Design of Bridging System between Hospital Information Service with National Insurance

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***Abstract*—Indonesian hospitals, as primary healthcare providers, are required to deliver fast, accurate, and integrated services in accordance with standards set by Badan Penyelenggara Jaminan Sosial (BPJS). However, many existing Hospital Information Systems (HIS) remain fragmented and lack full interoperability with BPJS digital platforms. This condition leads to redundant workflows, repetitive data entry, delays in patient registration, and inconsistencies in medical record synchronization, ultimately affecting service performance. To address these issues, this study implements an Application Programming Interface (API)-based integration framework that enables real-time connectivity between hospital subsystems and BPJS applications. A comparative approach is used to evaluate system efficiency before and after integration. The results show a significant reduction in processing time, from 3 minutes and 12 seconds to 1 minute and 17 seconds. These findings demonstrate that API-based interoperability improves data exchange efficiency, reduces administrative delays, and enhances system compliance with BPJS standards, contributing to a more efficient and reliable Hospital Information System.**

Keywords— Bridging Method, Hybrid Framework, BPJS, Hospital Information System, Efficient Service

I. INTRODUCTION

Hospitals are essential healthcare institutions that play a crucial role in delivering fast, accurate, and high-quality medical services to the community [1], [2]. The digital era has increased the demand for efficiency and effectiveness in healthcare operations, particularly for hospitals collaborating with the Badan Penyelenggara Jaminan Sosial (BPJS). Health, the national social security agency responsible for administering Indonesia's universal health coverage program [3], [4]. BPJS health, requires an integrated information system to ensure that participant administration, claims processing, and medical service delivery are performed seamlessly. However, in practice, many hospitals in Indonesia still operate standalone information systems without direct integration between their Hospital Management Information System (SIMRS) and the BPJS application [5], [6].

The Hospital Management Information System (SIMRS) serves as a comprehensive platform for managing various hospital operations, including patient registration, medical services, financial reporting, and insurance claims [7], [8]. An integrated SIMRS should facilitate smooth information exchange between service units and external entities such as BPJS health [9]. Nevertheless, in the absence of proper technical integration specifically through bridging mechanisms data exchange between SIMRS and the BPJS application is often performed manually [10], [11]. This manual process increases the workload of administrative staff, causes delays in patient services, and results in potential data inconsistencies across both systems.

The adoption of bridging techniques through an Application Programming Interface (API) offers a key solution to these data inconsistency challenges [12], [13]. By implementing an API, SIMRS can directly communicate with the BPJS system, allowing the automated transfer of patient data, medical diagnoses, and claim information without redundant data entry [14], [15]. The implementation of this bridging mechanism is expected to enhance administrative efficiency, reduce human errors during data input, and improve overall data accuracy. Moreover, such integration provides hospital management with reliable and real-time data that can serve as a foundation for strategic decision-making aimed at improving healthcare service quality [16], [17].

Despite its potential benefits, the implementation of SIMRS–BPJS bridging still encounters several challenges, including data format incompatibilities, limited human resources skilled in system integration, and the absence of uniform technical standards among hospitals. Despite these challenges, existing studies predominantly emphasize the technical implementation of API-based integration, with limited attention to its empirical impact on administrative time efficiency in real-world hospital settings. Furthermore, there is a lack of rigorous comparative analysis between pre- and post-integration conditions, particularly within BPJS-compliant hospital systems in Indonesia. This limitation indicates a clear research gap in systematically and quantitatively evaluating the operational effectiveness of

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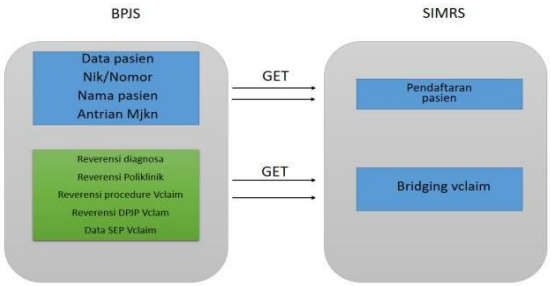

Fig. 1. Bridging Architecture.

SIMRS–BPJS integration. Therefore, this study aims to analyze and compare administrative time efficiency before and after the implementation of the BPJS API within SIMRS. Using a comparative methodological approach, the study seeks to provide empirical evidence on how system integration through API-based bridging can improve administrative efficiency in hospitals and to serve as a reference for developing more integrated health information systems aligned with BPJS health standards. The contributions of this study are summarized as follows:

- Implementation of API-based Integration: This study applies the concept of Application Programming Interface (API) within the Hospital Management Information System (SIMRS) to enhance time efficiency in data exchange across different modules
- Data transfer efficiency: The main contribution of this study is the analysis and comparison of data transfer efficiency in API-based systems, with a focus on how varying data volumes affect data retrieval performance.

II. METODOLOGY

This This study employs a comparative approach to evaluate the integration of SIMRS with the BPJS system via a bridging API, by comparing systems with and without API integration in terms of efficiency, processing time, and interoperability.

The experimental procedure consists of two scenarios: manual processing without API and automated processing using the bridging API. In both scenarios, patient registration and administrative processes are conducted under comparable conditions, and processing time is recorded. Each scenario is repeated multiple times to ensure consistency. The results are then analyzed by comparing average processing time to assess efficiency gains, although the evaluation is limited to time-based metrics and may be influenced by system and network conditions.

A. Architecture

Figure 1 illustrates the architecture of the Hospital Information System (SIMRS) integrated with the BPJS Healthcare System through a bridging API. The SIMRS retrieves patient data—such as NIK, patient ID, name, and queue information from the MJKN service via the API, which is then automatically processed within the registration module. This integration enables efficient data exchange, reduces manual input, minimizes errors, and ensures real-time synchronization between the hospital system and the BPJS network.

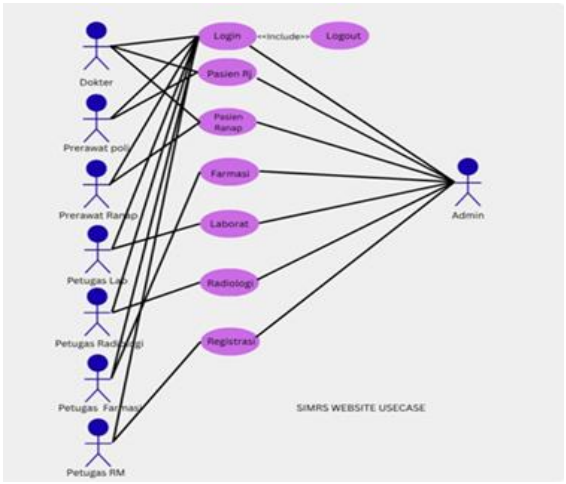

Fig. 2. Use case diagram.

Furthermore, the Hospital Information System (SIMRS) integrates with the BPJS Healthcare System through an Application Programming Interface (API) to access essential reference data, including diagnoses, polyclinics, VClaim procedures, attending physicians (DPJP), and patient eligibility letters (SEP). The retrieved data are automatically validated, structured, and stored within the VClaim module of SIMRS, forming a centralized repository for verification and claim processing. This integration ensures that patient transactions in SIMRS comply with BPJS data standards, enabling consistent and reliable information exchange. The automation reduces manual input, minimizes errors, and improves data accuracy and traceability. Additionally, real-time synchronization allows hospital staff to efficiently verify diagnoses, service codes, and patient eligibility prior to claim submission. Overall, the API-based interoperability enhances operational efficiency, supports accurate medical documentation, and provides a scalable foundation for future healthcare data integration.

B. Use case diagram

The figure 2 is the Hospital Information System (SIMRS) illustrates the interaction between various user roles and their corresponding system functionalities within the hospital environment. The diagram identifies multiple actors, including the Doctor, Outpatient Nurse, Inpatient Nurse, Laboratory Staff, Radiology Staff, Pharmacy Staff, Medical Records Staff, and the Administrator, each of whom is granted access to specific modules based on their professional duties. The Doctor is authorized to access both the Outpatient and Inpatient patient modules, enabling comprehensive patient management across different care settings. The Outpatient Nurse is restricted to the Outpatient module, while the Inpatient Nurse can access only the Inpatient module for patient monitoring and care documentation.

The Laboratory Staff have access solely to the Laboratory module to manage test requests and laboratory results, whereas the Radiology Staff are assigned access to the Radiology module for handling imaging records and diagnostic data. Similarly, the Pharmacy Staff operate within the Pharmacy module to process prescriptions and manage medication inventory, while the Medical Records Staff have

Fig. 3. SIMRS Web View.

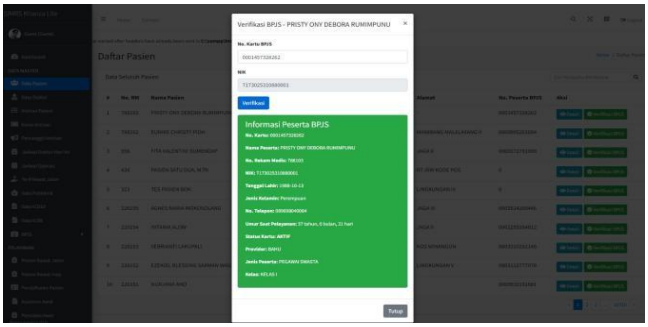

Fig.4. Bridging the verification of BPJS health insurance membership.

access to the Registration module to maintain patient data and administrative records. The Administrator, as the highest-level user, possesses full privileges to access and manage all modules, including administrative and clinical functionalities across the system. Moreover, the system employs a dynamic access control mechanism, in which modules that are not permitted for a particular user role will not be displayed within the sidebar interface. This approach enforces strict role-based access control, ensuring that users can only interact with system components relevant to their roles, thereby improving data confidentiality, minimizing unauthorized access, and optimizing user interface efficiency within the SIMRS framework.

C. *Hardware and software*

In this study, several hardware and software components were utilized to design and evaluate an integration system between the Hospital Information System (SIMRS) and the Badan Penyelenggara Jaminan Sosial Kesehatan (BPJS) health application. The hardware configuration consisted of a computer equipped with an MSI motherboard, an Intel Core i3 processor, 8 GB of RAM, and a 512 GB SSD, which was selected to provide adequate performance for the development and testing of systems involving Application Programming Interfaces (APIs) and data exchange processes between the hospital system and the BPJS module without causing significant delays during simulation. Regarding the software environment, PHP was employed as the primary programming language to develop the API bridge connecting SIMRS with the BPJS system [18], while MySQL functioned as the Relational Database Management System (RDBMS) for storing patient records, claim information, and related data [19]. Furthermore, XAMPP was utilized as a local server package incorporating Apache and MySQL to enable system testing on the developer's local machine [20], and Visual Studio Code (VS Code) served as the integrated development environment (IDE) for writing and editing the source code. The user interface was developed using HTML5, CSS, and JavaScript to ensure an interactive and user-friendly design, and all development and testing activities were conducted on the Windows 10 operating system.

III. RESULTS

A. *Bridging web view*

Figure 3 illustrates the web-based interface of the Hospital Information System (SIMRS), which includes a sidebar navigation menu for accessing various system modules. The dashboard section presents key operational statistics, such as the total number of patients, daily and monthly patient visits, and the number of active sessions. In addition, the system provides graphical visualizations, including vertical and horizontal bar charts as well as a pie chart, to represent patient distribution and service activity. This interface supports real-time monitoring and facilitates data-driven decision-making through a structured and intuitive layout, although its effectiveness depends on the accuracy and consistency of the integrated data.

Figure 4 illustrates the process of verifying BPJS Health Insurance membership within the integrated system. The system retrieves patient information based on the insurance card number and automatically validates the membership status. The verification results are then displayed on the interface, indicating whether the patient is active or inactive. This automated mechanism improves efficiency and accuracy by reducing manual validation; however, it relies on the stability of API communication, where potential

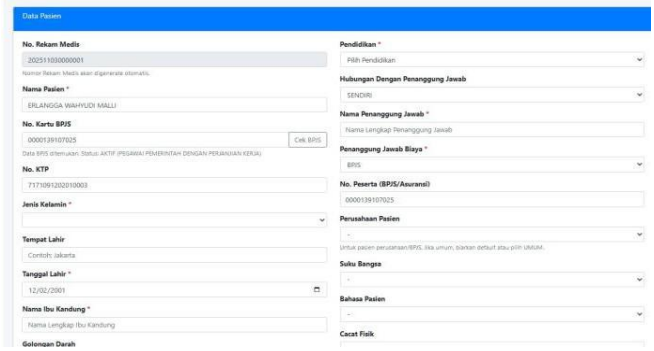

Fig.5. Bridging patient data collection using card numbers.

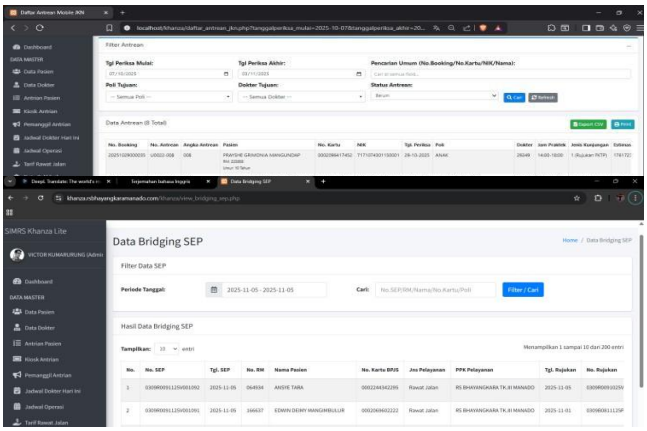

Fig.7. Bridging data for patient eligibility (SEP) display.

disruptions may affect the reliability of the verification results.

Figure 5 shows the patient registration process, where the system retrieves patient data using the insurance card number to enable automatic data import into the Hospital Management Information System (SIMRS). This integration streamlines the registration workflow by reducing manual data entry, improving data accuracy, and accelerating the patient admission process. However, the effectiveness of this mechanism depends on the consistency and availability of data from the BPJS system. Any discrepancies or delays in data retrieval may affect registration accuracy and processing time. Therefore, ensuring reliable data synchronization is essential to maintain system efficiency and interoperability.

Figure 6 presents the registration process for patients using the JKN Mobile application integrated with the Hospital Management Information System (SIMRS). Patient data submitted through the application are automatically synchronized, enabling efficient verification and registration without manual input. This integration improves efficiency, accuracy, and interoperability between BPJS digital services and hospital systems. However, its performance depends on the reliability of data synchronization and system connectivity. Any delays or inconsistencies in the integration process may impact registration accuracy and service timeliness, highlighting the need for stable system integration.

Figure 7 illustrates the bridging process for generating the Patient Eligibility Letter (SEP) through the BPJS VClaim system. This integration enables automatic retrieval and validation of patient eligibility data, ensuring synchronization between SIMRS and the BPJS database. The use of a bridging API reduces manual input errors, improves data consistency, and accelerates the verification process. However, the reliability of SEP generation depends on the accuracy of input data and the stability of the API connection. Any discrepancies or system disruptions may affect eligibility validation, potentially impacting administrative processes and service delivery.

B. Efficiency Comparison

Figure 8 illustrates a comparative analysis between patient registration processes using the BPJS Bridging API and those performed without API integration. The results indicate that API-based registration significantly reduces processing time (approximately one minute) compared to the manual approach (up to three minutes). This improvement is driven by automated data retrieval and validation, which minimize redundant input and reduce human error. Moreover, real-time synchronization enhances data consistency and interoperability between SIMRS and BPJS systems. However, the observed efficiency gain is highly dependent on network stability and system integration quality, where latency or API failures may reduce the expected performance benefits. Quantitatively, this reflects a reduction of approximately 2 minutes, or more than 60% improvement in processing time.

Figure 9 presents a comparative analysis of the process for generating Patient Eligibility Letters (SEP) using the BPJS VClaim application and the Bridging feature within SIMRS. The results show a substantial reduction in processing time,

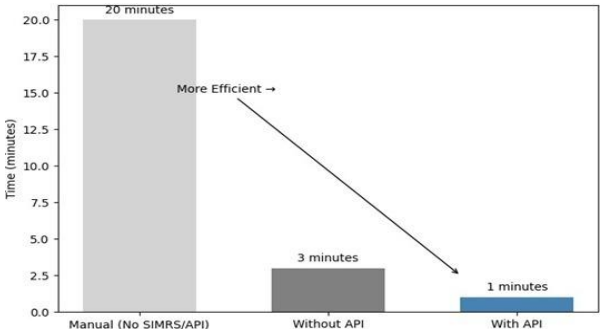

Fig.8. Bar chart comparison of patient registration.

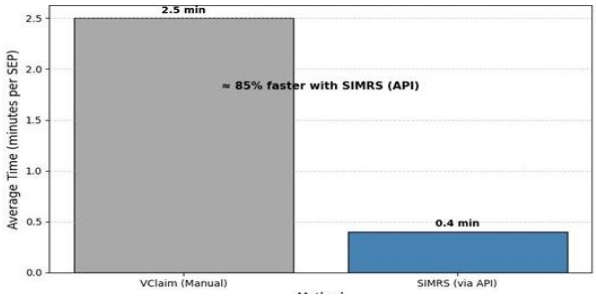

Fig.9. Bar chart comparison of SEP creation.

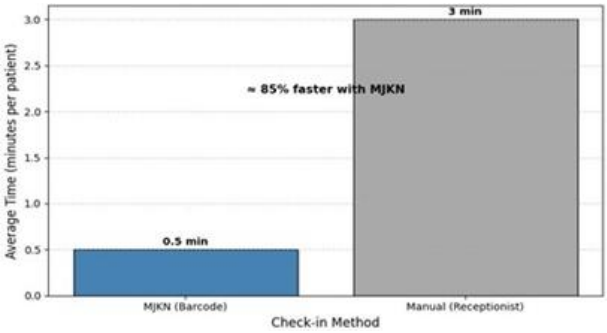

Fig.10. Bar chart comparsion of patient registration.

from approximately 2.5 minutes to 34 seconds when using the bridging mechanism. This improvement is driven by automation and real-time data synchronization, which reduce manual intervention and enhance data accuracy. Consequently, the implementation of the SIMRS Bridging feature optimizes administrative workflows and improves service efficiency, contributing to the development of a more integrated and interoperable digital healthcare ecosystem in Indonesia. However, these benefits depend on the reliability of system integration, data consistency, and network stability, where potential disruptions may affect validation accuracy and overall system performance. This corresponds to a time reduction of approximately 1 minute 56 seconds, indicating an efficiency improvement of more than 75%.

Figure 10 presents a comparison of the patient check-in process using the JKN Mobile application and manual registration at the hospital reception desk. The results indicate that JKN Mobile users complete the check-in process significantly faster (approximately 35 seconds) compared to manual registration, which may take around 3 minutes or more due to queuing and manual data verification. This demonstrates that digital self-service mechanisms can substantially improve operational efficiency, reduce

administrative workload, and minimize patient waiting time. However, the effectiveness of this approach depends on user adoption, digital literacy, and system reliability. Patients who are unfamiliar with the application or experience technical issues may still rely on manual processes, potentially limiting the overall efficiency gains. Therefore, while JKN Mobile integration supports digital transformation and interoperability within hospital systems, its impact is influenced by both technological and user-related factors. Overall, this represents a reduction of more than 2 minutes, or approximately 80% faster than the manual process.

IV. CONCLUSION

In this study, the implementation of an Application Programming Interface (API) successfully established an integrated connection between the Hospital Management Information System (SIMRS) and the BPJS Health System, resulting in improved administrative efficiency. Beyond the observed reduction in processing time, this integration demonstrates the importance of interoperability in minimizing data redundancy, enhancing workflow coordination, and supporting more reliable healthcare information management. However, the effectiveness of the proposed approach is influenced by factors such as system reliability, network stability, and data consistency, which may affect performance in real-world implementations. Therefore, ensuring robust infrastructure and standardized integration protocols is essential to maximize the benefits of API-based systems. Overall, this study contributes to the growing body of research on healthcare system integration by providing empirical evidence of efficiency gains in BPJS-compliant environments. For future work, the integration of intelligent decision-support systems, such as drug recommendation modules, is recommended to further enhance clinical effectiveness and support comprehensive digital healthcare transformation.

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