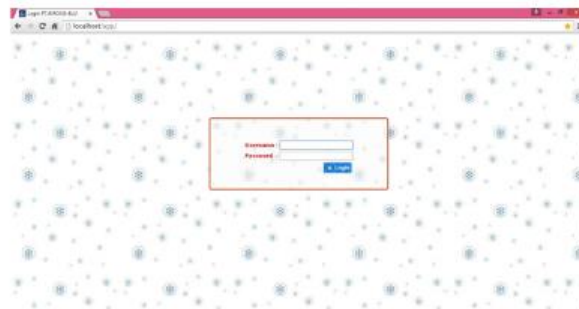


Figure 6. Login Page Result



Figure 7. Dashboard Page Result

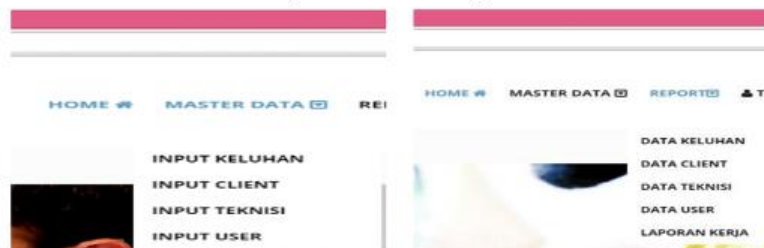


Figure 8. Master Page Result



Figure 9. Report Page Result

During the coding phase, incremental development facilitated ongoing enhancements, while the testing phase validated system functionality through black-box testing. The use of XP shown efficacy in managing dynamic requirements and enhancing cooperation, in alignment with agile development principles [9], [10].

System features were implemented to solve issues reported during data collecting. The ticket submission functionality guarantees organized reporting, and automatic allocation enhances task distribution. Real-time tracking improves transparency, while centralized data management facilitates documentation and reporting. The results of the interface display are presented in Figures 6 to 11.

These attributes markedly enhance coordination and service provision, consistent with prior studies highlighting centralized helpdesk systems [6], [7].

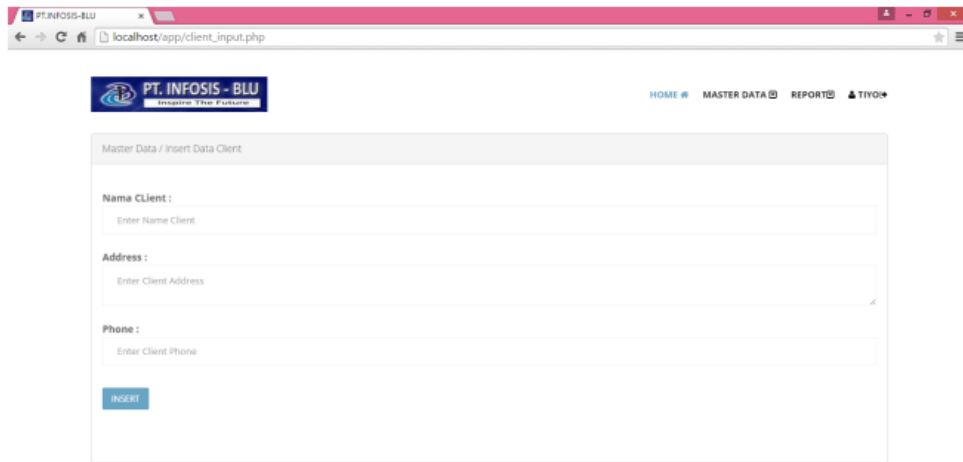
A screenshot of a web browser displaying the 'Master Data / Insert Data Client' page. The browser address bar shows 'localhost/app/client_input.php'. The page header includes the logo for 'PT. INFOSIS - BLU' and navigation links for 'HOME', 'MASTER DATA', 'REPORT', and 'TIYO'. The main content area contains three input fields: 'Nama Client' (with placeholder 'Enter Name Client'), 'Address' (with placeholder 'Enter Client Address'), and 'Phone' (with placeholder 'Enter Client Phone'). Below these fields is a blue 'INSERT' button.

Figure 10. Master Client Page Result

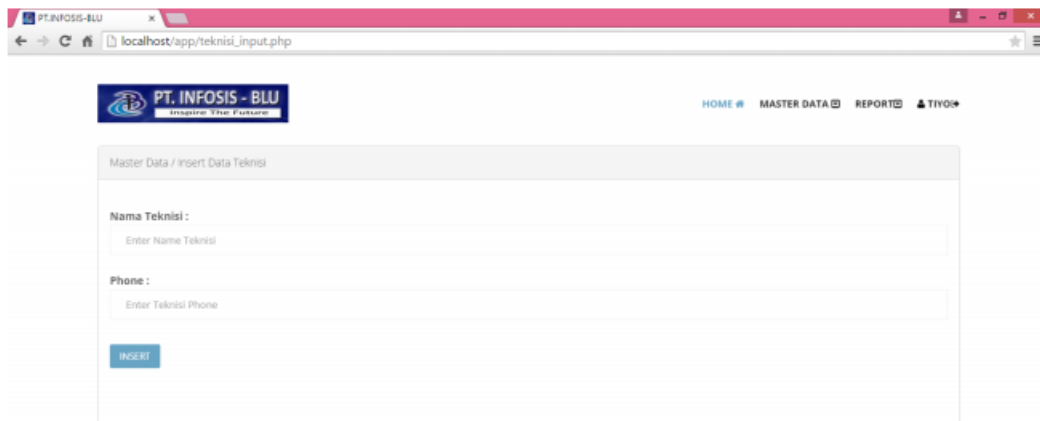
A screenshot of a web browser displaying the 'Master Data / Insert Data Teknisi' page. The browser address bar shows 'localhost/app/teknisi_input.php'. The page header includes the logo for 'PT. INFOSIS - BLU' and navigation links for 'HOME', 'MASTER DATA', 'REPORT', and 'TIYO'. The main content area contains two input fields: 'Nama Teknisi' (with placeholder 'Enter Name Teknisi') and 'Phone' (with placeholder 'Enter Teknisi Phone'). Below these fields is a blue 'INSERT' button.

Figure 11. Master Engineer Page Results

3.2 System Testing and Performance Evaluation

The testing was conducted to ensure that all functionalities with black-box testing method (such as the login function, ticket creation, status modification, and report generation) operate in accordance with the initial specifications, free from any input or output errors. All features were validated and successfully functioned according to the predetermined testing scenarios.

The system performance was evaluated based on three variables: response time (RT), operational efficiency (OE), and user satisfaction (US).

- **Response Time (RT):**
Reduced from 6–8 hours to less than 10 minutes, indicating faster service handling.
- **Operational Efficiency (OE):**
Increased by 30%, reflecting improved workflow and reduced redundancy.
- **User Satisfaction (US):**
Achieved 85%, indicating high user acceptance and usability.

These improvements demonstrate the effectiveness of the proposed system in enhancing IT service performance.

To guarantee that the developed web-based helpdesk ticketing system meets the functional requirements identified during the planning phase, a functional validation was conducted using the Black-box testing method. The testing instrument utilized was a test case scenario table designed to evaluate the system's inputs and outputs without examining the internal source code. The data results of the Black-box testing are presented in Table 1.

Table 1. Black-box Testing Result

No	Tested Feature	Testing Scenario	Expected Output	Actual Output	Status
1	Login Functionality	User inputs valid registered username and password.	System authenticates credentials and redirects the user to the appropriate dashboard based on their role.	The system successfully redirected users to their respective dashboards.	Valid
2	Ticket Creation	Client submits a new helpdesk ticket with complete details.	System saves the ticket data into the database and generates a unique Ticket ID.	Ticket is recorded, ID is generated, and ticket appears on the technician's queue.	Valid
3	Status Modification	Engineer updates the ticket status from 'Open' to 'Resolved'.	System updates the database and the client interface reflects the new 'Resolved' status in real-time.	Status successfully updated and visible to the client immediately.	Valid
4	Report Generation	Administrator filters the ticket history by a specific date range.	System generates a summarized report of total tickets, statuses, and technician performance.	A comprehensive report is successfully displayed based on the selected dates.	Valid

As shown in Table 1, all core features were validated and successfully functioned according to the predetermined testing scenarios, indicating that the system is fully operational and free from input-output errors

3.3 Discussion

The comparative evaluation of the manual helpdesk process and the newly implemented web-based ticketing system at PT. INFOSIS-BLU reveals substantial, quantifiable enhancements across all assessed categories. Before the implementation, the helpdesk procedure relied heavily on fragmented, manual communication channels (such as telephone calls and messaging applications), which yielded an average response time of 68 hours and caused disorganized workflows. Following the deployment of the proposed system, the response time was drastically reduced to under 10 minutes. This significant improvement in system responsiveness occurs because the centralized database eliminates the need for manual data handover and allows for automated, instant ticket assignment to available technicians.

Furthermore, the operational efficiency (OE) experienced a 30% augmentation. This rationalizes the fact that automated ticketing streamlines previously redundant administrative tasks, allowing IT personnel to focus directly on problem resolution rather than manual documentation. The user satisfaction (US) level achieved 85%, emphasizing a highly favorable user perception of the system's transparency, ease of use, and improved service quality.

These findings strongly align with and support previous literature regarding the benefits of centralized IT service management. For instance, studies by Pujihastuti et al. [6] and Widiarsa et al. [7] highlighted that centralized systems inherently facilitate enhanced service coordination and reporting, which is also in line with recent digital transformation efforts in internal services [13] and the adoption of modern helpdesk applications [14]. Our quantitative results empirically prove these theoretical claims by demonstrating exact performance metric improvements.

Moreover, the successful and rapid deployment of this system underscores the effectiveness of the Extreme Programming (XP) methodology in dynamic corporate environments. Consistent with the theories proposed by Al-Saqqa et al. [9] and Hoda et al. [10], ensuring that the final product precisely matched the operational needs of PT. INFOSIS-BLU. These positive outcomes corroborate other empirical studies that have successfully utilized XP [15] and combined agile methods like XP and Scrum [16] for helpdesk system development.

A primary scientific contribution of this research is its quantitative approach to system evaluation. While many previous studies, such as those by Pratama et al. [8], predominantly focused on the design and deployment phases of agile software development, this study bridges a critical research gap by providing concrete, measurable performance data (RT, OE, and US) to validate the system's effectiveness post-implementation.

Despite these positive outcomes, this study has limitations that present opportunities for further research. The evaluation was conducted exclusively within the specific environment of PT. INFOSIS-BLU; thus, the metrics might vary if applied to enterprises with different scales or organizational structures. For future improvements, the integration of Artificial Intelligence (AI) or chatbot systems for initial troubleshooting, as hinted at in the foundational concepts of modern helpdesks [17], could be explored to automatically resolve tier-1 user issues, potentially reducing the response time to near-instantaneous levels and further enhancing operational efficiency. The performance evaluation results are as described in Table 2.

Table 2. Performance Evaluation Results

Variable	Before Implementation	After Implementation
Response Time (RT)	6–8 hours	< 10 minutes
Operational Efficiency (OE)	Low	+30% improvement
User Satisfaction (US)	Not measured	85%

4. Conclusion

The results validate that the deployment of a web-based helpdesk ticketing system markedly enhances IT service efficiency. The enhancements in response time, operational efficiency, and user happiness demonstrate that the system proficiently mitigates the shortcomings of manual operations. This work offers a quantitative assessment of system performance, filling a significant research need, in contrast to earlier studies that mostly concentrate on system design [8]. Moreover, the implementation of Extreme Programming facilitates adaptable development and ongoing enhancement, aligning with agile development concepts [9], [10].

The combination of organized features and centralized data management improves collaboration and transparency, resulting in superior service quality. The results indicate that the proposed system offers a viable and efficient alternative for enhancing IT service management.

Acknowledgement

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References

- [1] M. A. R. Nasution and A. I. Permana, "Rancang bangun aplikasi sistem helpdesk service pada PT. PLN Nusantara Power UMRO UPHK Medan berbasis web," *Jurnal Minfo Polgan*, vol. 14, no. 1, pp. 410-416, 2025, doi:10.33395/jmp.v14i1.14739.
- [2] R. Tarigan, I. Kusosi, and A. Usri, "Perancangan aplikasi helpdesk ticketing system pada PT. Indonesia Nippon Seiki," *Jurnal SISFOKOM*, vol. 11, no. 1, pp. 9-18, 2022, doi:10.32736/sisfokom.v11i1.1271.
- [3] E. P. Wonohardjo, A. H. Putra, and E. H. Yossy, "Design of web-based helpdesk ticketing system at PT DENSO Indonesia," *Jurnal PIKSEL*, vol. 10, no. 1, pp. 1-18, 2022, doi:10.33558/piksel.v10i1.3183.
- [4] R. Muharam and F. Sulianta, "Sistem informasi helpdesk IT Perum Peruri," *Jurnal Syntax Idea*, vol. 5, no. 2, 2023, doi:10.36418/syntax-idea.v3i6.1227.
- [5] Y. Chanchad, S. Kanade, and R. Singh, "Helpdesk ticketing system," *International Journal of Innovative Research in Technology (IJIRT)*, vol. 9, no. 10, pp. 557-560, 2023.
- [6] A. Pujiastuti and E. Efanti, "Helpdesk application design for electronic medical record reporting," *Journal Rekam Medis*, vol. 1, no. 1, pp. 24-34, 2025, doi:10.69855/rekammedis.v1i1.290.
- [7] B. L. Widiarsa, H. Hendri, B. O. Lubis, B. Santoso, and R. T. Yunandar, "Penerapan metode extreme programming pada sistem informasi helpdesk pengajuan gambar berbasis website," *Jurnal Teknologi Sistem Informasi*, vol. 6, no. 1, pp. 21-35, 2025, doi:10.35957/jtsi.v6i1.9267.
- [8] A. G. Pratama, D. S. Cahyadi, H. Iskandar, and R. Djatalov, "Rancang bangun sistem informasi helpdesk berbasis web menggunakan metode agile," *Biner: Jurnal Ilmu Komputer*, vol. 2, no. 5, pp. 787-794, 2024.
- [9] S. Al-Saqqa, S. Sawalha, and H. AbdelNabi, "Agile software development: Methodologies and trends," *International Journal of Interactive Mobile Technologies*, vol. 14, no. 11, pp. 246-270, 2020, doi:10.3991/ijim.v14i11.13269.
- [10] R. Hoda, J. Noble, and S. Marshall, "Developing a grounded theory to explain the practices of self-organizing agile teams," *Empirical Software Engineering*, pp. 609-639, 2011, doi:10.1007/s10664-011-9161-0.
- [11] G. F. Adnyana, I. M. D. Ardiada, and A. T. A. P. Kusuma, "Perancangan sistem informasi helpdesk pada departemen ICT menggunakan metode FAST," *Jurnal Media Informatika (JUMIN)*, vol. 6, no. 2, pp. 296-303, 2024.
- [12] K. Sofi and B. J. Santoso, "Analysis of helpdesk system development in a manufacturing company using design thinking approach," *International Journal of Advances in Data and Information Systems*, vol. 6, no. 1, pp. 15-30, 2025, doi:10.59395/ijadis.v6i1.1354.
- [13] R. Cahyadi and D. Ramayanti, "Transformasi digital layanan internal melalui aplikasi helpdesk ticketing berbasis web di PT Centrepark Citra Corpora," *Jurnal RJTI*, vol. 4, no. 2, pp. 173-179, 2025.
- [14] S. A. Siwiantoko, H. Hermana, and H. Azis, "Aplikasi helpdesk dengan pendekatan knowledge management system menggunakan framework CodeIgniter dan notifikasi Telegram," *Buletin Sistem Informasi dan Teknologi Islam*, vol. 3, no. 2, pp. 113-120, 2022.
- [15] F. Wicaksono and O. S. Baswara, "Design and implementation of web-based helpdesk information systems using extreme programming methods," *Information Technology Engineering Journals*, vol. 5, no. 2, pp. 88-96, 2020.
- [16] M. Siahaan and Kelvin, "Pengembangan helpdesk ticketing system berbasis website dengan metode SDLC, XP, dan Scrum," *Jurnal KLIK*, vol. 4, no. 3, pp. 1399-1410, 2023, doi:10.30865/klik.v4i3.1400.
- [17] R. R. Benedictus, H. Wowor, and A. Sambul, "Rancang bangun chatbot helpdesk untuk sistem informasi terpadu Universitas Sam Ratulangi," *E-Journal Teknik Informatika*, vol. 11, no. 1, pp. 1-7, 2017, doi: 10.35793/jti.v11i1.16557