Journal of Information Technology and Cyber Security 3(1) January 2025: 64-78 EISSN 2987-386X | PISSN 2987-3878
DOI: 10.30996/jitcs.12979
Research Article Pratama et al.

Design and Implementation of Digital Transmitter Monitoring Information System for TVRI East Java Transmission Unit Using Scrum Framework

Ario Satria Wahyu Pratama [1,*], Ratna Nur Tiara Shanty [2], and Cempaka Ananggadipa Swastyastu [3]

[1,2,3] Department of Informatics, Universitas Dr. Soetomo, Indonesia
* Corresponding author: ario.satria45.as@gmail.com

Received: 19 February 2025 | Revised: 13 August 2025
Accepted: 15 August 2025 | Available online: 01 September 2025

To cite this article: Pratama, A. S. W., Shanty, R. N. T., & Swastyastu, C. A. (2025). Design and Implementation of Digital Transmitter Monitoring Information System for TVRI East Java Transmission Unit Using Scrum Framework. *Journal of Information Technology and Cyber Security, 3*(1), 64-78. https://doi.org/10.30996/jitcs.12979

Abstract
The Digital Transmitter Monitoring Information System for the TVRI East Java Transmission Unit is developed to enhance efficiency in recording and monitoring transmitter conditions, which were previously documented manually using logbooks. This system is designed to facilitate operators in recording technical transmitter data and assist technicians in the failure analysis process. The development method used is the Scrum methodology, allowing the system to be developed iteratively with improvements based on user feedback. System testing is conducted using Black-Box Testing to ensure all features function according to user requirements, while system acceptance evaluation is carried out using the Technology Acceptance Model (TAM) to measure the system's usability and ease of use. The testing results indicate that all system features function properly without significant errors. The TAM evaluation produced an average score of 84.5% for perceived usefulness and 86.5% for perceived ease of use, indicating that the system is well accepted by users. With key features such as transmitter data recording, reporting, employee performance tracking, and data export, this system is expected to help TVRI East Java monitor digital transmitters more effectively and efficiently. Compared to the previous manual logbook system, this digital-based approach reduces dependency on physical documentation, minimizes the risk of data loss, and improves accessibility for operators and technicians. By enabling centralized data storage and streamlined reporting, the system ensures that monitoring activities are more structured, responsive, and cost-effective.
Keywords: monitoring information system, scrum, Technology Acceptance Model, transmitter monitoring, TVRI.

1. Introduction

As digital technology has advanced in recent years, its role has become crucial in supporting the operational activities of companies and organizations (Santos, Piqueiro, Dias, & Rocha, 2024), including the digital television broadcasting industry (Hakim, Marwiyati, Wahyudin, & Kristiadi, 2022). Technological advancements have enabled a shift from manual processes to digital forms, making television broadcasting more effective and efficient (Hakim, Marwiyati, Wahyudin, & Kristiadi, 2022). Digital television broadcasting utilizes Very High Frequency (VHF) and Ultra High Frequency (UHF) waves, which can transmit clear images up to a certain limit where the signal can no longer be received (Hakim, Marwiyati, Wahyudin, & Kristiadi, 2022). Televisi Republik Indonesia (TVRI) plays a significant role in the development of digital television in Indonesia, having launched the first digital broadcast in Indonesia.

The current issue faced by the TVRI East Java transmission station is that the monitoring of transmitter machines is still conducted manually using logbooks. This method is considered inefficient as it requires operators to record data 24 times per day, with each entry taking approximately 2 minutes and 40 seconds. If a new table needs to be created, an additional 1 minute is required per entry. Furthermore, if logbooks or stationery run out, operators may need up to 30 minutes to purchase new supplies, causing delays in documentation. Manual records are also vulnerable to physical damage, such as water spills or termite infestations, which can lead to data loss and disrupt the monitoring process. Additionally, technicians may face difficulties in analyzing malfunctions if data is incomplete or inaccessible due to limited availability of writing tools. Moreover, TVRI East Java has reported instances where delays in recording transmitter data have resulted in longer repair processes, leading to extended downtime. Based on these issues, an efficient information system is needed to monitor the implementation of terrestrial digital television broadcasts at TVRI East Java.

This study aims to develop a web-based digital transmitter monitoring information system for TVRI East Java Station located in Sambikerep, Surabaya, East Java, and does not cover other TVRI transmitters. The system is developed using the CodeIgniter 4 framework, which follows the MVC (Model-View-Controller) architectural pattern to promote organized code structure and maintainability (Ramadaniah, Fitra, Satria, & Zidane, 2022). PHP is used as the server-side scripting language due to its compatibility and widespread use in web development, while MySQL is employed as the database server for its reliability in handling structured data and supporting scalable applications. The scope of this research includes a system that can display information related to TVRI East Java's digital transmitter machines, record technical data of the transmitter machines, and generate reports regarding issues encountered in the machines. The software development method used is the Scrum model, while the system evaluation is conducted using the TAM model. The Scrum method is chosen due to its iterative nature, which allows for rapid adaptation to changing requirements and continuous improvement based on user feedback. It provides clear role distribution, ensures visibility through artifacts, and creates opportunities for inspection and adaptation through various events. This approach is particularly beneficial in system development that requires flexibility and responsiveness, such as monitoring systems where accurate data logging and system reliability are crucial. This allows teams to better manage project complexity and improve efficiency in system development (Kadenic, Pacheco, Koumaditis, Tjørnehøj, & Tambo, 2023). The TAM evaluation model is selected as it effectively measures user acceptance and usage of the system (Wei, et al., 2025). Ensuring that the system not only enhances workflow efficiency compared to manual logbooks but is also easy to learn and operate. TAM explains technology adoption based on perceived usefulness (PU) and perceived ease of use (PEOU), where users tend to adopt a system if they find it beneficial and easy to operate (Belmonte, Prasetyo, Cahigas, Nadlifatin, & Gumasing, 2024).

2. Literature Review

2.1. Monitoring Information System

A monitoring information system is an integrated computer system that collects and manages data from various sources to generate relevant information (Herdiansah, Borman, & Maylinda, 2021). It continuously gathers and analyzes data related to performance and field conditions to support evaluation and necessary improvements, preventing more serious damage (Dewi & Chairun, 2022).

2.2. Monitoring

Monitoring is a systematic and continuous process carried out to collect and evaluate information about an activity based on predetermined indicators, allowing for necessary corrective actions to be taken (Purnama, Purwanto, & Herdiyanto, 2023). It follows a cycle that includes data collection, reorganization, reporting, and taking action based on information about an ongoing process (Nasution, Darmayunata, & Wahyuni, 2022). Additionally, monitoring involves gathering information at multiple points in time using a standardized approach, ensuring consistency and reliability, so that changes and conditions can be compared over time (Eiter, Fjellstad, & Schaik, 2025). This process helps evaluate activities or programs and enables necessary adjustments for future improvements.

2.3. Scrum

Scrum is a framework derived from the Agile software development methodology, developed by Jeff Sutherland and his team in 1990 (Lawong & Akanfe, 2025). Each role within the Scrum team has specific responsibilities that contribute to an effective and efficient development process (Kadenic, Pacheco, Koumaditis, Tjørnehøj, & Tambo, 2023). Previous researchers, such as (Setiawan, Fatimah, & Primasari, 2023), implemented Scrum in the development of a web-based information system for recording data from the Village Innovation Ambassador program. The system was developed using Laravel and divided into four sprints, with each sprint tested using Black-Box Testing to ensure its functionality. Their findings indicate that the iterative nature of Scrum allows for continuous system improvements based on user feedback, making it an effective approach for managing large-scale data processing and recording. Meanwhile, Kur-

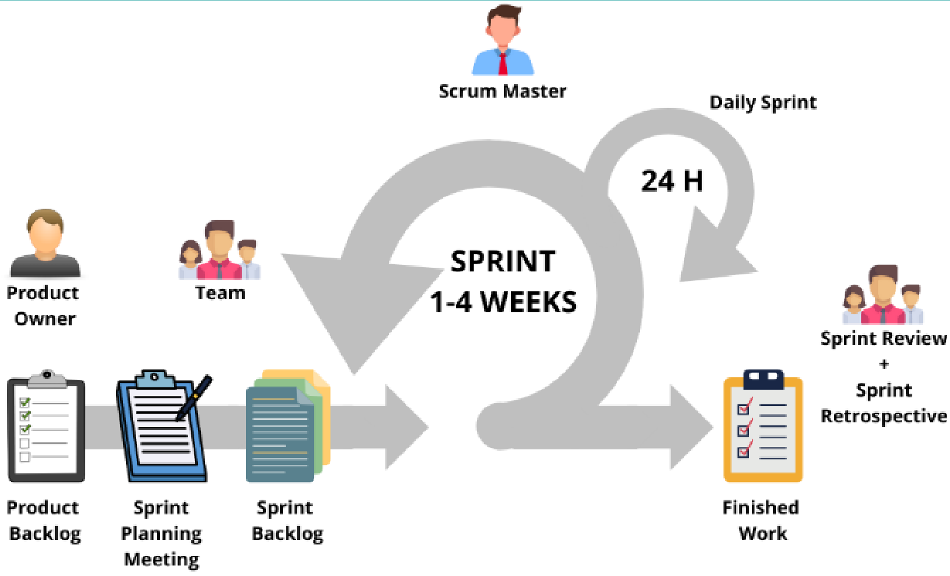

Fig. 1. Scrum System Development Model.

niadi, Setiawan, & Ginanjar (2023) applied Scrum in the development of an employee performance monitoring and reporting system based on the Balanced Scorecard. Their study emphasized that Scrum's structured development process, including sprint planning, product backlog, and sprint review, facilitates better coordination and transparency. Their findings conclude that Scrum enhances system development efficiency by providing clear task distribution, improving team collaboration, and ensuring that all functional requirements are effectively met. These findings further reinforce the suitability of Scrum for complex and iterative system development, supporting its application in this study. The Scrum-based software development method is illustrated in Fig. 1.

2.4. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is an extension of the Theory of Reasoned Action (TRA) introduced by Davis in 1989 (Kabir, et al., 2022). This model serves as a framework for better understanding user behavior regarding the acceptance and use of information systems. TAM emphasizes the importance of user attitudes toward technology by identifying three key variables: ease of use, usefulness, and user acceptance of IT (Belmonte, Prasetyo, Cahigas, Nadlifatin, & Gumasing, 2024). Perceived usefulness represents an individual's belief that using a particular information system will significantly enhance their performance (Belmonte, Prasetyo, Cahigas, Nadlifatin, & Gumasing, 2024). On the other hand, ease of use refers to the degree to which a user believes that the system is easy to use and does not require excessive effort (Wei, et al., 2025).

2.5. Digital Television Transmitter

A digital transmitter is an amplifier, which amplifies the signal before sending it (Mansour, 2025). This transmitter converts digital signals into electromagnetic waves that can be received by digital TV antennas (Hakim, Marwiyati, Wahyudin, & Kristiadi, 2022). The use of digital transmitters enables digital television broadcasting with better picture and sound quality compared to analog television. Additionally, digital transmitters allow for more efficient frequency usage, reduced energy consumption, and improved coverage, especially in rural and remote areas of Indonesia (Hakim, Marwiyati, Wahyudin, & Kristiadi, 2022). A digital transmitter consists of two main components: the exciter and the RF power amplifier (Hakim, Marwiyati, Wahyudin, & Kristiadi, 2022). The exciter is responsible for converting baseband digital signals into RF modulated signals. It also performs essential functions such as signal correction to prevent distortion during RF signal amplification (Hakim, Marwiyati, Wahyudin, & Kristiadi, 2022).

3. Methods

3.1. Data Requirements

The data requirements for developing the digital transmitter monitoring information system for TVRI Jawa Timur were obtained through direct observation and interviews with Widya Setyawan, the Head of the Surabaya Transmission Team. This study focuses specifically on the TVRI transmitter located in the Sambikerep area of Surabaya, which serves as the main broadcasting transmitter for TVRI Jawa Timur:

1) Employee Data

Table 1
Functional requirements of the system

No.	Features	Description
1	User management and authentication login	A feature for user authentication, allowing users to log into the system.
2	Transmitter machine data recording feature	A feature to manage transmitter machine data, including adding, editing, and deleting technical data related to the transmitter machine.
3	Employee data management	A feature to add, edit, and delete operator data within the system.
4	User data management	A feature to add, edit, and delete user data within the system.
5	Employee performance feature	A feature to display employee performance.
6	Report feature	A feature to add reports regarding any damage that occurs.

Employee data was collected through interviews with the head of the Surabaya transmission team and was then used to create accounts for the login process.

2) Technical Data
The technical data recorded in the monitoring system includes key parameters used to determine normal and fault conditions in transmitter monitoring. These parameters are based on the applicable standard operating procedures (SOP). This system is designed for a transmitter using the Rohde & Schwarz TX9 model. The transmitter's technical data parameters are as follows:
   a. Transmitter Temperature: The normal temperature range is 35°C - 55°C, while temperatures above 55°C are considered faulty.
   b. Transmitter Power: The optimal transmitter power is 10,000 W, while values below 7,000 W are categorized as faults.
   c. Reflect Power: A normal power reflection value is below 65 W, whereas values above 65 W are considered faults.
   d. Electric Voltage: The normal voltage range is between 380 V - 410 V, while values below 360 V or above 410 V are categorized as faults.
   e. Audio: The maximum allowable audio level is 0 dB; values above this are considered faults.
   f. Video: The image is considered normal if it appears clear. If the display is blank or distorted (stretched), it is considered faulty.

3) Report Data
Report data contains records of transmitter machine issues obtained through observations of previously submitted reports.

3.2. System Requirements Analysis

3.2.1. Functional requirements

The system's functional requirements were gathered through interviews with the head of the transmission team. The results of these interviews were summarized into several key functions that the system must have to support the monitoring of digital transmitters. The system's functional requirements are presented in Table 1.

3.2.2. Non-functional requirements

The system's non-functional requirements include an intuitive user interface that is easy for personnel to understand, minimizing the need for extensive training. Additionally, the system must be responsive and accessible from various devices, including desktops and mobile devices, ensuring flexibility in its use. Security is also a priority, ensuring that only authorized users can access the system, while unauthorized users are restricted. Each role in the system has different access rights based on their responsibilities, allowing users to interact only with features relevant to their roles.

3.3. System Design

3.3.1. System architecture

The system architecture illustrates the technical structure of the monitoring system, including how its components interact. The monitoring system architecture demonstrates how the system connects the server with user devices over the internet. The system is accessed by three main actors: Admin, Head of Transmission Team, and Transmission Operator. The system architecture diagram is shown in Fig. 2.

3.3.2. Use case diagram

The use case diagram is used to represent the developed system and its main functions (Aquino et al., 2021). This system involves three main actors: Admin, Head of the Transmission Team, and Transmission Operator. Each actor must log in first to access the features according to their assigned access rights. The system's use case diagram is shown in Fig. 3.

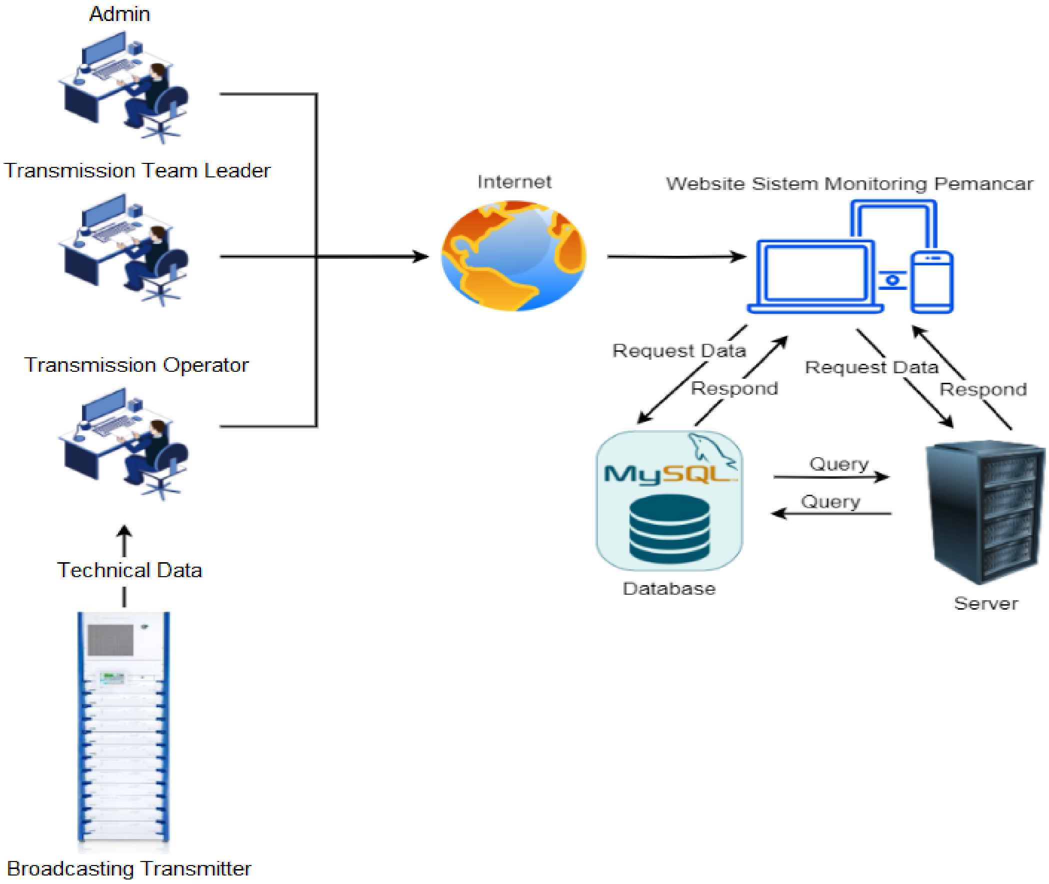

Fig. 2. Transmitter Monitoring Information System Architecture Diagram.

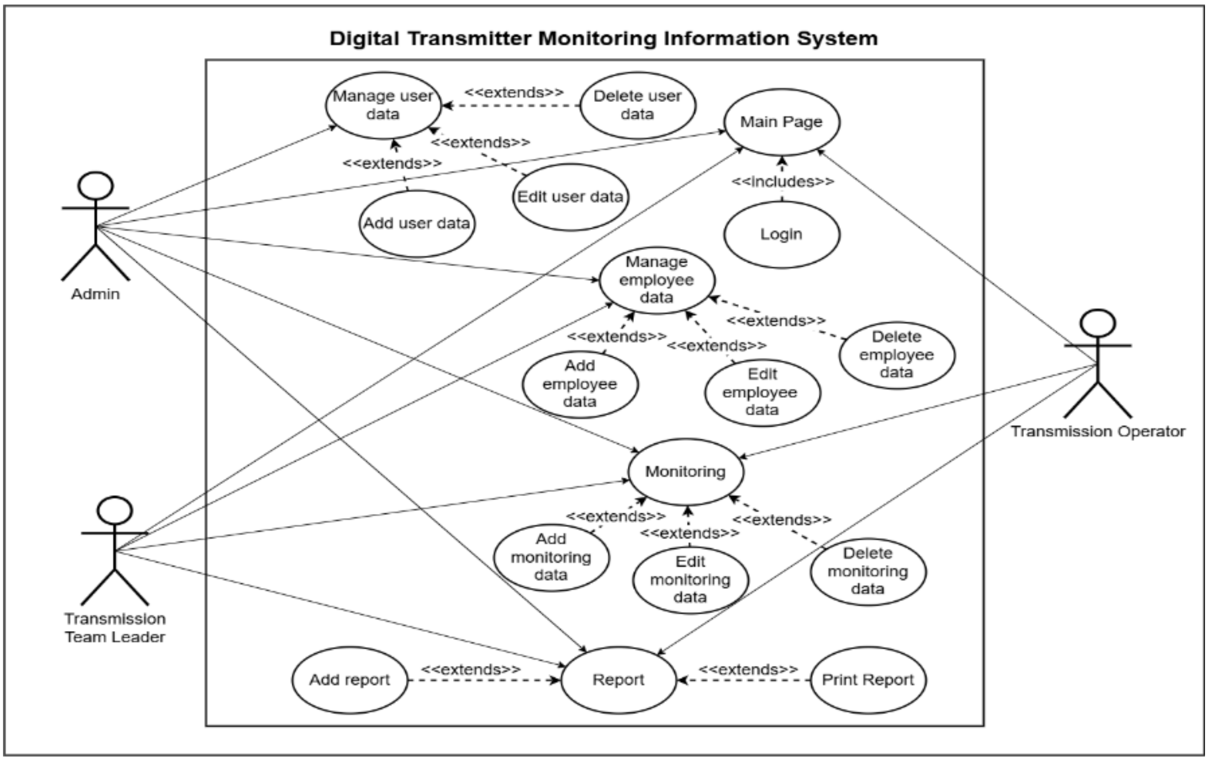

Fig. 3. Use Case Diagram of the Transmitter Monitoring Information System.

3.3.3. Class diagram

The class diagram illustrates the various classes within the system along with their respective attributes (Numa & Ohnishi, 2023). Additionally, it represents the relationships between these classes. The

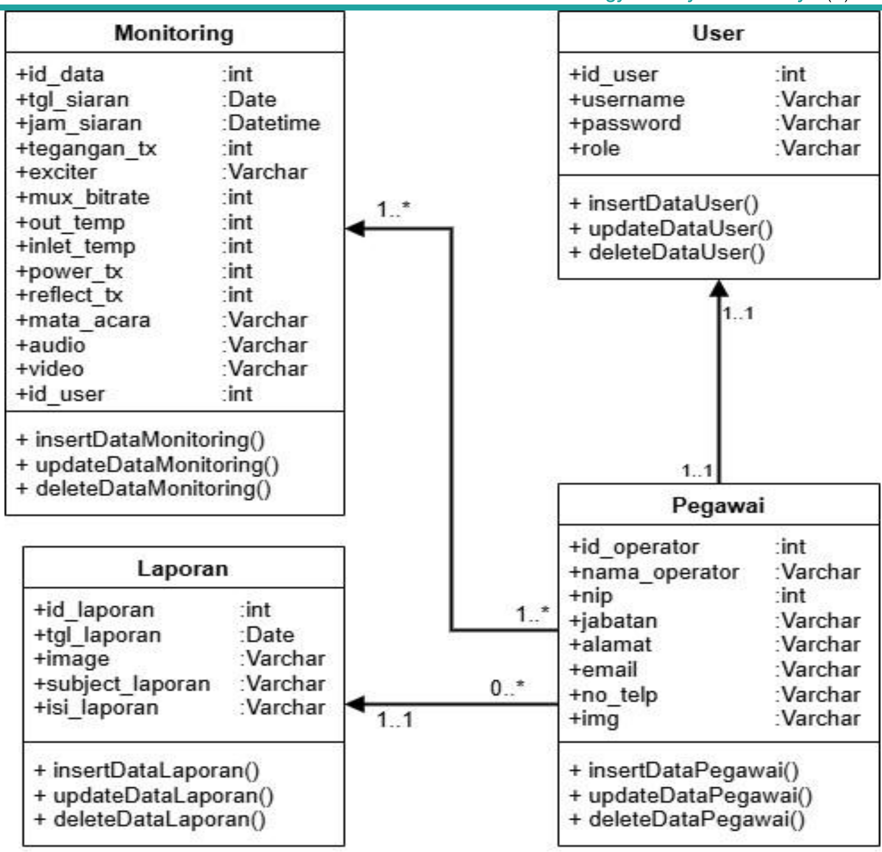

Fig. 4. Class Diagram of the Transmitter Monitoring Information System.

class diagram can also be used as a reference for designing the database structure of the system. This class diagram is specifically designed to monitor a single digital transmitter located in Sambikerep, Surabaya, and does not cover other transmitters in East Java. The class diagram for the digital transmitter monitoring information system is shown in Fig. 4.

3.4. Software and Hardware

3.4.1. Software

The Digital Transmitter Monitoring Information System at TVRI East Java was developed using the PHP programming language with the CodeIgniter framework, and using MySQL as the DBMS. Various software that supports the development and implementation process of this system include, Visual Studio Code as an IDE for writing program code, XAMPP which functions as a local web server on the developer's device, Draw.io which is used to create system diagram designs, Mockup.io as software for designing user interface prototypes.

3.4.2. Hardware

The development of the East Java TVRI Digital Transmitter Monitoring Information System utilizes several hardware, including:

1) Laptop with the following specifications:
   a. Brand: Acer Aspire E5-475G,
   b. Processor: Intel® Core™ i5-7200U CPU @ 2.5GHz ~ 3.1GHz,
   c. Memory: 12288 MB.
   d. SSD: 128 GB.
2) Mouse, helps navigation when operating the device.

4. Results and Discussion

4.1. Product Backlog Item

At the initial stage of system development, the Scrum team designs the product backlog to be implemented in the sprint for the development of the digital transmitter monitoring information system. The product backlog for the digital transmitter monitoring information system is presented in Table 2.

Table 2
Product backlog item.

No.	Backlog Item	Priority	Description
1	System Analysis and Design	P0	The process of analyzing system requirements and designing a system that meets user needs.
2	System User Interface Design	P0	The process of creating the system's user interface design.
3	User Login Authentication	P1	A feature for authenticating users who can log into the system.
4	Dashboard Page	P1	The primary page of the system.
5	Transmitter Monitoring Data Management Menu	P1	A feature to add and delete technical data related to transmitter machines.
6	Employee Data Management Menu	P1	A feature to add, edit, and delete operator data in the system.
7	User Data Management Menu	P1	A feature to add, edit, and delete user data in the system.
8	Report Menu	P1	A feature to add reports regarding occurring damages.
9	Data Export Feature	P2	A feature to export data into a downloadable format.
10	Profile Management Menu	P2	A feature to edit user data in the system.
11	Employee Performance Feature	P2	A feature to display employee performance.

Table 3
First Sprint

No	Backlog item	Task	Estimation (Days)
1.	System Analysis and Design	1. Create Business Process. 2. List Functional and Non-Functional Requirements. 3. Create Block Diagram. 4. Create Process Model.	5
2.	System User Interface Design	1. Create Design System User Interface.	2

Table 4
Second Sprint

No	Backlog item	Task	Estimation (Days)
1.	User Login Authentication	1. Create User Login Feature.	1
2.	Dashboard Page	1. Create Main Dashboard for Admin. 2. Create Main Dashboard for Team Leader. 3. Create Main Dashboard for Operator.	3
3.	Transmitter Monitoring Data Management Menu	1. Create Feature to Add Transmitter Machine Data. 2. Create Feature to Edit Transmitter Machine Data. 3. Create Feature to Delete Transmitter Machine Data.	3
4.	Employee Data Management Menu	1. Create Feature to Add Operator Data. 2. Create Feature to Edit Operator Data. 3. Create Feature to Delete Operator Data.	3
5.	User Data Management Menu	1. Create Feature to Add User Data. 2. Create Feature to Edit User Data. 3. Create Feature to Delete User Data.	3
6.	Report Menu	1. Create Feature to Add Reports. 2. Create Feature to Delete Reports. 3. Create Feature to Edit Reports.	3

Table 5
Third Sprint

No	Backlog item	Task	Estimation (Days)
1.	Data Export Feature	1. Create Feature to Export Data into a Downloadable Format.	3
2.	Profile Management Menu	1. Create User Profile Page.	2
3.	Employee Performance Feature	1. Create Employee Performance Page.	2

4.2. Sprint Planning

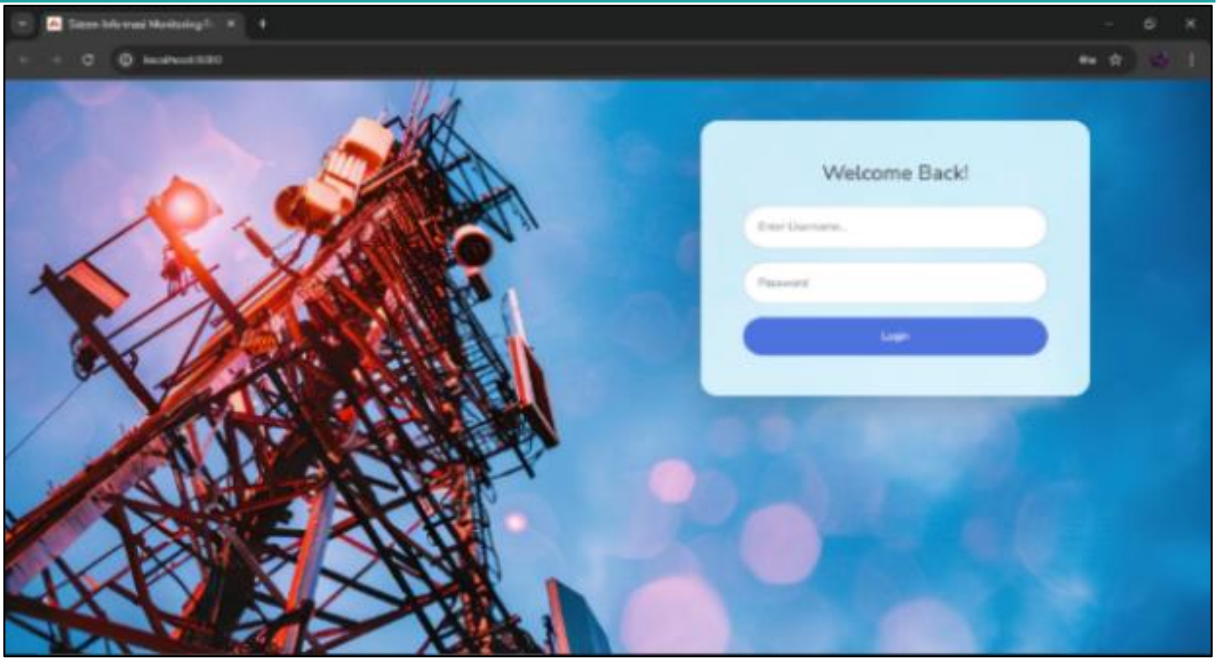

Fig. 5. Login page.

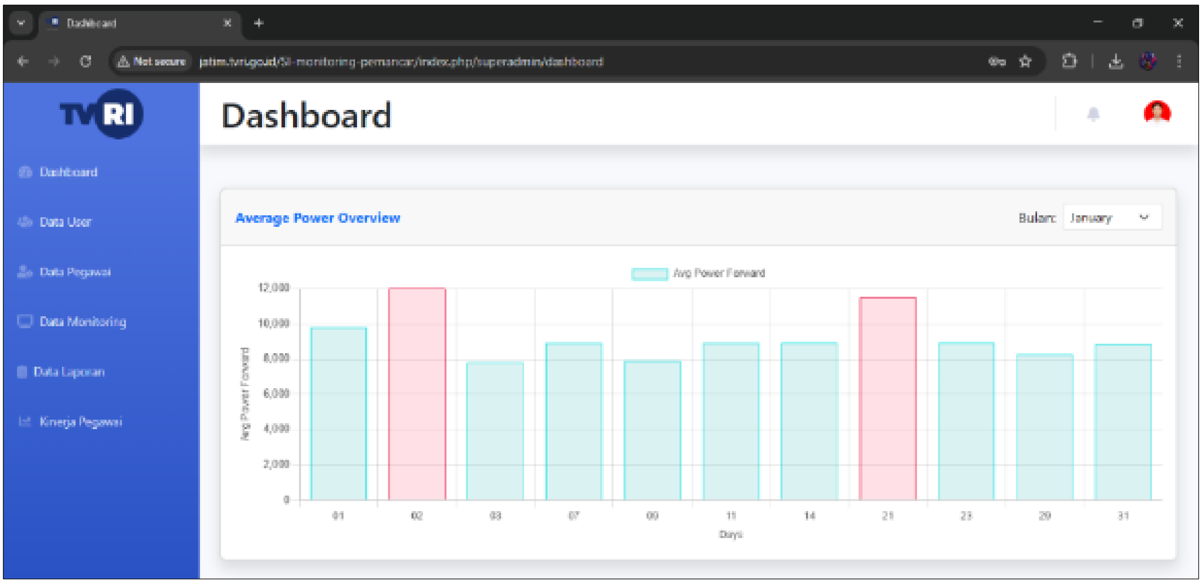

Fig. 6. Dashboard.

Before starting system development, the Scrum team conducts a sprint planning session lasting approximately two hours to plan the key features that will be implemented across three separate sprints. The task details for each sprint are outlined in Table 3, Table 4, and Table 5.

4.3. Sprint Development

The development of the Digital Transmitter Monitoring Information System is carried out using the CodeIgniter framework and the PHP programming language, implemented as a web-based application. It's specifically designed to monitor the Sambikerep transmitter in Surabaya. The results of the system implementation can be seen in Figures 5, 6, 7, and 8. Figure 5 shows the Login Page, where users authenticate themselves before accessing the system. Figure 6 displays the Dashboard, which provides an overview of system status, and navigation options. Figure 7 presents the Monitoring Page, which is designed to facilitate users in monitoring transmitter data. On this page, users can view information related to transmitter status, such as voltage levels, transmitter temperature, transmitter power, as well as audio and video quality. This feature helps ensure that the broadcasting system operates within optimal parameters and allows for early detection of potential issues. Finally, Figure 8 illustrates the Reports Page, which enables

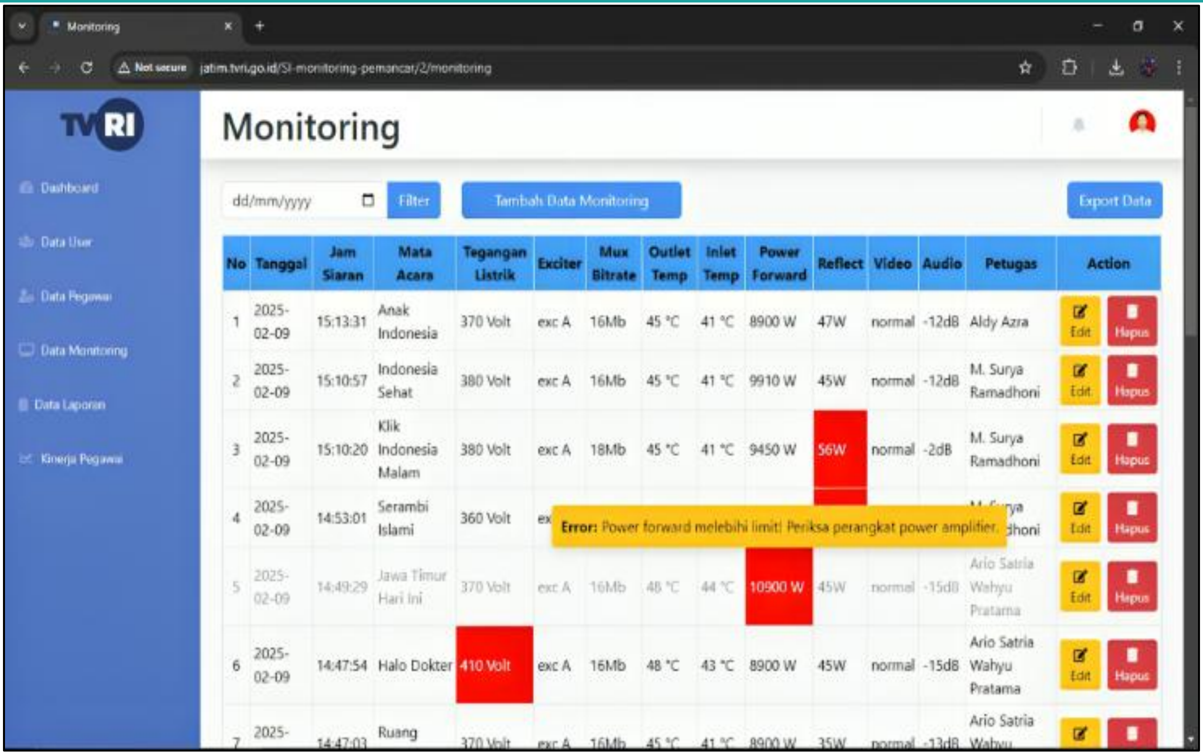

Fig. 7. Monitoring page.

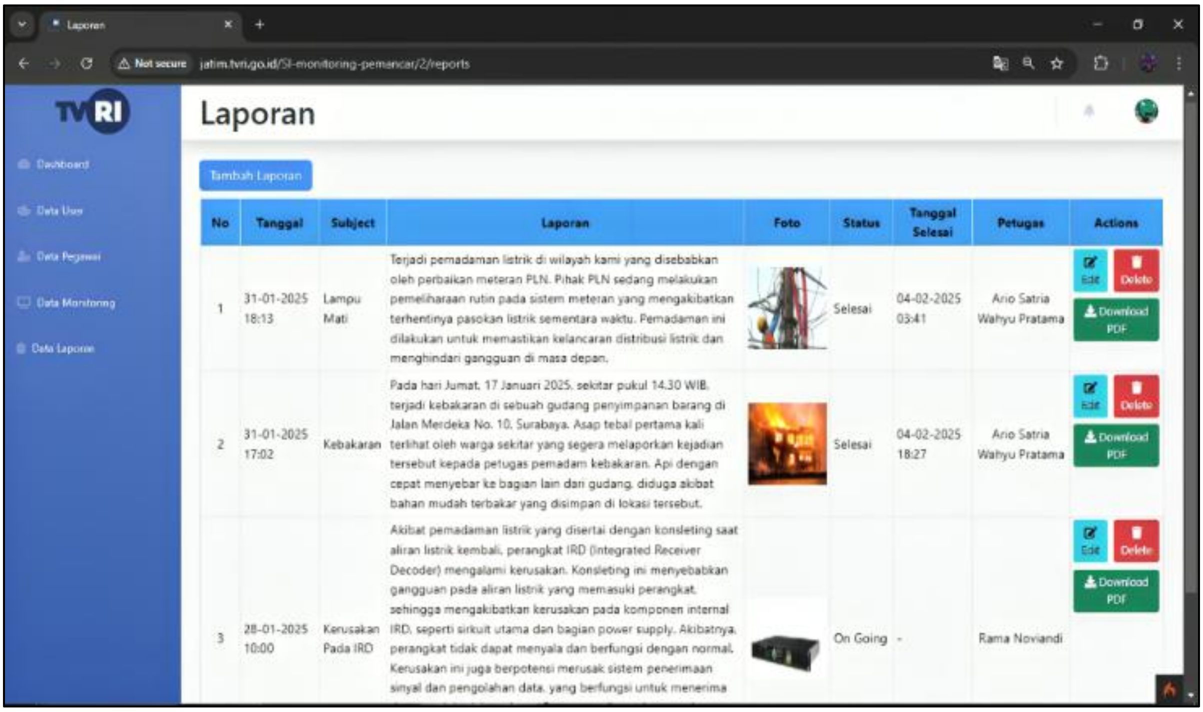

Fig. 8. Monitoring report page.

users to generate and review reports on transmitter performance and recorded incidents.

4.4. Daily Scrum

During the sprint process, daily discussions are conducted in the daily Scrum stage, lasting between 1 to 15 minutes. In this session, each team member reports on the progress of their tasks, plans for upcoming work, and any obstacles encountered during task execution. These discussions enable early identification of issues and facilitate quick decision-making to keep the development process on track (Katic, 2024). The daily scrum in this study are presented in Table 6.

Table 6
Daily Scrum

Sprint	Date	What was done today?	What obstacles were encountered?
First Sprint	October 1, 2024	Created a list of functional and non-functional requirements based on the user story	-
	October 2, 2024	Created the business process	-
	October 3, 2024	Created the block diagram	-
	October 4, 2024	Created the system flowchart	Revisions were required regarding the addition of the super admin actor.
	October 5, 2024	Created the Use Case diagram, sequence diagram, and class diagram	Encountered difficulties in determining actors, leading to the discovery that the super admin actor had not been included in the diagram.
	October 6, 2024	Revised the Use Case diagram	-
	October 7, 2024	Created the activity diagram	Adjusted the activity diagram by adding an activity diagram for the super admin role.
	October 8, 2024	Designed the system database	Adjusted the user table by adding roles to support multi-level features.
	October 9, 2024	Designed the system interface	Added interface design for the dashboard section.
	October 10, 2024	Added additional interface designs	-
Second Sprint	January 1, 2025	Create a login feature for users	The page still displays the same dashboard for all roles.
	January 2, 2025	Create the main page for the super admin	-
	January 3, 2025	Create the main system page for the team leader and operator	-
	January 4, 2025	Design a power transmitter graph display on the dashboard menu	Unable to display data because the monitoring page has not been created.
	January 5, 2025	Create a monitoring page for transmitter technical data	Unable to display monitoring data because the monitoring data has not been added.
	January 6, 2025	Develop CRUD features for transmitter technical data	-
	January 7, 2025	Create a user management page	-
	January 8, 2025	Develop CRUD features for user data	User data cannot be added because employee data is not available.
	January 9, 2025	Create an employee management page	-
	January 10, 2025	Develop CRUD features for employee data	-
	January 11, 2025	Create a reports page	-
	January 12, 2025	Develop CRUD features for report data	-
	January 13, 2025	Conduct testing on all main features	-
Third Sprint	January 20, 2025	Create a data export feature	The exported data cannot include images.
	January 21, 2025	Continue progress on the data export feature	-
	January 22, 2025	Create a user profile page	-
	January 23, 2025	Develop an edit user data feature	-
	January 24, 2025	Create an employee performance feature	There is no data filter for monitoring yet.
	January 25, 2025	Continue progress on the employee performance feature	-
	January 26, 2025	Conduct testing on each additional feature	-

4.5. Sprint Review

Table 7
Sprint Review

No	Backlog item	Estimation (Days)	Actual Progress (Days)	Review
1.	System Analysis and Design	5	6	The system design meets user requirements, although an evaluation led to the addition of a role feature, requiring database design updates. This caused the process to take longer than the estimated time.
2.	System User Interface Design	2	2	The user interface design was completed on time and met expectations. No significant updates or changes were required.
3.	User Login Authentication	1	1	The login authentication feature was completed on time as estimated.
4.	Dashboard Page	3	3	The dashboard page was completed as planned, although it initially could not display the transmitter power graph due to the absence of the monitoring page. However, this was successfully implemented once the monitoring menu was completed.
5.	Transmitter Monitoring Data Management Menu	3	2	The monitoring menu functioned as expected. Despite initial issues with data not being displayed, all problems were resolved without the need for additional tasks in the next sprint.
6.	Employee Data Management Menu	3	2	The employee management menu was completed ahead of schedule and worked well without significant issues.
7.	User Data Management Menu	3	2	The user data management menu was also completed earlier than expected, although there were challenges in adding new users, which was not initially possible.
8.	Report Menu	3	2	The report menu was completed faster than estimated and met all requirements. It displayed reports properly without any issues.
9.	Data Export Feature	3	2	The data export feature was completed ahead of schedule. Although there was an issue where images did not appear in the export results, this was resolved without requiring additional tasks in the next sprint.
10.	Profile Management Menu	2	2	The user profile management feature was completed on time and functioned as expected without issues.
11.	Employee Performance Feature	2	2	The employee performance feature was also completed on time and successfully displayed employee performance data for monitoring activities.

During the sprint review process, the Scrum team evaluates the completed work from the sprint. The team presents the finished features and discusses with the product owner whether they meet expectations and requirements. The sprint review in this study is summarized in Table 7.

4.6. Sprint Retrospective

During the sprint retrospective process, the scrum team reflects on the work process during the recently completed sprint. The team discusses what went well, the challenges faced, and the steps that can be taken to improve performance in the next sprint. The results of the sprint retrospective are presented in the following Table 8. With the completion of the main and additional features, the entire process can be combined into a complete system that is ready to be tested.

4.7. Testing

Based on the results of black-box testing, the system has been verified to function as expected, ensuring that all implemented features work correctly according to the predefined requirements. The detailed outcomes of the testing process can be seen in Table 9.

4.8. System Evaluation Model

The system evaluation model in this study uses the Technology Acceptance Model (TAM). The TAM method is applied by distributing questionnaires to system users to measure the acceptance and effectiveness of system implementation. The questionnaire consists of five (5) perceived usefulness questions, as shown in Table 10, and five (5) perceived ease of use questions, as shown in Table 11.

The TAM evaluation was conducted with ten (10) respondents, consisting of seven (7) transmission

Table 8
Sprint Retrospective

No	Sprint	Retrospective Results	Evaluation for the Next Sprint
1.	First Sprint	1. All backlog items for the first sprint were successfully completed, but took longer than scheduled. 2. Despite many changes, the workflow during system analysis and design ran smoothly and aligned with requirements.	1. Involve End Users in Early Reviews to ensure that system requirements are fully met. 2. Plan Time More Precisely by detailing the schedule and estimating the duration of each task more accurately.
2.	Second Sprint	1. The main planned features were implemented faster than expected. Although some features were delayed, they did not extend the overall project timeline. 2. The developed features were thoroughly tested using black-box testing to ensure proper functionality.	1. Ensure Continuous Testing not only after implementation but also during the development process to detect issues earlier. 2. Improve Test Documentation to make testing results more structured and easily accessible to the development team.
3.	Third Sprint	1. Despite some challenges, the planned features were successfully implemented within the scheduled time. 2. All developed features were comprehensively tested and functioned as expected. Each completed feature was immediately verified to ensure its functionality.	-

Table 9
Black-box testing

No.	Features	Expected Result	Result
1	Login with User-Specific Access Rights	User can log in to the system according to their respective roles.	Correct
2	Login with Incorrect Username and Password	User cannot log in to the system.	Correct
3	Display Super Admin Dashboard	If the user role is super admin, the super admin dashboard will be displayed.	Correct
4	Display Team Leader Dashboard	If the user role is team leader, the team leader dashboard will be displayed.	Correct
5	Display Operator Dashboard	If the user role is operator, the operator dashboard will be displayed.	Correct
6	Add Monitoring Data	Monitoring data is added to the system and displayed on the monitoring page.	Correct
7	Edit Monitoring Data	Monitoring data is successfully updated and displayed on the monitoring page with the latest data.	Correct
8	Delete Monitoring Data	Monitoring data is deleted from the database and no longer displayed on the monitoring page.	Correct
9	Display Monitoring Data Based on Selected Date	Monitoring data is displayed according to the specified date.	Correct
10	Add User Data	User data is successfully added and displayed on the user management page.	Correct
11	Edit User Data	User data is successfully updated and displayed on the user management page with the latest data.	Correct
12	Delete User Data	User data is deleted from the system and no longer displayed on the user management page.	Correct
13	Add Employee Data	Employee data is successfully added and displayed on the employee management page.	Correct
14	Edit Employee Data	Employee data is successfully updated and displayed on the employee management page with the latest data.	Correct
15	Delete Employee Data	Employee data is deleted from the system and no longer displayed on the employee management page.	Correct
16	Add Report	Report data can be added to the system and	Correct

(continued on next page)

Table 9. *(continued)*

No.	Features	Expected Result	Result
		displayed on the report page.	
17	Edit Report	Report data is successfully updated and displayed on the report page with the latest data.	Correct
18	Delete Report	Report data is successfully deleted from the database and no longer displayed on the report page.	Correct
19	Display User Profile Page	The employee profile page is displayed with data from the logged-in user.	Correct
20	Edit User Profile	Employee data is successfully updated and displayed on the profile page with the latest data.	Correct
21	Export Monitoring Data	Selected monitoring data based on the date range is successfully exported to PDF format.	Correct
22	Export Report Data	Selected report data is successfully exported to PDF format.	Correct
23	Employee Performance Menu	Employee performance in monitoring is displayed.	Correct

Table 10
Perceived usefulness questions

No.	Variables	Questions
1.	PU1	This system helps me complete tasks faster.
2.	PU2	This system improves my work productivity.
3.	PU3	This system makes my work more effective.
4.	PU4	This system helps organize work better.
5.	PU5	This system assists in decision-making.

Table 11
Perceived ease of use questions

No.	Variables	Questions
1.	PEOU1	The system is easy to learn.
2.	PEOU2	The system is easy to operate.
3.	PEOU3	The system's interface is easy to understand.
4.	PEOU4	The system's menus are easy to access.
5.	PEOU5	The system provides clear error messages.

Table 12
Results of the perceived usefulness questionnaire

No.	Name	Age	Score					Value
			PU1	PU2	PU3	PU4	PU5	
1.	Widya Setyawan	50	4	3	4	4	3	18
2.	Rama Noviandi P.	34	4	3	3	3	3	16
3.	Rachmad Fikri D. P.	25	3	4	3	4	3	17
4.	Ahmad Zaki Farid	24	4	3	4	4	3	18
5.	M. Surya Romadhoni	24	4	3	4	4	3	18
6.	Hapsoro C. Guritno	24	3	3	4	3	3	16
7.	Aldy Azra Al Ayubi	23	3	3	4	3	3	15
8.	Ryo Rizky Aries F.	36	4	3	4	3	3	18
9.	Aditya Wijaya Santosa	30	3	4	3	3	3	16
10	Rijal Fakih	20	3	3	4	4	3	17
		Total						169
		Persentase						84.5%

employees at TVRI East Java and three (3) IT technicians from TVRI East Java. The number of respondents was determined based on the limited number of transmission employees working at TVRI East Java, especially in Surabaya, which only has seven (7) employees. To complement the evaluation, the testing also involved IT technicians who have a technical understanding of the system. The evaluation results for perceived usefulness are shown in Table 12, while the evaluation results for perceived ease of use are presented in Table 13.

5. Conclusions

The research results indicate that the Digital Transmitter Monitoring Information System has successfully addressed the issues faced by TVRI East Java. With this system, 87.5% of respondents felt

Table 13
Results of The Perceived Ease of Use Questionnaire

No.	Name	Age	Score					Value
			PEOU1	PEOU2	PEOU3	PEOU4	PEOU5	
1.	Widya Setyawan	50	4	3	3	3	4	17
2.	Rama Noviandi P.	34	4	3	4	3	3	17
3.	Rachmad Fikri D. P.	25	4	3	4	3	4	18
4.	Ahmad Zaki Farid	24	4	4	3	3	4	18
5.	M. Surya Romadhoni	24	4	3	4	3	4	18
6.	Hapsoro C. Guritno	24	4	3	4	2	4	17
7.	Aldy Azra Al Ayubi	23	4	3	4	2	3	16
8.	Ryo Rizky Aries F.	36	4	3	4	3	4	18
9.	Aditya Wijaya Santosa	30	4	3	3	3	3	16
10.	Rijal Fakih	20	4	4	4	3	3	18
			Total					173
			Persentase					86.5%

that they could complete their tasks more quickly, while 90% of respondents found that the system provided clear error messages, making it easier for technicians to analyze faults. Additionally, black-box testing proved that the system functions according to the required specifications without significant errors. Overall, the system was well received by users, with a Perceived Usefulness score of 84.5% and a Perceived Ease of Use score of 86.5%. These results demonstrate that the system effectively meets existing challenges and is regarded as both beneficial and easy to use.

For future development, the system needs to be improved to manage the entire transmitter monitoring and data management process more efficiently. Some aspects to consider include the integration of IoT devices for automated data collection and the implementation of electronic signatures to enhance security and validate fault reports.

6. Declaration of AI and AI assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT in order to translate the manuscript from Indonesian to English and to improve its grammar and clarity. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

7. Credit Authorship Contribution Statement

Ario Satria Wahyu Pratama: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Project Administration, Resource, Software, Visualization and Writing – Original Draft. **Ratna Nur Tiara Shanty**: Conceptualization, Formal Analysis, Investigation, Methodology, Project Administration, Supervision, Validation and Writing – Review & Editing. **Cempaka Ananggadipa Swastyastu**: Conceptualization, Formal Analysis, Investigation, Methodology, Project Administration, Supervision, Validation and Writing – Review & Editing.

8. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

9. Acknowledgments

The author expresses sincere gratitude to LPP TVRI Jawa Timur for providing the opportunity to conduct research and develop the monitoring system for digital transmitters. Appreciation is also extended to all employees of LPP TVRI Jawa Timur for their assistance during the research activities. It is hoped that this work can contribute to the improvement of monitoring systems at LPP TVRI Jawa Timur.

10. Data Availability

Data will be made available on request.

11. References

Belmonte, Z. J., Prasetyo, Y. T., Cahigas, M. M., Nadlifatin, R., & Gumasing, M. J. (2024). Factors influencing the intention to use e-wallet among generation Z and millennials in the Philippines: An extended technology acceptance model (TAM) approach. *Acta Psychologica, 250*. doi:https://doi.org/10.1016/j.actpsy.2024.104526

Dewi, I. K., & Chairun, R. (2022). Sistem Informasi Monitoring Perbaikan dan Perawatan Pada Divisi Mekanik PT. XYZ. *JR: Jurnal Responsive Teknik Informatika, 6*(1), 49-61. doi:https://doi.org/10.36352/jr.v6i01.552

Eiter, S., Fjellstad, W., & Schaik, L. V. (2025). Monitoring sustainability of urban agriculture: Who is going to do it and how? *Landscape and Urban Planning, 257*. doi:https://doi.org/10.1016/j.landurbplan.2025.105300

Hakim, A., Marwiyati, M., Wahyudin, A., & Kristiadi, D. (2022). Penerapan Teknologi Siaran Digital Bagi LPP TVRI Jawa Timur. *Jurnal Heritage, 10*(1), 59-71. doi:https://doi.org/10.35891/heritage.v10i1.3196

Herdiansah, A., Borman, R. I., & Maylinda, S. (2021). Sistem Informasi Monitoring dan Reporting Quality Control Proses Laminating Berbasis Web Framework Laravel. *Jurnal Tekno Kompak, 15*(2), 13-24. doi:https://doi.org/10.33365/jtk.v15i2.1091

Kabir, K. H., Hassan, F., Mukta, M. Z., Roy, D., Darr, D., Leggette, H., & Ullah, S. A. (2022). Application of the technology acceptance model to assess the use and preferences of ICTs among field-level extension officers in Bangladesh. *Digital Geography and Society, 3*. doi:https://doi.org/10.1016/j.diggeo.2022.100027

Kadenic, M. D., Pacheco, D. A., Koumaditis, K., Tjørnehøj, G., & Tambo, T. (2023). Investigating the role of Product Owner in Scrum teams: Differentiation between organisational and individual impacts and opportunities. *Journal of Systems and Software, 206*. doi:https://doi.org/10.1016/j.jss.2023.111841

Katic, M. (2024). Effects of Daily Scrum Meeting on Software Quality–Open Questions. *Proceedings of the Eleventh Workshop on Software Quality Analysis, Monitoring, Improvement, and Applications. 3845.* Novi Sad, Serbia: CEUR-WS. Retrieved 8 15, 2025, from https://ceur-ws.org/Vol-3845/paper24.pdf

Kurniadi, D., Setiawan, R., & Ginanjar, G. P. (2023). Development of Information System Monitoring and Reporting on Company Employee Performance Using Balanced Scorecard and Scrum. *JATISI (Jurnal Teknik Informatika dan Sistem Informasi), 10*(1), 366-380. doi:https://doi.org/10.35957/jatisi.v10i1.3168

Lawong, D. A., & Akanfe, O. (2025). Overcoming team challenges in project management: The scrum framework. *Organizational Dynamics, 54*(1). doi:https://doi.org/10.1016/J.ORGDYN.2024.101073

Mansour, M. (2025). A mm-Wave On-Off-Keying radio transmitter with 10 GHz bandwidth employing 130 nm CMOS. *Ain Shams Engineering Journal, 16*(3). doi:https://doi.org/10.1016/j.asej.2025.103328

Nasution, N., Darmayunata, Y., & Wahyuni, S. (2022). Information System Design for Monitoring and Evaluation of Learning on Blended Learning. *Al-Ishlah: Jurnal Pendidikan, 14*(2), 1633-1644. doi:https://doi.org/10.35445/alishlah.v14i2.1368

Numa, Y., & Ohnishi, A. (2023). Supporting change management of UML class diagrams. *Procedia Computer Science, 225*, 208-217. doi:https://doi.org/10.1016/j.procs.2023.10.005

Purnama, D. H., Purwanto, P., & Herdiyanto, H. (2023). Pembangunan Sistem Informasi Monitoring Karyawan pada Bagian Logistik di PT. Mowilex Indonesia. *Zonasi: Jurnal Sistem Informasi, 5*(1), 111 - 125. doi:https://doi.org/10.31849/zn.v5i1.12831

Ramadaniah, D., Fitra, J., Satria, F., & Zidane, E. Y. (2022). Design of Library Information System Based on Framework Code Igniter Case Study of Instidla. *Asia Information System Journal (AISJ), 1*(1), 15-20. doi:https://doi.org/10.24042/aisj.v1i1.13622

Santos, R., Piqueiro, H., Dias, R., & Rocha, C. D. (2024). Transitioning trends into action: A simulation-based Digital Twin architecture for enhanced strategic and operational decision-making. *Computers & Industrial Engineering, 198*. doi:https://doi.org/10.1016/j.cie.2024.110616

Setiawan, D., Fatimah, F., & Primasari, D. (2023). Pengembangan Sistem Informasi Duta Inovasi Desa Berbasis WEB Menggunakan Metode Scrum. *Processor: Jurnal Ilmiah Sistem Informasi, Teknologi Informasi dan Sistem Komputer, 18*(1), 26-39. doi:https://doi.org/10.33998/processor.2023.18.1.191

Wei, W., Prasetyo, Y. T., Belmonte, Z. J., Cahigas, M. M., Nadlifatin, R., & Gumasing, M. J. (2025). Applying the technology acceptance model – Theory of planned behavior (TAM-TPB) model to study the acceptance of building information modeling (BIM) in green building in China. *Acta Psychologica, 254*. doi:https://doi.org/10.1016/j.actpsy.2025.104790