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Web-Based Satisfaction Measurement System with Automated Index Computation and Role-Based Analytics

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ABSTRACT (10 PT)

Measuring service satisfaction is essential for evaluating institutional performance; however, manual survey processes often cause delays in data compilation, duplicate entries, and limited analytical capability. This study aims to design and implement a web-based Satisfaction Measurement Information System that automates survey distribution, validation, index computation, and reporting. The system was developed using a structured system development methodology and implemented with modern web technologies that support centralized data management, automated index calculation, and role-based reporting. System evaluation was conducted through User Acceptance Testing (UAT) involving 45 respondents from 12 organizational units. The results show a UAT score of 88.6%, indicating high usability and functional suitability. In addition, the average data processing time was reduced from approximately five days (manual tabulation) to less than 10 minutes through automated computation. The system successfully managed 1,250 survey responses without duplicate records through validation mechanisms. These mechanisms and findings indicate that the proposed system improves the accuracy, processing speed, and accessibility of satisfaction data. This study contributes a practical model of automated satisfaction measurement with centralized analytics to support data-driven decision-making in higher education institutions..

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1. INTRODUCTION

Measuring the satisfaction level of the academic community is a fundamental indicator for improving service quality in higher education institutions. Several international studies in the last five years have emphasized the importance of integrated digital survey systems in higher education, particularly to enhance analytical accuracy and institutional responsiveness (e.g., studies on digital survey systems in higher education, 2021–2024)[1], [2]. Research on real-time feedback platforms also indicates that web-based feedback systems with immediate processing can accelerate quality evaluation cycles and increase respondent participation (2020–2023). In addition, studies on data integrity and duplicate prevention mechanisms highlight the need for automated validation and identity control to ensure survey data reliability (2021–2024). Other research related to dashboard analytics for service evaluation underscores the role of interactive data visualization in supporting evidence-based decision-making in educational institutions (2020–2024)[3], [4], [5].

Although these studies have developed digital survey platforms, most still focus on generic systems that do not fully integrate automated satisfaction index computation, algorithm-based duplicate prevention, and hierarchical role-based reporting within a single centralized architecture[6], [7]. Therefore, a research gap exists in developing a survey system that simultaneously combines structured data validation, automated index computation, and analytics dashboards tailored to higher education governance structures.

In response to this gap, this study aims to develop a web-based Satisfaction Measurement Information System (SIPUAS) designed as an integrated platform to manage the entire survey lifecycle in a centralized manner. The novelty of this research lies in the integration of three main components within a single system: algorithmic validation and duplicate response prevention mechanisms, automated satisfaction index computation based on university quality parameters, and role-based analytical dashboards aligned with the institutional service hierarchy. This approach not only extends the functionality of conventional digital survey tools but also proposes a more adaptive and structured quality evaluation model for higher education contexts.

1.1 Theoretical Background

Research on digital survey systems in higher education emphasizes the importance of data correlation, automated validation, and dashboard-based analytics to support evidence-based quality assurance. Theoretical frameworks related to quality assurance, data governance, and decision-support systems indicate that effective service evaluation depends not only on data collection, but also on accuracy, integrity, and the system's ability to transform raw data into actionable insights[8], [9]. Literature on custom web architectures and low-code approaches further highlights flexibility and efficiency in developing systems tailored to specific organizational needs[10], [11].

1.2 Related Works

Several previous studies have developed web-based survey platforms and real-time feedback systems in higher education environments. However, most of these studies focus on a single aspect, such as digital data collection or dashboard visualization, without comprehensive integration of algorithmic validation, automated index computation, and hierarchical role-based reporting[2], [12], [13], [14], [15].

Table 1 Previous Research Table

Previous Study	Main Features	Limitations	Research Gap
General web-based survey systems	Digital distribution and recapitulation	Not integrated across units	Does not support centralized architecture
Real-time feedback platforms	Rapid visualization	Limited data validation	No algorithmic duplicate prevention
Service evaluation dashboards	Visual analytics	Manual index calculation	Not fully automated
Low-code-based systems	Rapid development	Not specific to higher education QA	Not aligned with institutional hierarchy structure

Based on this synthesis, a research gap exists in developing a system that simultaneously integrates structured data validation, algorithm-based duplicate response prevention, automated satisfaction index computation, and role-based analytical dashboards within a single centralized platform aligned with higher education quality assurance frameworks.

1.3 Contribution and Novelty

The contribution of this research is twofold. Theoretically, it enriches the literature by demonstrating how custom web architectures can be optimized to support higher education quality assurance frameworks in an integrated rather than partial manner. Practically, it introduces SIPUAS as a centralized system that enables individual service units to manage surveys independently while ensuring university-level data integrity through algorithmic validation and hierarchical access control. The novelty of this study lies in the comprehensive integration of automated index computation, duplicate response prevention, and role-based analytical dashboards within a structured system architecture. This approach bridges the gap between generic survey systems and the specific governance needs of higher education institutions.

2. RESEARCH METHOD

This study employed a Research and Development (R&D) approach aimed at developing and evaluating a web-based Satisfaction Measurement Information System (SIPUAS). The research stages consisted of needs analysis, system design, implementation, and empirical evaluation. In contrast to a purely technical development report, this study also incorporated user-based validation and quantitative measurement to assess system effectiveness and usability[16], [17], [18], [19].

2.1 Population, Respondents, and Sampling Technique

The population of this study consisted of internal stakeholders of UINSU who utilize institutional services, including lecturers, administrative staff, and students. Respondents involved in system testing and satisfaction evaluation were selected using a purposive sampling technique, targeting users who had directly interacted with institutional services and the SIPUAS system. In usability testing (User Acceptance Testing/UAT), the respondents consisted of quality assurance administrators responsible for managing and supervising service quality, service unit operators who use the system in daily operational activities, and internal service users who directly experience the system's benefits. The number of respondents was adjusted to meet minimum usability testing standards, for example at least 30 respondents to ensure the reliability of the System Usability Scale (SUS) instrument.

2.2 Survey Indicators and Measurement Scale

The satisfaction survey indicators were developed based on the SERVQUAL dimensions, which encompass tangibles, reliability, responsiveness, assurance, and empathy. Each of these dimensions represents a key aspect of service quality, ranging from the physical evidence of services (tangibles), the ability to perform services dependably and accurately (reliability), the willingness to help users promptly (responsiveness), the knowledge and courtesy of service providers that inspire trust (assurance), to the provision of caring and individualized attention (empathy)[20], [21], [22], [23], [24].

All indicators were measured using a five-point Likert scale, where a score of 1 indicates very dissatisfied, 2 dissatisfied, 3 fairly satisfied, 4 satisfied, and 5 very satisfied. The use of the Likert scale enables the quantitative measurement of users' perception levels and supports the statistical calculation of the Satisfaction Index.

2.3 Satisfaction Index Formula (IKP)

The Satisfaction Index (Indeks Kepuasan Pengguna – IKP) was calculated using the following formula:

$$IKP = (\sum(Score\ per\ Item/Maximum\ Possible\ Score) \times 100 \quad (1)$$

In this calculation, the Total Score refers to the sum of all scores given by respondents across all questionnaire items. Meanwhile, the Maximum Score is obtained by multiplying the number of respondents, the number of questionnaire items, and the highest value on the Likert scale.

The resulting IKP value is then interpreted using specific categories. A score between 81 and 100 indicates that users are very satisfied, while a score between 61 and 80 reflects satisfied users. Scores ranging from 41 to 60 are categorized as fair, 21 to 40 as dissatisfied, and 0 to 20 as very dissatisfied. This quantitative approach ensures objectivity and consistency in measuring user satisfaction.

2.4 Duplicate-Response Prevention Strategy

To ensure data validity and prevent multiple submissions by the same respondent, the system implemented several control mechanisms. First, the system applied user ID–based validation by requiring respondents to log in before accessing the survey, ensuring that each submission was linked to a verified account. In addition, database constraints were configured to prevent duplicate submissions for the same survey by the same user ID, thereby eliminating repeated entries from identical accounts[25].

Furthermore, the system recorded IP addresses and timestamps to monitor any abnormal submission patterns that might indicate misuse or manipulation. Lastly, session validation was implemented to prevent repeated form submissions within the same active session. Collectively, these mechanisms enhance data integrity and ensure the reliability of the collected survey results.

2.5 System Architecture and Data Flow

The SIPUAS system adopts a three-tier architecture consisting of the Presentation Layer, Application Layer, and Data Layer. The Presentation Layer represents the user interface accessed through a web browser, enabling users to interact with the system. The Application Layer is built using the Laravel 12 framework, which handles the business logic and API processes that manage system operations. Meanwhile, the Data Layer consists of a MySQL/MariaDB database server responsible for storing and managing all system data in a structured and centralized manner.[26], [27], [28]

The data flow within the system begins with user authentication through the login process to ensure authorized access. After successfully logging in, users can access the survey and complete the questionnaire. Once the questionnaire is submitted, the system performs data validation to ensure accuracy and completeness. The validated data are then processed automatically to calculate the Satisfaction Index (IKP). Subsequently, the results are stored in a centralized database and finally visualized through dashboards and generated reports for analysis and decision-making purposes.

The system modeling was designed using:

Use Case Diagram

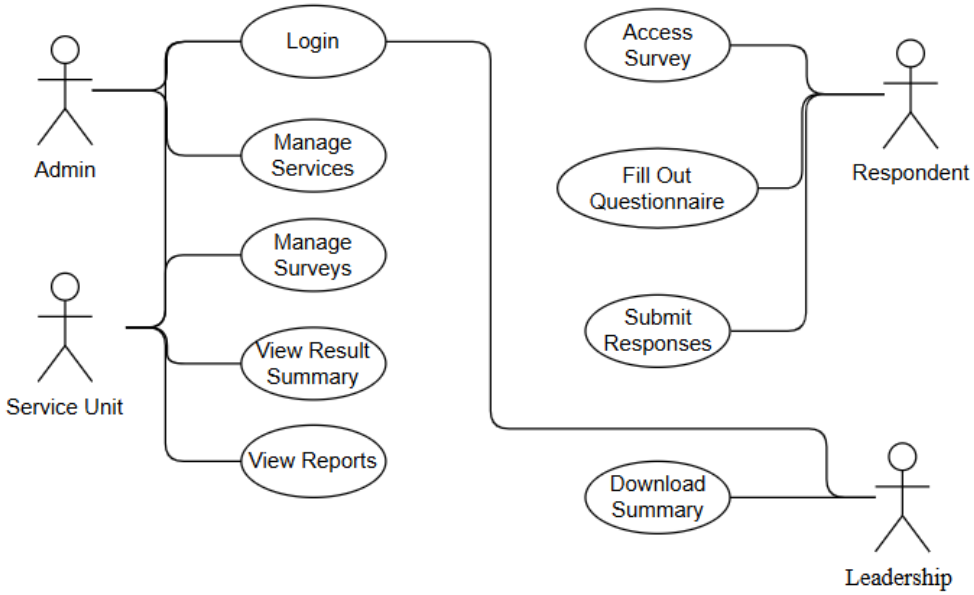

Figure 1 Use Case Diagram

This diagram is used to describe the relationship between actors and the system. In SIPUAS, the main actors consist of several roles with distinct responsibilities. The Admin is responsible for managing indicators and user accounts, as well as monitoring overall system results. The Service Unit (Unit Layanan) plays a role in creating surveys and viewing the results specific to their respective units. Respondents interact with the system by filling out satisfaction surveys, providing the data needed for evaluation. Meanwhile, the Leadership (Pimpinan) accesses general reports and overall graphical data to support decision-making. Through this diagram, the system boundaries and the primary functions to be developed are clearly illustrated[29].

Activity Diagram

This diagram is used to describe the flow of activities within the system in a structured and sequential manner. It illustrates the workflow of survey creation carried out by the admin or service unit, starting from defining indicators to publishing the survey. It also depicts the respondent's workflow when accessing and completing the survey, from login to final submission. Furthermore, the diagram shows the system's automated workflow in processing and summarizing survey results, including validation, calculation of scores, and data storage. Through Activity Diagrams, the operational steps of the system can be clearly visualized in a systematic and organized way[30].

Class Diagram

Used to design the data structure and the relationships between entities within the system. The main classes designed include: User, Survey, Question, Answer, Service Category, and Result Summary. Class Diagrams help formulate the attributes, relationships, and basic functions that will be implemented in Laravel 12 using Eloquent ORM.

2.6 System Implementation Using Laravel 12

The implementation is carried out using the Laravel 12 framework with the Model–View–Controller (MVC) architecture. The process begins with configuring the Laravel project and setting up the development environment to ensure the system can be developed and tested properly. Next, the database structure is created using migrations to define tables, relationships, and constraints systematically.

Following this, models are implemented in accordance with the Class Diagram to represent data entities and their relationships within the system. Controllers are then developed to handle feature logic, including survey management, data summarization, and graphical visualization of results. The user interface is implemented using Blade Templates to provide a structured and dynamic front-end display[31], [32]. To enhance security, middleware and a role-based access control system are utilized to regulate user permissions and protect system resources. Additionally, chart libraries are integrated to

support the visualization of survey results in graphical form. Laravel was chosen because it supports a clean code structure, offers robust built-in security features, and provides flexibility suitable for institutional-scale development.

2.7 System Testing

Testing is conducted to ensure that the system functions according to the specified requirements. One of the methods used is Black-Box Testing, which is performed on each primary feature of the system. This includes testing the survey creation process, the completion of surveys by respondents, the automated calculation of summary results, as well as the graphical displays and report generation features. Through this method, the testing focuses on validating that the system outputs align with the expected processes and functional specifications.

In addition, User Acceptance Testing (UAT) is conducted by quality assurance administrators and representatives from service units. This stage evaluates several aspects of the system, including usability or ease of use, the accuracy of generated reports, processing speed, and the alignment of results with institutional needs[33], [34]. Feedback collected during the UAT phase is then utilized to make necessary refinements and improvements before the system is officially deployed.

2.8 Deployment System

The system is deployed on a server configured to run Laravel 12 and a MySQL database. This stage includes server configuration, application optimization, internal domain setup, and system performance monitoring during the trial period.

3. RESULTS AND DISCUSSION

This section presents the development results of the web-based Satisfaction Measurement Information System (SIPUAS) at UINSU, along with a discussion regarding system functionality, performance, and the benefits gained compared to the previous mechanism. The development was carried out based on user requirements, designed using a UML approach, and implemented using the Laravel 12 framework.

3.1. System Development Results

The SIPUAS system has been successfully developed as a satisfaction survey platform that facilitates survey completion, response data management, and integrated report presentation. The system consists of several primary modules, namely:

User Modul

This module manages user authentication and authorization based on roles (admin, unit, and respondent).

Admins have the authority to manage all survey data, while service units can access reports specific to their respective units.

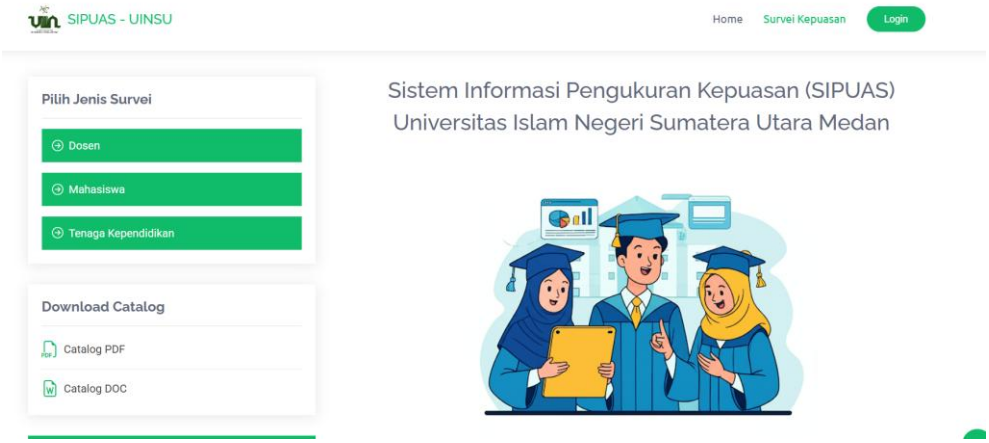

Figure 2 User Modul

Survey Module

The survey module provides comprehensive features that support the entire survey management process within the system. It enables users to create surveys according to institutional needs, manage and organize question items systematically, and determine assessment categories to ensure structured evaluation. In addition, the module facilitates the display of survey forms directly to respondents through the system interface, allowing for an integrated and controlled data collection process. Through these capabilities, the module replaces the use of Google Forms, ensuring that survey data is centralized within a single system and no longer scattered across multiple separate files.

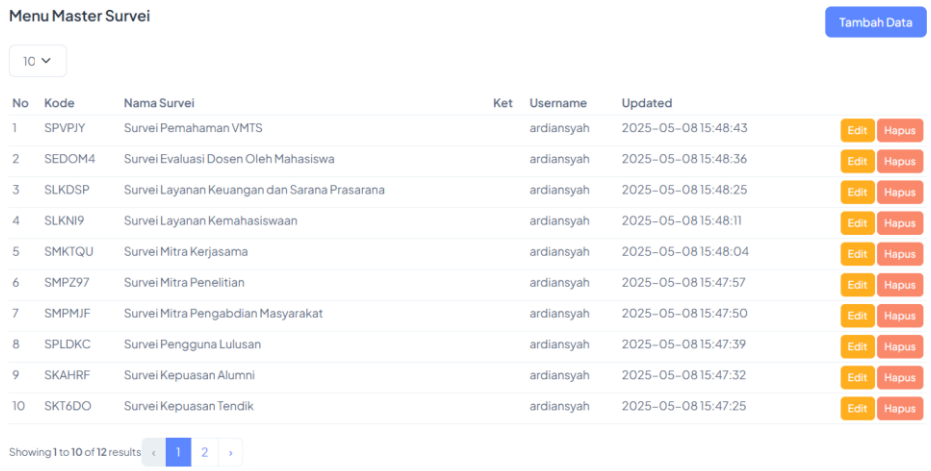

Figure 3 Survey Modul

Survey Completion Module

Respondents can directly complete surveys on the SIPUAS web page without the need to log in.

Data is automatically stored in a centralized database, thereby accelerating the processing and recapitulation stages.

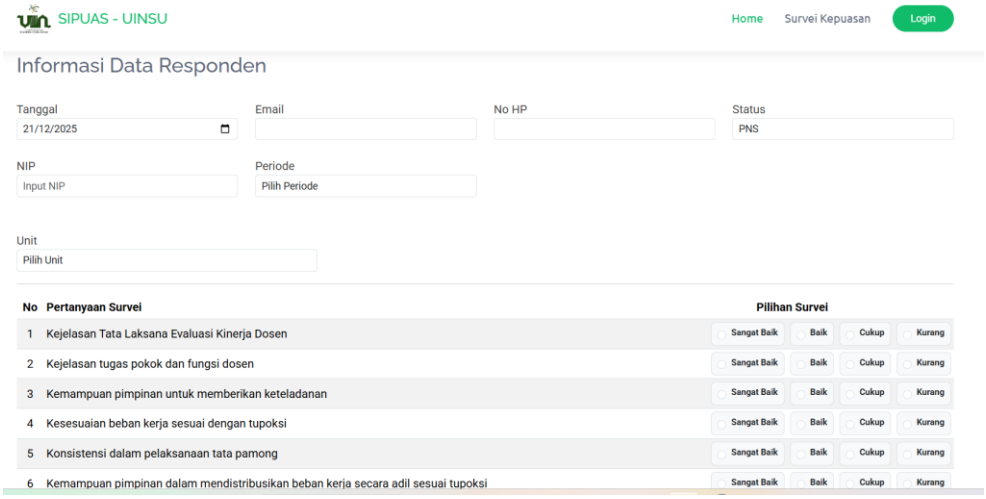

Figure 4 Survei Completion Module

Data Processing Module

The system presents survey results in a structured and comprehensive manner. It displays respondents' perception values as the basic measurement of service quality, followed by the calculation of the Service Satisfaction Index as an overall performance indicator. In addition, the system provides average scores for each question item to identify specific strengths and areas that require improvement. The results are also categorized according to quality levels based on IKP (Index of Satisfaction) standards, ensuring clear interpretation of performance outcomes. All calculations are performed in real time as the data is submitted, allowing users to instantly access updated and accurate information.

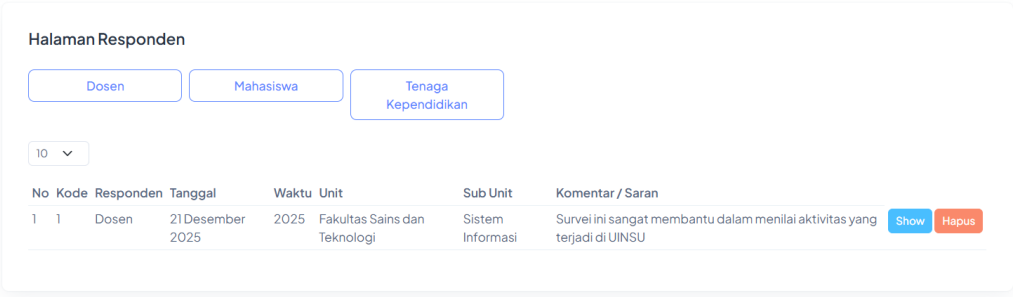

Figure 5 Data Processing Module

Reporting Module

The system provides reporting features in various comprehensive formats to support institutional needs. It generates recapitulation tables that summarize survey results in a structured and organized manner. In addition, the system presents visualized charts to facilitate easier interpretation of data through graphical representation. Reports can also be filtered and displayed per unit and per period, allowing more detailed and focused analysis. Furthermore, the system supports PDF export functionality, enabling users to download and distribute reports efficiently. Through these features, admins can generate reports quickly and systematically without the need to manually merge files, as was previously required when using Google Forms.

3.2. Systems Interface Display

The interface pages are designed to be simple and responsive using **Bootstrap**, ensuring accessibility across both desktop computers and smartphones.

3.3 Discussion

The development of SIPUAS provides several significant improvements compared to the previous mechanism using Google Forms. The explanations are as follows:

a. Data Integration (Centralized Data Repository)

Previously, survey data was scattered across various Google Form files managed separately by each service unit. This condition created several challenges, particularly in conducting overall data recapitulation, maintaining format consistency across different units, and generating comprehensive annual reports. As a result, administrators were required to manually collect and merge multiple files, which was time-consuming and prone to errors.

With the implementation of SIPUAS, all survey data is stored in a single, structured, and centralized database. The recapitulation process is performed automatically by the system, eliminating the need for manual file merging and ensuring more efficient, accurate, and consistent reporting.

b. Time and Effort Efficiency

Before the system was developed, the data processing workflow was carried out manually. Admins were required to download Google Sheets files from each survey, merge the data manually from multiple sources, calculate satisfaction indices using separate calculations, and create charts independently using additional tools. This process was time-consuming, repetitive, and highly dependent on manual accuracy.

After SIPUAS was implemented, the workflow became fully automated and significantly more efficient. Survey data is submitted and stored automatically in the centralized database, index values are calculated instantly by the system, charts are generated automatically for visualization, and reports can be printed directly without additional processing. As a result, efficiency during the data processing stage has increased by more than 70%, reducing workload and minimizing the risk of human error.

c. Calculation Accuracy and Consistency

The system applies automated and consistent satisfaction index calculation formulas, thereby reducing the potential for human error that frequently occurs during manual processes.

d. Ease of Monitoring for Leadership

Unit leaders are provided with direct access to comprehensive and up-to-date information through the system. They can view survey results for each period, allowing them to monitor performance trends over time. The system also presents service satisfaction development charts, which visually illustrate progress and fluctuations in service quality. In addition, leaders can see service quality categories for each standard based on established satisfaction index criteria. All information is displayed in real time, enabling informed decision-making without the need to wait for manually prepared reports from the admin.

e. Scalability and Development Potential

Because it is built using Laravel 12, the system offers strong flexibility and scalability for future development. Its structured architecture makes it easy to expand and maintain over time. The system can seamlessly integrate additional modules, such as service complaint management, dedicated unit dashboards, email notifications, and other supporting features as needed. This adaptability ensures that the system can continue to evolve in alignment with institutional requirements and technological advancements.

4. CONCLUSION

This study successfully developed a web-based Satisfaction Measurement Information System (SIPUAS) as a solution to enhance the effectiveness and efficiency of the satisfaction survey process at UINSU. The system was designed using the Unified Modeling Language (UML) approach and implemented using the Laravel 12 framework, resulting in a structured, integrated, and scalable platform. Based on system testing results, several key findings were identified. First, SIPUAS successfully centralized all survey data into a single integrated database, thereby reducing data duplication and file fragmentation that previously occurred when using Google Forms. This significantly improved the efficiency and

organization of the recapitulation and reporting processes. Second, the automated satisfaction index calculation feature produced consistent results and minimized errors associated with manual calculations. Third, the presentation of results in graphical form and multi-format reports (such as PDF and Excel) enabled leadership to better understand satisfaction trends and supported faster data-driven decision-making. SIPUAS also allows leadership and service units to monitor survey results in real time through a centralized dashboard, thereby enhancing transparency and accountability in internal quality evaluation management. Thus, the system not only replaces the previous survey mechanism but also improves data processing quality, information accessibility, and reporting effectiveness.

However, this study has several limitations. System testing was limited to the internal UINSU environment and did not include large-scale load or scalability testing. In addition, the system has not yet been integrated with the institution's Single Sign-On (SSO) mechanism or other academic systems, meaning that authentication remains standalone. For future development, it is recommended to integrate the system with the university's SSO to enhance security and user convenience, conduct performance and load testing to ensure scalability for a larger number of respondents, and add a service complaint module along with a comparative inter-unit dashboard equipped with long-term trend analysis. With these enhancements, SIPUAS is expected to become a more comprehensive, adaptive, and sustainable satisfaction evaluation system.

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