Development of Worker Network Information System at the Batu City Manpower Using the Prototyping Method

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Abstract: The unemployment rate in Indonesia continues to pose significant social and economic challenges, requiring government initiatives such as job training programs. However, administrative processes that still rely on Google Forms lead to several issues, including data duplication (19 duplicates out of 598 registrations or 3.2%), slow verification procedures (24–32 working hours per period), and limited real-time monitoring. This study focuses on developing a digital job training module integrated with the Worker Network Information System (SiJoker) at the Batu City Manpower Office. The system was developed using the Prototyping method through three iterative cycles with direct user involvement, allowing the solution to be refined according to actual operational needs. The module includes participant registration, training management, and document validation features. System evaluation was conducted using Black Box Testing with 19 functional scenarios covering account management, training management, document management, verification, and reporting. The test results confirmed valid outputs for all scenarios without any critical errors. User evaluation by three staff members also validated system feasibility, particularly the effectiveness of explicit document status indicators, simplified navigation, and enhanced system responsiveness through optimized database queries.

Keywords: Information System, Job Training, Prototyping, Black Box Testing, Digital Transformation.

1. Introduction

Unemployment remains a crucial issue in Indonesia because it affects national productivity, economic development, and community welfare, with impacts on a decline in potential state revenue, investment interest, an increase in poverty rates, and potential social tensions [1]. The government is trying to tackle this problem through various job training programs designed to improve skills and expand job opportunities for the community [2]. However, the implementation of these programs at the regional level still faces obstacles, mainly due to administrative processes that are not yet fully digital and coordination between units that is not yet optimal [3].

Digital transformation in government systems requires not only technological readiness, but also competent human resources and regulations that support its sustainable implementation [4]. The use of information systems for data collection and public service management has been proven to increase time efficiency and reduce complexity in administrative processes [5]. The Batu City Manpower Office has provided the Manpower Network Information System (SiJoker) as a platform for employment services, including for managing training activities. However, the training module in the system is still run manually through Google Forms, which

has given rise to various operational problems. Based on a recapitulation of registration data through Google Forms for the period April to August 2025, there were 598 registration responses. From the results of manual verification, 19 duplicate data (3.2%) were found, caused by double registration and variations in the spelling of participants' names. The verification and validation process is still carried out manually by officers, requiring approximately 24–32 working hours or the equivalent of 3–4 working days to complete the verification of all registration data per period. When data duplication or discrepancies are found, the verification time must be extended, which ultimately slows down the entire administrative process. On average, there are 5 cases per batch that experience verification delays exceeding the standard time, which has an impact on decreasing service efficiency and participant satisfaction levels. In addition, the Google Form-based system, which is separate from the main SiJoker system, causes a lack of data integration and difficulties in monitoring progress in real-time.

The Prototyping method is an effective approach in information system development because it allows the development process to be carried out in stages by involving user feedback in each cycle [6]. Previous studies have shown that adding new modules to an operating system can increase efficiency without disrupting the main functions that are already running [7]. A good training information system should be able to handle participant data management, schedule arrangements, and evaluation in an integrated manner [8]. However, the application of the Prototyping method to integrate job training modules into existing employment service systems, especially at the local government level, is still rarely discussed. This study aims to develop a digital job training module integrated with SiJoker at the Batu City Manpower Office using the Prototyping method. The novelty of this study lies in its integrated approach, which is designed to overcome data duplication issues, accelerate the verification process from 3–4 working days to a more efficient centralized digital verification system, and strengthen real-time monitoring and evaluation capabilities. With the implementation of this integrated system, the research is expected to support the acceleration of digital transformation of public services in the employment sector and increase the effectiveness of job training programs.

2. Literature Review

Research on the development of information systems using the Prototyping method has been conducted in various fields and shows that this approach is effective in producing interactive systems that are able to adapt to user needs. In a study on the development of an e-KTP registration application, the Prototyping method enabled the creation of a prototype that was able to meet the functional requirements of the application [9]. Meanwhile, in the realm of public services, the application of the same method to a public complaint information system has been proven to increase data management efficiency while accelerating the handling of complaints [10]. In the tourism sector, Prototyping is also used in the development of geographic information systems that can present tourist attraction mapping effectively and efficiently [11]. To provide a more systematic overview of the position of this study in relation to previous studies, a comparison of the focus of studies using the Prototyping method can be seen in the following table.

Table 1. Comparison with Previous Research

No	Researcher & Year	Research Object	Main Focus
1	Kurniawan & Suharso (2024) [9]	e-KTP Registration Application	Development of a new system for online e-KTP registration
2	Jonathan & Suharso (2024) [10]	Public Complaint Information System	Efficiency in managing and monitoring complaints
3	Podomi et al. (2024) [11]	Tourism Geographic Information System	Mapping and tourist attraction information

Based on the table above, previous research has generally focused on developing new, stand-alone systems and has not yet addressed module integration into existing systems. Important aspects such as data duplication management and real-time validation have also been under-explored. This research addresses this gap by integrating a digital job training module into SiJoker at the Batu City Manpower Office. This integration approach aims to address data duplication issues, accelerate the verification process from 3–4 working days through a centralized digital verification system, and strengthen real-time monitoring and evaluation capabilities to improve the efficiency of job training services.

3. Methods

This study used a software engineering approach with the Prototyping method to develop a digital job training module on SiJoker at the Batu City Manpower Office. This method was chosen because it is iterative and involves users directly in each stage of development. User involvement allows the system to be adjusted based on the feedback obtained, resulting in a product that is more suited to operational and functional needs [12]. This study was conducted over a period of two months. The research activities followed the stages in the prototyping cycle as shown in the following figure.
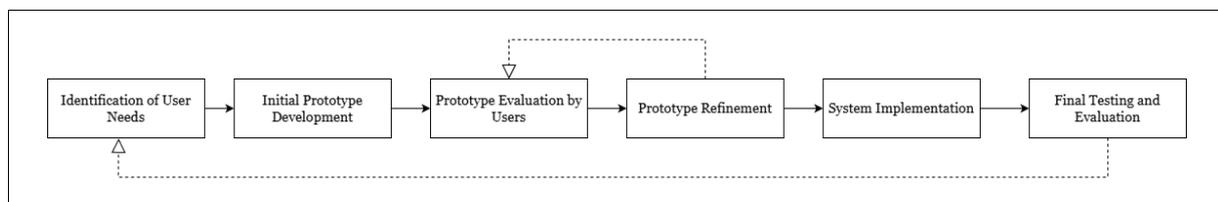

Figure 1. Prototyping Method Flow

The development process involved six main stages, each iterative and responsive to user needs. Three iterations of prototype evaluation and refinement were conducted until implementation feasibility criteria were met. Each stage was designed to ensure the resulting system met the established functional and non-functional specifications. The research stages were as follows.

a. **User Needs Identification**. The initial stage began with analyzing the system used and identifying the obstacles experienced by administrators and users [13]. Data was collected through interviews with Batu City Manpower Office staff and observation of the registration process, which still used Google Forms. Analysis was conducted on the workflow, operational obstacles, and requirements for a new system to identify the main problems in the current system. Based on the results of this identification, system requirements were formulated into functional requirements that focused on the main features of the system and non-functional requirements that emphasized quality, such as ease of use of the interface and processing time efficiency [14]. The next step was to design the system logic using a use case diagram as a model of user interaction with the system [15].

b. **Initial Prototype Development**. Based on the results of the requirements analysis, an initial prototype of the management system was developed, beginning with the design of a database structure using ERD to represent entities and relationships between data in the system. ERD serves to model the organization's data requirements by visually depicting the relationships between entities [16]. The initial prototype includes basic features such as training registration, participant document verification, and training data management with a simple interface that represents the main workflow.

c. **Prototype Evaluation by Users**. The prototype was tested through live demonstrations to three staff members of the Batu City Manpower Office who manage job training programs.

Each respondent carried out three main task scenarios, namely adding training data, verifying participant documents, and managing training data. The evaluation was conducted through semi-structured interviews lasting 30–45 minutes to assess feature suitability, ease of use, and workflow completeness. Respondents provided feedback on the clarity of interface elements, the need for document status feedback, and the efficiency of the system workflow. All input was recorded in interview transcripts and used as the basis for prototype improvements in the next stage.

d. **Prototype Refinement**. Based on the results of the previous evaluation stage, user input was used to gradually refine the functions, process flow, and interface display until the prototype met the implementation feasibility standards. The refinement was carried out through three iteration cycles, which included improving document status, enhancing interface clarity, and optimizing system performance. These improvements ensured that all key features functioned properly and were in line with the agency's operational procedures. The prototype was then deemed feasible for implementation after all criteria were met and confirmed by the respondents [17].

e. **System Implementation**. Based on the refined prototype, the next implementation stage was carried out using PHP with the Laravel framework through the Laragon environment. All features that had been designed were built with security [18, performance, and scalability in mind. The training registration module was then integrated with the SiJoker system to maintain consistency of function.

f. **Final Testing and Evaluation**. The final stage was system testing using the Black Box Testing method to ensure that all functions ran according to specifications [19]. A total of 19 functional testing scenarios were run, covering all key features such as account management, training management, document management, verification, and reporting. This testing ensures that the system functions according to operational requirements. In addition, non-functional aspects such as responsiveness and stability were also observed to validate the optimization results carried out in the previous iteration stage. Analysis of the test results shows that the system is free from critical errors and meets all specified functional requirements, with all 19 scenarios yielding valid results.

4. Results and Discussion

a. User Needs Identification

Based on interviews with staff from the Batu City Manpower Office and observations of the training administration process, it was found that the registration process is still carried out manually using Google Forms. Training information is published on social media, participants fill out the form, then the administrator views the response data on Google Forms, verifies the documents via WhatsApp, and compiles the data into Excel for data collection.

Figure 2. Recap of Training Registration Data from Google Forms

From the analysis results, five main problems were found in the training registration system. First, the participant data validation process took a long time because it was done manually through separate communications using WhatsApp. Second, there was duplication of registration data because there was no automatic validation mechanism to prevent double registration. Third, there was no feature to monitor the registration status and completeness of participant documents in real-time, making it difficult for administrators to track the verification progress. Fourth, generating training reports takes a long time because the recapitulation is done manually from Google Forms. Fifth, participants do not have access to view their registration status and training history.

i. **System Functional Requirements**. Functional requirements are derived from user needs analysis and are designed to support the efficiency of the job training process. The detailed requirements are presented as follows.

Table 2. System Functional Requirements

Code	Requirements Category	Feature Description	Actor
F01	Account Management	Register a new account, log in, and log out to access features according to user access rights.	Participant, Admin
F02	Training Management	Display training lists and details (description, schedule, location, quota), register for training, and manage training data.	Participant, Admin
F03	Document Management	Profile completion, upload of required documents, and admin access to view and download participant documents	Participant, Admin
F04	Verification & Confirmation	Document verification by the administrator, display of verification status to participants, and confirmation of training participation	Participant, Admin
F05	Report & Recap	Displaying a list of registered participants and exporting data to Excel format for data collection and reporting purposes	Admin

ii. **System Non-Functional Requirements**. Non-functional requirements are identified to ensure that the system runs optimally and reliably. The five main aspects are presented in the following table.

Table 3. System Non-Functional Requirements

Code	Requirements Category	Feature Description	Actor
F01	Usability	The system is easy for users to understand and operate	Intuitive interface; maximum 3 clicks to navigate to key features
F02	Performance & Reliability	Responsive and stable system during use	The system responds quickly and operates stably
F03	Security	Data protection and prevention of unauthorized access	Password encryption; input validation works well
F04	Compatibility	Support for access on various devices and browsers	Works optimally on Chrome, Firefox, and Edge
F05	Data Integrity	Data accuracy is maintained throughout every process	Strict data validation; use of database constraints

The above non-functional requirements focus on usability, security, and performance to support the effectiveness of SiJoker.

iii. **Use Case**. This stage focuses on developing a use case diagram to model how users interact with the SiJoker job training system. This diagram shows the roles of two main actors, namely the Community, who can register, log into the system, view and participate in training, manage their profiles and documents, and confirm their training, and the Admin, who has access to log into the system, manage training data, and verify participant documents. The include relationship between the document verification process and document management confirms that verification can only be performed if the participant's documents are available in the system.
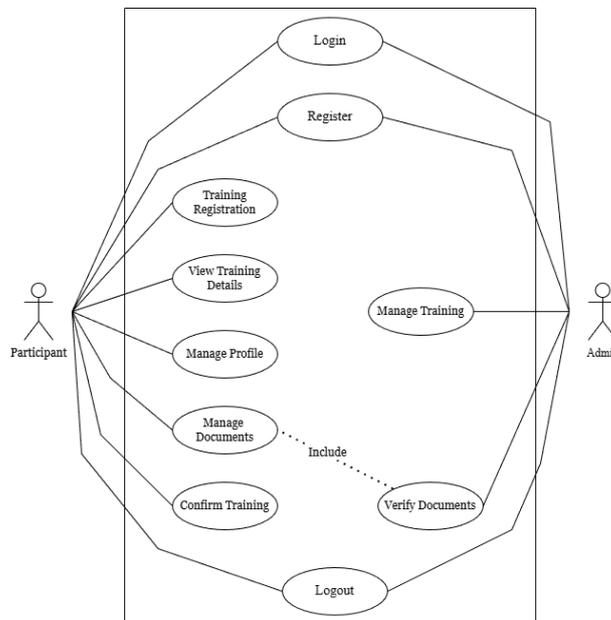

Figure 3. Sijoker Training System Use Case

The design of this use case considers several important design trade-offs. First, to handle changes in registration status, the system implements a five-stage flow (Registered, Documents Complete, Verified, Confirmed, Completed) as a compromise between a simple status that lacks detail and a complex status that confuses users. Cancellations are only allowed before the Confirmed stage to maintain quota integrity, with an automatic timeout mechanism handling unresponsive participants. Second, potential data conflicts when multiple participants confirm training simultaneously on a limited quota are addressed with a locking mechanism that ensures data consistency despite slightly reduced performance, compared to the first-come-first-served alternative that risks frustration or temporary reservations that lock slots. Explicit document statuses (Confirmed/Pending/Rejected) prevent changes while the admin reviews. Third, regarding structural choices, CRUD operations are combined into a single Training Management use case to simplify the diagram, sacrificing granular detail for clarity. This design prioritizes robustness and user clarity with controlled complexity.

b. Initial Prototype Development

Based on the requirements design and use case diagram that have been compiled, this stage focuses on developing an initial prototype. Before implementing the interface, an ERD is first compiled to model the data structure and relationships between entities in the system. The design ensures the connectivity of processes such as user registration, training registration, document uploading, and file verification so that they are integrated between administrators and participants.
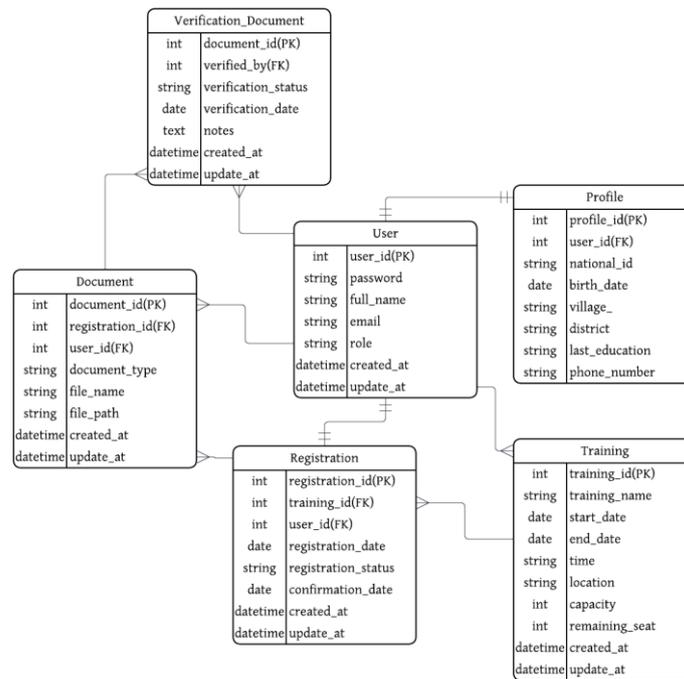
Figure 4. ERD Sijoker Training Module

The ERD design considers several critical design trade-offs to meet system requirements. The separation of User and Profile entities with a one-to-one relationship was chosen to separate authentication concerns from profile data, facilitating future role extensibility. To handle changes in registration status, the Registration entity is designed with a status_registration attribute of type ENUM (Registered, Documents Complete, Verified, Confirmed, Completed), which provides better data integrity than boolean/integer, complemented by the attributes date_registered and date_confirmed as an audit trail for real-time tracking. Regarding potential data conflicts in training quotas, the capacity and remaining_places attributes are designed to support pessimistic locking when simultaneous confirmation is selected over triggers/computed columns because it is easier to debug and transparent in handling race conditions. The separation of the Document and Document_Verification entities is a trade-off between normalization and query complexity: although it requires JOINs, this structure provides a complete audit trail (verifier, time, record) that is essential for transparency and accountability, unlike the alternative of storing the status directly in the Document table, which is simpler but loses the historical verification trail.

After the database design was completed, an initial prototype was developed that included features for training registration, document verification, and training schedule and data management. The interface was designed to be simple and responsive for easy access via a browser, with role-customized dashboards so that administrators could manage data and verification, while participants could register and update their personal information. This prototype functions as a basic web application with core features already implemented, and is ready to be evaluated to identify areas for improvement to suit the operational needs of the Batu City Manpower Office.

c. Prototype Evaluation by Users

The evaluation stage was conducted through direct demonstrations to users involved in the management of the job training program. The evaluation results showed that the system has

supported operational needs well, particularly in training management, document verification, and data presentation. However, there are several improvements that need to be followed up to enhance the quality of the interface and system performance. A summary of the evaluation results is shown in the table below.

Table 4. Summary of Evaluation Findings

Evaluation Aspect	Positive Findings	Findings That Need Improvement
Functionality	Key features (data entry, document verification, data management) are in line with operational requirements	The status of the document is unclear, so it requires an explicit indicator (accepted/rejected)
Interface	The layout and structure of the menu are well organized	Button labels are not descriptive enough and navigation is still confusing
Performance	Stable system without critical errors	System responsiveness needs to be improved through database query optimization

d. Prototype Refinement

Based on user evaluation results, system improvements were made through three iteration cycles with different development focuses at each stage. A summary of the improvement process is presented in the following table.

Table 5. Summary of Evaluation Findings

Iteration	Users Feedback	Improvements Made	Evaluation Result
1	• There needs to be a statement indicating whether the document was rejected or accepted	• Adding explicit document status labels (Confirmed/Pending/Rejected) • Adding reasons for rejection	The verification process is more transparent and facilitates administrative follow-up
2	• The save button is unclear • Difficulty navigating the menu	• Use more striking colors and icons on action buttons • Simplify the menu navigation structure • Add tooltips to important elements	The interface is more intuitive and reduces user confusion
3	• A participant search feature is needed • Data access time is too slow	• Optimizing data input validation • Adding a search feature based on name • Database query optimization	System responsiveness has improved significantly and the search feature makes data management easier.

Each iteration was retested by the same three respondents to ensure that the improvements were in line with operational needs. After going through three development cycles, the prototype received a final assessment based on the formulated implementation feasibility criteria. The evaluation process was conducted through re-demonstrations and confirmation interviews, and all respondents stated that the three criteria had been met, as shown in the following table. Thus, the prototype was declared feasible for implementation.

Table 6. System Feasibility Test Results by Respondents

Eligibility Criteria	Respondents 1	Respondents 2	Respondents 3	Respondents 4	Status
Key features work as required for operations	✓	✓	✓	✓	Fulfilled
No significant obstacles were found in its use	✓	✓	✓	✓	Fulfilled
Workflow in accordance with agency procedures	✓	✓	✓	✓	Fulfilled

e. System Implementation

After the refinement process was complete, the system was developed into a web application integrated with SiJoker. The implementation focused on three main modules that addressed work training administration issues.

   i. Training List Page. This page presents a digital list of training courses containing information on schedules, locations, and requirements. Participants can view program details and register independently, making the administrative process more efficient, as shown in the image below.
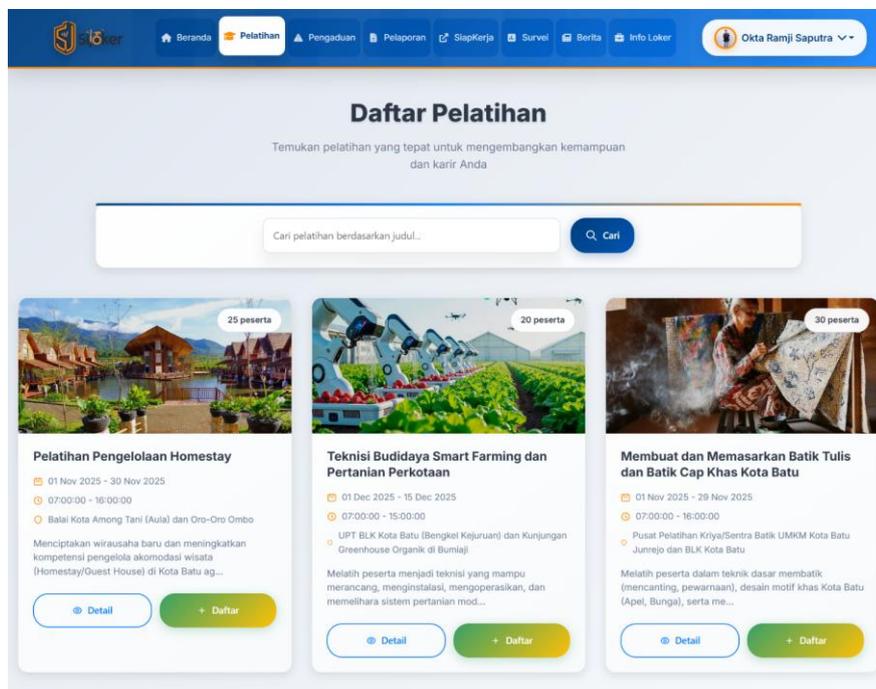

Figure 5. Training List Page

   ii. Training Management Page. This page provides a centralized interface for administrators to manage training data. Administrators can add and update training information, view participant lists, and delete training sessions through a single dashboard, making the management process more efficient, as shown in the image below.
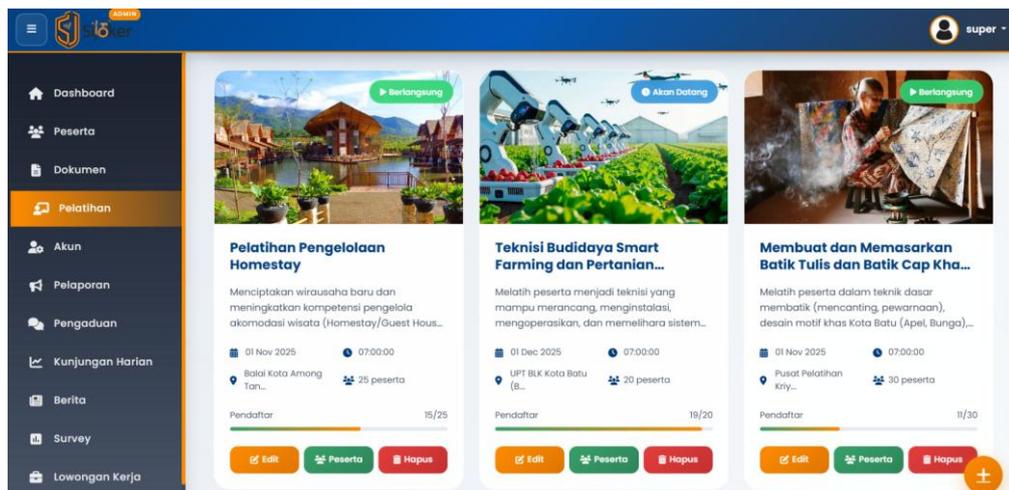
Figure 6. Training Management Page

iii. Document Verification Page. This page allows administrators to check documents uploaded by participants and assign a status to those documents. This mechanism speeds up the verification process and increases administrative transparency, as shown in the image below.
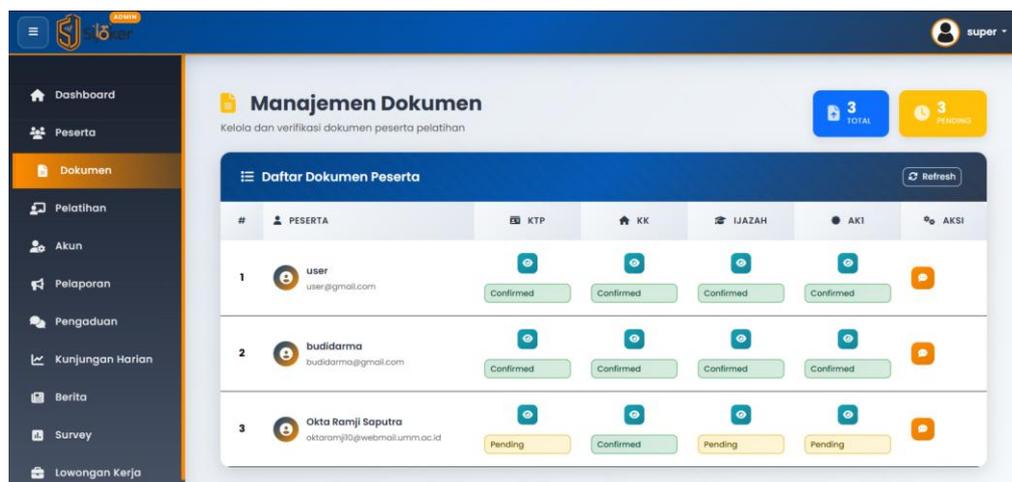

Figure 7. Document Verification Page

f. Final Testing and Evaluation

System testing was conducted to ensure that all functions in the job training module operated in accordance with user requirements and design specifications. The trials focused on validating several key scenarios covering all critical processes in the system. Each scenario was tested to assess the conformity between actual and expected results in order to ensure the overall reliability of the system.

Table 7. System Testing Result

No	Module	Number of Scenarios	Testing Scenarios	Status
1	Account Management	5	Registration (valid & duplicate data), login (valid & invalid), logout	Valid
2	Training Management	5	view list, view details, register for training, add, edit/delete training	Valid

3	Document Management	4	Fill in your profile (complete & incomplete), upload documents (valid & invalid)	Valid
4	Verification & Confirmation	3	Document verification, training confirmation, viewing verification status	Valid
5	Report & Recap	2	View the list of registered participants, export data to Excel	Valid

Test results show that all key functions in the job training module are running according to user requirements and design specifications. Of the 19 scenarios tested, all provided valid and expected results, covering the registration process, training management, document verification, and reporting. In addition, database query optimization has successfully maximized system performance, ensuring it remains responsive and stable in accordance with non-functional requirements. As such, the system is deemed to have met functionality requirements and is ready for implementation.

5. Conclusions

This study successfully designed and developed an integrated digital work training module with SiJoker at the Batu City Manpower Office using the Prototyping method through three iterative cycles with direct user involvement, thereby addressing operational needs in overcoming data duplication and manual verification processes that previously required 24–32 working hours per period. User evaluation showed improvements in verification transparency through the addition of explicit document status labels and reasons for rejection, ease of navigation through a simpler menu structure and more prominent icons, and improved system performance through database query optimization and the addition of a search feature, all of which were deemed feasible for implementation by three respondents. Black Box Testing on 19 scenarios covering account management, training management, document management, verification, and reporting also proved that all key features ran according to specifications without critical errors, making the system ready for deployment to the production server. Further research is recommended to conduct additional evaluations in the production environment by measuring quantitative indicators such as actual verification time, data duplication rates, and user satisfaction levels to ensure the system's long-term effectiveness.

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