Jurnal Ilmiah Informatika dan Komputer (Informatech)
Volume 2, Nomor 1, Month Year, page 48-58
DOI : 10.69533
Website : *https://ejournal.rizaniamedia.com/index.php/informatech*

E-ISSN: 3047-4752

Development Information System for Monitoring of Health Workers Practice Licenses (STR)

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(*Article Received: 3 April 2025; Article Revised: 27 May 2025; Article Published: 1 June 2025*)

ABSTRACT *– The management of Health Worker Registration Certificates (STR) in Indonesia is still dominated by manual processes, resulting in data fragmentation, delays in renewals, and the prevalence of fake or expired STRs, which pose potential risks to patient safety and hinder oversight by healthcare facilities and relevant authorities. To address these issues, this study developed a web-based STR monitoring information system using the Waterfall method, encompassing stages of needs analysis, system design, implementation, testing (through Black Box Testing and User Acceptance Testing), and deployment on healthcare institution servers. The developed system features a centralized database, expiration notifications, and quick, easy access. Evaluation results indicate that the system enhances efficiency, accuracy, and transparency in STR management, with user satisfaction reaching 87%, time efficiency reported by 89% of respondents, and 95% stating the system is easy to use. Based on these findings, the system is recommended for broader adoption, integration with the national e-Health system, and supported by regular maintenance and user training to achieve accountable, transparent, and sustainable healthcare workforce management.*

Keywords *- Registration Certificate (STR), Integrated Information System, STR monitoring, Black Box Testing, User Acceptance Testing*

Pengembangan Sistem Informasi Terpadu untuk Pemantauan dan Validasi Surat Tanda Registrasi (STR) di Fasilitas Kesehatan

ABSTRAK *– Pengelolaan Surat Tanda Registrasi (STR) tenaga kesehatan di Indonesia masih didominasi proses manual, mengakibatkan fragmentasi data, keterlambatan perpanjangan, serta maraknya praktik STR palsu atau kadaluarsa yang berpotensi membahayakan keselamatan pasien dan menghambat pengawasan oleh fasilitas kesehatan maupun otoritas terkait. Untuk mengatasi permasalahan tersebut, penelitian ini mengembangkan sebuah sistem informasi monitoring STR berbasis web menggunakan metode Waterfall, yang mencakup tahapan analisis kebutuhan, desain sistem, implementasi, pengujian (melalui Black Box Testing dan User Acceptance Testing), serta deployment pada server instansi kesehatan. Sistem yang dikembangkan dilengkapi fitur database terpusat, notifikasi kadaluarsa dan mudah diakses secara cepat. Hasil evaluasi menunjukkan bahwa sistem mampu meningkatkan efisiensi, akurasi, dan transparansi dalam pengelolaan STR, dengan tingkat kepuasan pengguna mencapai 87%, efisiensi waktu dirasakan oleh 89% responden, dan 95% menyatakan sistem mudah digunakan. Berdasarkan temuan tersebut, sistem ini direkomendasikan untuk diadopsi secara lebih luas, diintegrasikan dengan sistem e-Health nasional, serta didukung oleh pemeliharaan berkala dan pelatihan pengguna guna mewujudkan pengelolaan tenaga kesehatan yang akuntabel, transparan, dan berkelanjutan.*

Kata Kunci *– Surat Tanda Registrasi (STR), sistem informasi terpadu, pemantauan STR, Black Box Testing, User Acceptance Testing*

1. INTRODUCTION

The quality of healthcare services is one of the main pillars of the national healthcare system, directly impacting patient safety and the success of medical service management. Competent, trained healthcare personnel with legal legitimacy to practice are key factors in ensuring the quality of these services[1]. In Indonesia, the legality and professionalism of health workers are regulated through a Registration Certificate (STR), which is

proof that a health worker has met the competency requirements, is officially registered, and is permitted to practice for a certain period of time[2].

STRs are issued by recognized professional institutions under the coordination of the Ministry of Health, and are mandatory for all healthcare workers before they can provide services in healthcare facilities. The issuance and renewal process for the STR involves verification of competence, validity period, and the obligation for continuous professional development (CPD). The existence of the STR is not only an administrative requirement but also an important tool in maintaining professional accountability and protecting the public from illegal or incompetent practices[3].

However, in practice, the process of monitoring and validating STRs in many healthcare facilities is still done manually and in a fragmented manner. Many hospitals, community health centers, and clinics rely on physical documents, Excel spreadsheets, or paper-based archives that are not integrated. This approach is prone to delays, data errors, and inaccuracies, such as failing to detect expired or even counterfeit STRs. Additionally, the lack of a centralized monitoring system makes it difficult for relevant agencies—such as health departments or professional bodies—to conduct effective and real-time supervision[4].

ICT technologies are becoming increasingly important in healthcare. They help create new e-health services that can make patients safer and improve the quality of care [5]. The use of Electronic Health Records (EHR) is now very important for providing consistent healthcare, especially in countries that are still developing. Older hospital management systems, which were made earlier, do not follow EHR guidelines and standards. In this paper, we look at a specific part of EHR called the Continuity of Care Document (CCD). This is a standard format that helps move patient information and medical records easily between different hospital management systems [6].

This situation creates gaps in health human resource management and potentially threatens patient safety. Amidst the government's efforts to transform the health sector digitally, the limitations of the information system specifically designed for STR monitoring pose a challenge that needs to be addressed immediately[7]. In fact, information technology has been widely applied in various aspects of health management, such as electronic medical record systems and personnel management, proving that digitization can improve efficiency, accuracy, and transparency [8].

Therefore, the development of an integrated information system for STR monitoring and validation is a strategic necessity. This system can provide a centralized database, automatic notifications for renewal periods, quick verification features, and compliance reports that can be accessed by healthcare facility management and regulatory authorities[9]. By utilizing web-based technology and cross-institutional data integration, the designed system is expected to support more accountable professional governance, prevent illegal practices, and improve the overall quality and safety of healthcare services[10].

2. LITERATURE REVIEW

2.1 Registration Certificate (STR)

Health workers play a crucial role in improving the quality of healthcare services to help the community enhance their awareness, motivation, and ability to live healthily, thereby achieving better health outcomes. In accordance with the provisions of Law Number 17 of 2023 on Health, healthcare professionals wishing to practice must obtain a Registration Certificate (STR). The STR is a written document issued to healthcare professionals who have obtained a competency certificate and/or professional certificate and have been officially registered[11].

STR applications are submitted online. In accordance with Law No. 17 of 2023 on Health, which is now in effect, STRs are valid for life, unlike previously, when they were only valid for five years[12]. Then, based on the 1945 Constitution, Article 5 explains that in carrying out its responsibilities, the government has the authority to foster, supervise, and improve the quality of health workers through competency certification and health worker registration (STR) activities[13].

In carrying out their duties, healthcare workers in Indonesia require a registration certificate (STR). The registration certificate, abbreviated as STR, is written proof issued by the government to healthcare workers who have obtained a certificate of competence[14]. The management and validation of Health Worker Registration Certificates (STR) is a crucial aspect in maintaining the quality of health services and protecting the public. The STR is legal proof that a health worker has met the competency requirements and is entitled to practice their profession in Indonesia, as stipulated in Law Number 36 of 2014 concerning Health Workers (Health Worker Law)[15].

However, in practice, the STR issuance and verification process still faces various challenges. Many processes are still carried out manually, fragmented between agencies, and prone to delays, data errors, and even fraud. The lack of a real-time centralized information system makes it difficult for

healthcare facility managers and regulators to monitor STR compliance[16].

Therefore, there has been a strong push to develop an integrated information system that can connect various stakeholders, including health workers, service facilities, health offices, and professional certification institutions. Such a system is in line with the direction of digital transformation in the health sector as announced by the Ministry of Health through e-Health and the National Health System (SKN)[17].

2.2 Website Based

A study by Hendra et al. (2025) shows that web- and mobile-based information systems can improve administrative efficiency and data accuracy in healthcare management. Integration with cloud technology and Application Programming Interface (API) enables secure data exchange between different systems[18]. Furthermore, user-centered design is essential to ensure widespread adoption by healthcare professionals and administrators[19].

The digital STR validation system can also be equipped with automatic notification features for STRs that are about to expire, tracking of training and education history, and QR code scanning capabilities for quick verification in the workplace. This not only increases transparency, but also supports better healthcare workforce planning[20].

2.3 Waterfall Model

The Waterfall model is one of the earliest and most well-known approaches in software engineering. Introduced by Winston W. Royce in 1970, this model describes the system development process in a linear and sequential manner, where each stage must be fully completed before the next stage begins. The stages in the Waterfall model generally consist of: requirements analysis, system design, implementation (coding), testing, implementation/deployment, and maintenance[21].

The main advantage of the Waterfall model is its clear and well-documented structure, making it ideal for projects with stable and clearly defined requirements from the outset. This model enables easy-to-track project management, as each phase has measurable milestones and deliverables. In addition, comprehensive documentation at each stage facilitates auditing, training of new teams, and long-term maintenance[22].

Understanding of information systems can be viewed from two aspects, namely the physical aspect and the functional aspect. From a physical perspective, an information system can be defined as a structure consisting of hardware, software, and the personnel who operate it. These three components support each other to produce the required output. Meanwhile, from a functional perspective, an information system operates as a sequential process, starting from data collection until it is finally communicated or disseminated. Additionally, an information system is considered effective if it can produce good, accurate, timely, complete, and concise information [23]. Accuracy is measured as the ratio of correct information to incorrect information. A system is considered to have high accuracy if its accuracy ratio reaches 95%. However, even with high accuracy, an information system is useless if the information arrives late and is disorganized. Therefore, an information system must be complete, concise, and structured to avoid confusing the users of that information [24].

2.4 System Testing

System testing is one of the critical stages in the software development life cycle (SDLC) that aims to ensure that the developed system functions according to the specifications and is able to meet user objectives [25]. This process is conducted after the implementation phase is completed and before the system is fully deployed. System testing not only evaluates functionality but also performance, security, reliability, and usability of the system [26].

Functional Testing focuses on whether the system's features work according to specifications. One commonly used method is black-box testing, where testing is conducted without looking at the internal structure of the system, based only on expected inputs and outputs[27]. For example, in an STR system, testing can be done by entering an STR number to verify whether the system displays the correct data (active, expired, or not found).

Acceptance Testing is conducted by end users or stakeholders to ensure that the system meets business needs[28]. In STR system projects, acceptance testing may involve trials by administrative staff at health facilities or health agencies[29]

There are two main approaches to system testing: black-box testing and white-box testing. Black-box testing evaluates the system from the user's perspective, without knowing the internal code. This method is ideal for testing business logic and user interfaces [30]. White-box testing requires access to the source code and is used to test logic flow, program structure, and error handling.

Thus, the development of an integrated information system for monitoring and validating STR is a strategic step to strengthen health workforce management in Indonesia[31]. This system is expected to provide an efficient, accurate, and easily accessible digital solution to ensure that only competent and registered health workers provide services to the community [32].

3. RESEARCH METHODS

The development of the STR Monitoring Information System uses the Waterfall method approach, which is a systematic and sequential software development method [33]. This method was chosen because of its structured nature, which is suitable for projects with clear and stable requirements as it has a specific and defined scope [34]. The following are the stages of the system development approach using the Waterfall method:

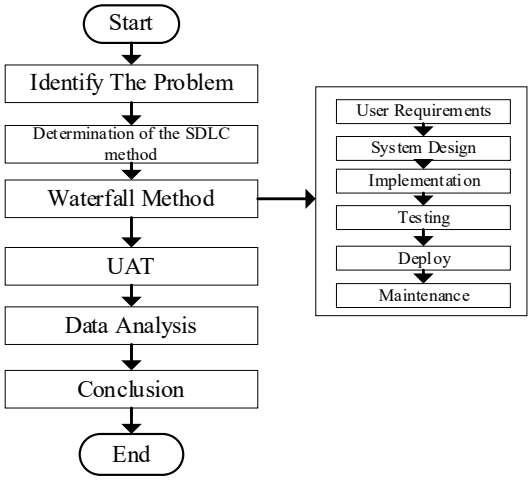

Figure 1. Flowchart Sistem Monitoring STR

Based on Figure 1. The initial stage of system development began with a needs analysis through interviews with stakeholders related to data management and non-functional aspects (data security, web-based access, scalability)[35]. Requirements specification documents are prepared to clearly document requirements. Next, the system design phase produces the system architecture and user interface design.

During the implementation phase, the program code was developed based on the approved design, with modules such as login, STR input, and reports integrated to support web-based access on various devices. The testing phase ensured the functionality of the system through unit testing and overall system testing, as well as usability for users, with bug fixes made as needed[27]. After passing the testing, the system was implemented on the Anwar Medika University server, followed by the migration of manual logbook data to digital and user training [36]. During the maintenance phase, the system is monitored to address issues, bugs, or update requirements, with periodic improvements to enhance performance, security, and technology compatibility.

4. RESULTS AND DISCUSSION

The novelty of this study is that it focuses on issues related to the supervision of STR documents belonging to health workers. Previous research by Zohrotul et al, 2022, applied digital transformation to hospital data, starting from patient registration, patient medical records, referrals, to the patient payment process[37]. Then Muslim et al, 2025, in their research, presented an alternative in the design of an information management system that can accelerate the application of HL7 or acceleration instructions in the implementation of RME in Indonesia issued by the Ministry of Health through PMK No. 24. The analysis and design used the Togaf Adm method, applying the lite version [38]. Furthermore, according to Kevin, 2022 proved that digital transformation in healthcare was implemented through a technology-based approach to improve patient-centered healthcare services [39].

Development of the STR Monitoring Information System has resulted in a platform designed to overcome the limitations of manual STR management. This section describes the results of the design, implementation, and testing of the system, which are visualized through diagrams and screenshots of the system interface as well as relevant test data [40]. The second stage after needs analysis is system design.

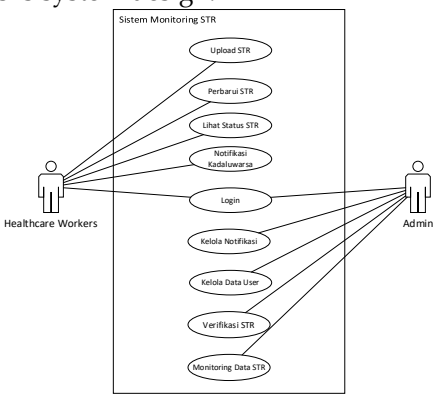

Figure 2. Use Case Diagram Sistem Monitoring STR

Based on Figure 2. Use Case Diagram illustrates the interaction between Healthcare Workers and Admin. This diagram shows key functions such as login, upload STR, update STR, STR notification, manage STR, and manage users. Each actor has a specific role. This diagram serves as the basis for ensuring that all functional requirements are met.

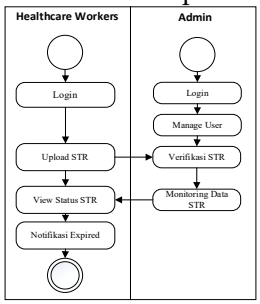

Figure 3. Activity Diagram Sistem Monitoring STR

Based on Figure 3. Activity Diagram visualizes the system workflow from the login process to STR

submission and verification. This diagram explains steps such as Manage users, verify STR, Upload STR, and view STR Status. This structured workflow ensures efficiency and consistency in the use of the system by all parties involved.

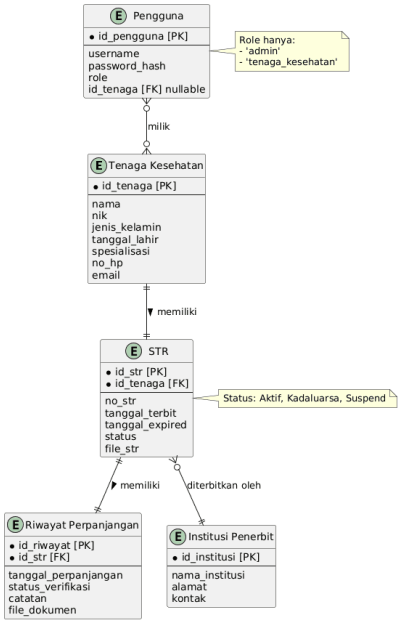

Figure 4. Entity Relationship Diagram

Based on Figure 4, the Entity Relationship Diagram (ERD) illustrates the structure of the system designed to manage Registration Certificates (STR) for health workers [41].

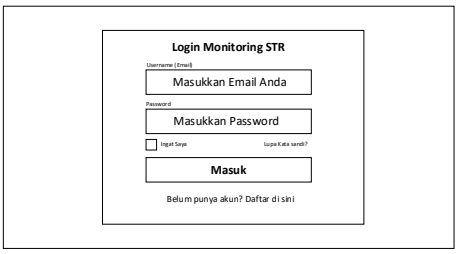

Figure 5. Prototype Login Page

Based on Figure 5. login page design features a simple and intuitive interface with fields for entering a username and password, as well as a login button. This design is intended to ensure ease of access for all users, including those with technical limitations, with a focus on authentication security.

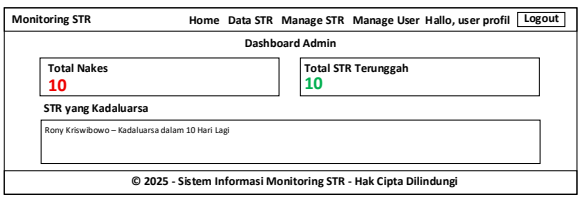

Figure 6. Prototype Admin Dashboard

Based on Figure 6. admin main page displays a dashboard containing data summaries such as Total Nakes, Total STR uploaded, and expired STR status. This design allows admins to monitor activities in real-time and manage data efficiently through a clear navigation menu.

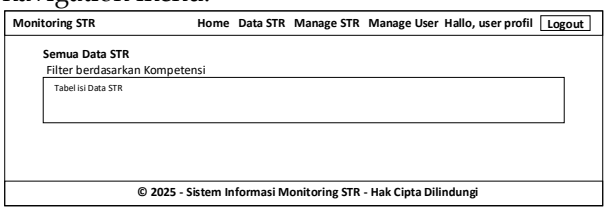

Figure 7. Prototype Data STR

Based on Figure 7. Explaining the design of the STR data management system display.

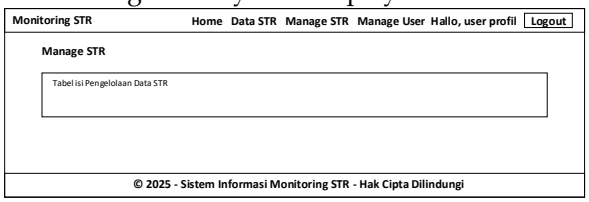

Figure 8. Prototype Manage STR

Based on Figure 8. Explains the design of the STR data management system display. This menu is used to validate STR data.

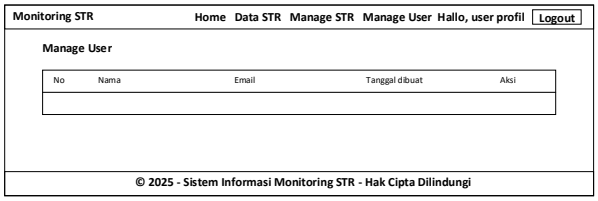

Figure 9. Manage User

Based on Figure 9. Explains the design of the user data management system display. This menu is used to add, edit, and delete user data.

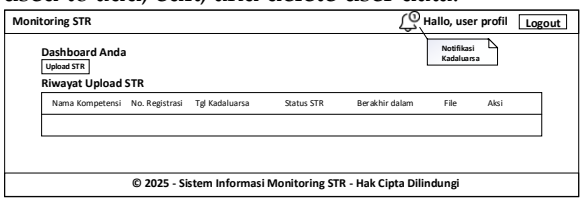

Figure 10. Prototype Dashboard User

Based on Figure 10. Explains the design of the user dashboard display. This menu is used to display user history and information related to STR expiration.

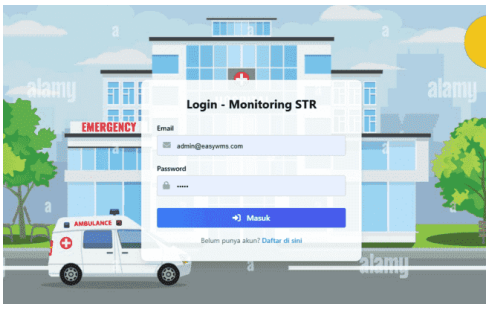

Figure 11. Interface Form Login

Based on Figure 11. This interface is designed to be simple and intuitive, consisting of columns for entering a username and password, as well as a login button.

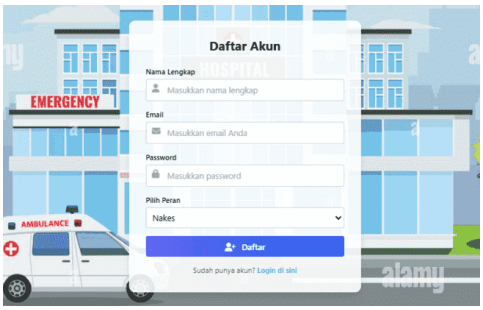

Figure 12. Interface Form Register

Based on Figure 12, This Interface is designed to create new accounts.

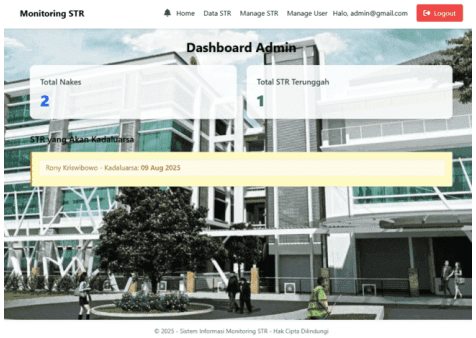

Figure 13. Interface Dashboard Admin

Based on Figure 13. shows the actual implementation of the admin main page containing data on health worker statistics and total STRs.

Figure 14. Interface Data STR

Based on Figure 14. shows the STR data page display.

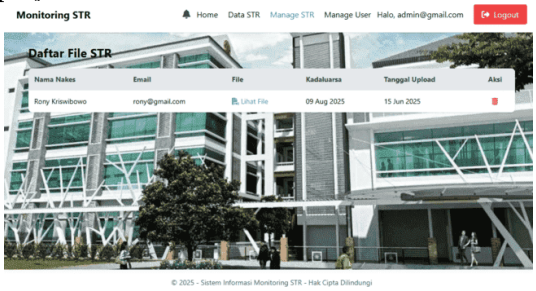

Figure 15. Interface Manage STR

Based on Figure 15. shows the STR management page.

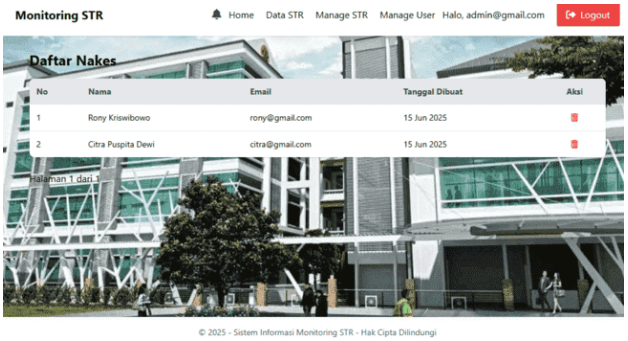

Figure 16. Interface Manage User

Based on Figure 16 shows the manage user. The "Manage User" menu is a module for managing user accounts in the system.

Figure 17. Interface Dashboard User

Based on Figure 17 shows the user dashboard page. User dashboard menu displays the history of submissions and information.

System testing is an important stage in the software development cycle to ensure that all features and functions of the application work according to the specified specifications [29]. In developing the Web-based STR Monitoring Information System, one of the testing methods used is Black Box Testing shown in Table 1.

Table 1. Blackbox Testing Results

Test Case	Input	Expected Result	Test Result	Pass/Fail
TC-001: Log in with valid credentials	Username : "admin"	1. Open the login page. 2. Enter your username and password. 3. Click the Login button.	Successfull logged into the Dashboard	Pass
TC-002: Login with incorrect password	Username : "admin"	1. Enter the correct username and incorrect password. 2. Click Login.	Unable to access the dashboard	Pass
TC-003: Log in with an	Username : "user123"	1. Enter your unregistered account.	Unable to access the dashboard	Pass

Test Case	Input	Expected Result	Test Result	Pass/Fail
unregistered account		2. Click Login.		
TC-004: Filter by Competency	Select bidan, TTK, apoteker, dokter	The system displays the appropriate health worker data.	Successful filtering	Pass
TC-005: Check active STR	No. STR: STR-12345 (still valid)	Status shows Active with a green label	A message appears stating that it is still valid.	Pass
TC-006: Apply for STR renewal	Complete data contained in registration Certificate	The system displays a notification: Submission successful.	All new application data appears	Pass
TC-007: STR notification will expire	STR with a validity period of 30 days	The system sends notifications	Expiration status display appears	Pass
TC-008: Add user	Data: name, email, role (admin, user)	A new account has been successfully created and you can log in.	notification appears stating that the account has been successfull created.	Pass

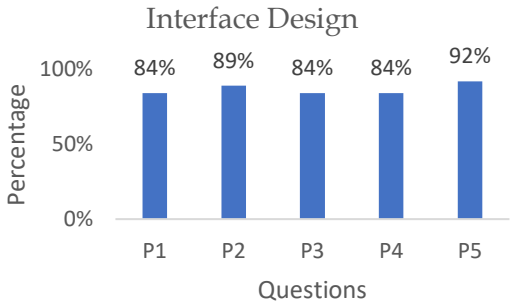

Figure 18. Percentage of Respondents Interpretation of Interface Design

Based on Figure 18. diagram shows that 87% of respondents rated the intuitive and easy-to-use interface design as reflecting the success of user-friendly design.

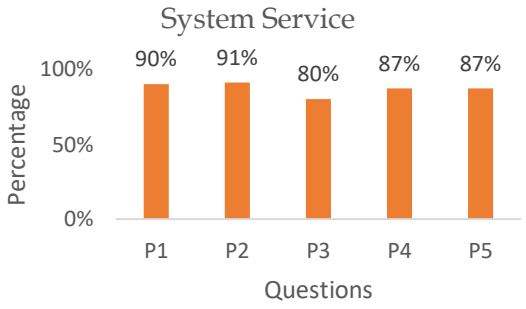

Figure 19. Percentage of Respondents Interpretation of System Services

Based on Figure 19. total of 87% of respondents stated that design services (such as navigation and responsiveness) met expectations, demonstrating the quality of interface implementation.

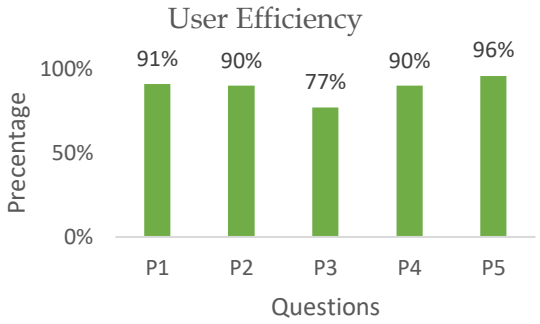

Figure 20. Percentage of Respondents Interpretation of User Efficiency

Based on Figure 20. diagram indicates that 89% of respondents feel that the system saves time in STR management, thus proving the efficiency of the system.

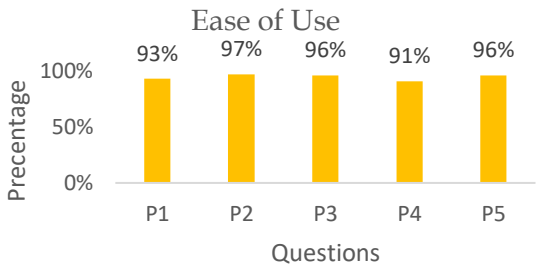

Figure 21. Percentage of Respondents Interpretation of Ease of Use

Based on Figure 21. total of 95% of respondents rated the system as easy to use without in-depth training, confirming its user-friendly design.

Table 2. Results of UAT Testing based on Indicators

No	Aspects evaluated	Indicators	Number of Items	%	Description
1	Sistem Monitoring STR	Interface Design	5	87 %	Approve
2		System Service	5	87 %	Approve
3		User Efficiency	5	89 %	Approve
4		Ease of Use	5	95 %	Approve

Based on Table 2 results of indicators measuring user acceptance using UAT with indicators of ease of use, efficiency, and satisfaction. The results show a high level of acceptance, with the majority of respondents giving positive ratings.

5. CONCLUSION

The development of an Integrated Information System for monitoring and validating the registration certificate (STR) of health workers in healthcare facilities represents a strategic innovation in health informatics to overcome the inefficiencies of manual STR management. This system introduces a digital transformation in the governance of health workforce credentials by leveraging centralized database architecture, automated alert mechanisms,

QR code-based verification, and real-time compliance reporting—features that collectively enhance data integrity, operational efficiency, and regulatory transparency. As a technological response to Law Number 36 of 2014 and Government Regulation Number 32 of 1996 (as reinforced by Law Number 17 of 2023 on Health), the system ensures that STR management aligns with legal requirements for health worker competency and accountability. From an informatics perspective, the system's innovation lies in its integration of secure web technologies with automated validation workflows, enabling seamless data interoperability between healthcare institutions and regulatory bodies. The implementation of QR code verification introduces a tamper-resistant method for authenticating STR documents, reducing the risk of fraud and supporting rapid on-site validation a significant advancement over paper-based or decentralized digital records. Furthermore, the system's modular design and structured data model lay the foundation for future scalability and integration within Indonesia's national e-Health ecosystem. The system was developed using the Waterfall methodology, selected for its systematic and phase driven approach, which is particularly suitable for projects with well-defined requirements and regulatory constraints. Development stages included requirement analysis, system design, implementation, rigorous testing (Black Box Testing and User Acceptance Testing), deployment on Server, and ongoing maintenance. The resulting platform enables cross-institutional data integration, real-time monitoring of STR status, and minimizes risks associated with human error, delayed renewals, and fraudulent practices such as the use of expired or counterfeit STRs. System evaluation through Black Box Testing confirmed functional correctness across all modules, while User Acceptance Testing (UAT) demonstrated high usability and satisfaction. Specifically, 87% of respondents rated the user interface as intuitive, 87% affirmed that system responsiveness and navigation met expectations, 89% reported significant time efficiency in STR administration, and 95% found the system easy to use without requiring extensive training. These results indicate strong user acceptance based on key usability indicators: ease of use, operational efficiency, and user satisfaction. Looking forward, the system can be enhanced through migration to a microservices architecture to improve scalability, fault tolerance, and independent deployment of features. Future development may also incorporate Artificial Intelligence (AI) and machine learning models to detect anomalies in STR documents such as forged signatures or altered data by analyzing uploaded files through image recognition and pattern classification. Integration with blockchain technology could further strengthen data immutability and audit trails, while API-based interoperability with national health information systems will support broader digital health integration. These advancements will position the system as a cornerstone of smart, secure, and sustainable health workforce management in Indonesia.

6. BIBLIOGRAPHY

[1] Rony Kriswibowo, Rusina Widha Febriana, and Johan Suryo Prayogo, "Tingkat Kebergunaan Aplikasi Pedulilindungi Mobile Menggunakan Metode Sistem Usability Scale dan Net Promoter Score: The Usability Level of Pedulilindungi Mobile Application Using the Usability Scale System and Net Promoter Score Method," *Decode: Jurnal Pendidikan Teknologi Informasi*, vol. 3, no. 1 SE-Articles, pp. 54–62, Feb. 2023, doi: 10.51454/decode.v3i1.120.

[2] H. Rohman, C. Wahyu, P. Dewi, and M. R. Nuswantoro, "Perancangan Sistem Informasi Pendaftaran Rawat Jalan Berbasis Web di Klinik Pratama Patalan," *SMIKNAS*, pp. 23–31, Mar. 2019, Accessed: Jul. 31, 2025. [Online]. Available: https://ojs.udb.ac.id/smiknas/article/view/689

[3] F. Khairul, H. S. Fahmi, and A. Ardiansah, "Implementasi Kepemilikan Surat Tanda Registrasi Perawat di Rumah Sakit Umum Daerah Bangkinang Berdasarkan Undang-Undang Nomor 38 Tahun 2014 Tentang Keperawatan," *Innovative: Journal Of Social Science Research*, vol. 4, no. 1, pp. 12896–12906, Feb. 2024, doi: 10.31004/INNOVATIVE.V4I1.9584.

[4] R. Husein, "Percepatan Pemenuhan Tenaga Medis dan Tenaga Kesehatan di Puskesmas Untuk Mengoptimalkan Layanan Kesehatan Bagi Masyarakat," *Jurnal Praba : Jurnal Rumpun Kesehatan Umum*, vol. 2, no. `1, pp. 92–103, Mar. 2024, doi: 10.62027/PRABA.V2I`1.74.

[5] L. Mainetti, L. Patrono, and R. Vergallo, "Combining EPCglobal and HL7 to deploy innovative e-health services for patients affected by multiple intolerances," *ACM International Conference Proceeding Series*, 2011, doi: 10.1145/2093698.2093784;

[6] S. Srivastava, S. Soman, A. Rai, A. Cheema, and P. K. Srivastava, "Continuity of care document for hospital management systems: An implementation perspective," *ACM International Conference Proceeding Series*, vol.

Part F128003, pp. 339–345, Mar. 2017, doi: 10.1145/3047273.3047362

[7] E. H. B. Koten, B. S. Ningrum, and Rr. T. S. Hariyati, "Implementasi Electronic Medical Record (EMR) dalam Pelayanan Kesehatan di Rumah Sakit: Studi Literatur," *Carolus Journal of Nursing*, vol. 2, no. 2, pp. 95–110, May 2020, doi: 10.37480/CJON.V2I2.45.

[8] M. K. Ali, "Pengembangan dan Validasi Rancang Bangun Sistem Informasi Surat Elektronik Poliklinik Berbasis Website," *JRTI (Jurnal Riset Tindakan Indonesia)*, vol. 6, no. 2, pp. 175–186, Jul. 2021, doi: 10.29210/3003996000.

[9] R. Kriswibowo *et al.*, "Evaluasi Kematangan Teknologi Informasi Kesehatan: Penerapan Health Information Technology Maturity Model (HITMM)," *RIGGS: Journal of Artificial Intelligence and Digital Business*, vol. 4, no. 2, pp. 5655–5662, Jul. 2025, doi: 10.31004/riggs.v4i2.1482.

[10] T. K. Nuckols *et al.*, "The effectiveness of computerized order entry at reducing preventable adverse drug events and medication errors in hospital settings: A systematic review and meta-analysis," *Syst Rev*, vol. 3, no. 1, Jun. 2014, doi: 10.1186/2046-4053-3-56.

[11] R. Husein, "Percepatan Pemenuhan Tenaga Kesehatan di Puskesmas untuk Daya Ungkit Pembangunan Kesehatan," *GEMAKES: Jurnal Pengabdian Kepada Masyarakat*, vol. 4, no. 1, pp. 149–157, Feb. 2024, doi: 10.36082/GEMAKES.V4I1.1552.

[12] L. N. Rokhmah and Y. Ramawati, "Upaya Peningkatan Kepuasan Tenaga Kesehatan Terhadap Dukungan Penerbitan Surat Tanda Registrasi (STR)," *Jurnal Analis Kebijakan*, vol. 7, no. 2, pp. 233–241, Dec. 2023, doi: 10.37145/JAK.V7I2.677.

[13] U. Setiadi and T. Yulianda Bakri, "Optimalisasi Kemampuan Basic Life Support (BLS) Diskes Kolinlamil Guna Meningkatkan Profesionalisme Dukungan Kesehatan Dalam Rangka Mendukung Tugas Operasional Kolinlamil," *JURNAL ILMIAH KAJIAN KEANGKATANLAUTAN*, vol. 6, no. 2, pp. 71–80, Oct. 2024, Accessed: Jul. 31, 2025. [Online]. Available: https://jurnalseskoal.id/index.php/jikk/article/view/21

[14] B. Bulkani and A. Harianto, "Implementasi Kebijakan Pembuatan Surat Tanda Registrasi (STR) Bagi Tenaga Kesehatan Provinsi Kalimantan Tengah," *Pencerah Publik*, vol. 6, no. 1, pp. 26–34, 2019, doi: 10.33084/pencerah.v6i1.962.

[15] S. Poluan, "Pemberlakuan Tindak Pidana Bagi Tenaga Kesehatan Apabila Melakukan Kelalaian Terhadap Penerima Pelayanan Kesehatan Menurut Undang-Undang Nomor 14 Tahun 2014 Tentang Tenaga Kesehatan," *LEX CRIMEN*, vol. 10, no. 3, Apr. 2021, Accessed: Jul. 31, 2025. [Online]. Available: https://ejournal.unsrat.ac.id/v3/index.php/lexcrimen/article/view/33118

[16] D. Artin Meirina, S. Farlinda, F. Erawantini, and M. Yunus, "Perancangan Dan Pembuatan Rekam Medis Elektronik Berbasis Web Dengan Memanfaatkan QR Code Di Puskesmas Karya Maju Kabupaten Musi Banyuasin," *J-REMI : Jurnal Rekam Medik dan Informasi Kesehatan*, vol. 3, no. 3, pp. 190–202, May 2022, doi: 10.25047/J-REMI.V3I3.2607.

[17] A. M. Barokah, E. L. Setianingsih, and D. Lituhayu, "Analisis Pelayanan Perizinan Tenaga Kesehatan dengan Aplikasi Sistem Informasi Cerdas Layanan Terpadu untuk Publik (SICANTIK) di Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu Kabupaten Wonogiri," *Journal of Public Policy and Management Review*, vol. 12, no. 4, pp. 326–345, Sep. 2023, doi: 10.14710/JPPMR.V12I4.41238.

[18] H. G. Lambe, M. Widyarini, and K. Grahadian, "Pengaruh Sistem Registrasi Online (MOBILE JKN) terhadap Kepuasan Pasien pada Manajemen Sistem Janji Temu," *Jurnal Ilmiah Manajemen, Ekonomi, & Akuntansi (MEA)*, vol. 9, no. 1, pp. 1041–1056, Feb. 2025, doi: 10.31955/MEA.V9I1.5070.

[19] Y. A. Rahman, E. D. Wahyuni, and D. S. Pradana, "Rancang Bangun Prototype Sistem Informasi Manajemen Program Studi Informatika Menggunakan Pendekatan User Centered Design," *Jurnal Repositor*, vol. 2, no. 4, pp. 503–510, Jan. 2020, doi: 10.22219/REPOSITOR.V2I4.30513.

[20] G. Willis, S. Cave, and M. Kunc, "Strategic workforce planning in healthcare: A multi-methodology approach," *Eur J Oper Res*, vol. 267, no. 1, pp. 250–263, May 2018, doi: 10.1016/J.EJOR.2017.11.008.

[21] E. Siswo and A. Sahputra, "Analysis of Waterfall and Agile Scrum Approaches in Information Technology Project Management," *Jurnal Ekonomi Teknologi dan Bisnis (JETBIS)*, vol. 4, no. 7, pp. 562-569., Jul. 2025, doi: 10.57185/JETBIS.V4I7.192.

[22] L. M. Wijethungaarachchi and S. Dayarathna, "An Analysis of Applying Software Development Methodologies in Military Software Development," 2020, Accessed: Jul.

31, 2025. [Online]. Available: https://ir.kdu.ac.lk/handle/345/3019

[23] H. Xin, X. Feng, Y. Xin, F. Heriyanti, and A. Ishak, "Design of logistics information system in the finished product warehouse with the waterfall method: review literature," *IOP Conf Ser Mater Sci Eng*, vol. 801, no. 1, p. 012100, May 2020, doi: 10.1088/1757-899X/801/1/012100.

[24] A. A and B. A, "Software Engineering Methodologies: A Review of The Waterfall Model and Object-Oriented Approach," *Int. Journal of Scientific & Engineering Research*, vol. 4, no. 7, pp. 427–434, 2014.

[25] R. S. Pressman, "Part Three Applying Web Engineering," *Software engineering : a practitioner's approach*, pp. 499–626, 2005, Accessed: Jul. 31, 2025. [Online]. Available: https://books.google.com/books/about/Software_Engineering.html?hl=id&id=bL7QZHtWvaUC

[26] I. Sommerville, "Software Engineering 9 (International Edition)," p. 773, 2011.

[27] R. Kriswibowo *et al.*, "Evaluasi Kematangan Teknologi Informasi Kesehatan: Penerapan Health Information Technology Maturity Model (HITMM)," *RIGGS: Journal of Artificial Intelligence and Digital Business*, vol. 4, no. 2, pp. 5655–5662, Jul. 2025, doi: 10.31004/riggs.v4i2.1482.

[28] R. Kriswibowo, F. K. Suhada, and M. A. Riskyansah, "Pengembangan Sistem Informasi Logbook PKL Berbasis Web dengan Fitur Real-Time Monitoring," vol. 3, no. 7, pp. 478–489, 2025.

[29] R. Kriswibowo, J. S. Prayogo, R. W. Febriana, and P. A. Alia, "Implementasi Black Box Testing dan Acceptance Testing Fitur SKKM pada Cybercampus.uam.ac.id Universitas Anwar Medika," *Jurnal Informatika Universitas Pamulang*, vol. 8, no. 4, pp. 561–567, Dec. 2023, doi: 10.32493/INFORMATIKA.V8I4.36904.

[30] R. Kriswibowo, R. Widha Febriana, J. Suryo Prayogo, and P. Ariatna Alia, "Pengaruh Fitur Dan Kemudahan Penggunaan Terhadap Kepuasan Pengguna Aplikasi Si Rekap KPU," *Neptunus: Jurnal Ilmu Komputer Dan Teknologi Informasi*, vol. 2, no. 2, pp. 16–24, Apr. 2024, doi: 10.61132/NEPTUNUS.V2I2.82.

[31] A. A. Tako and K. Kotiadis, "PartiSim: A multi-methodology framework to support facilitated simulation modelling in healthcare," *Eur J Oper Res*, vol. 244, no. 2, pp. 555–564, Jul. 2015, doi: 10.1016/J.EJOR.2015.01.046.

[32] A. Baumann *et al.*, "Strategic Workforce Planning for Health Human Resources," *Canadian Journal of Nursing Research*, vol. 48, no. 3–4, pp. 93–99, Sep. 2016, doi: 10.1177/0844562116680715.

[33] M. Agung Vafky, M. Rasyid, and F. Yuda, "Perancangan Sistem Informasi Monitoring Praktek Kerja Lapangan dengan Menggunakan Metode Waterfall," *Jurnal KomtekInfo*, vol. 11, no. 4, pp. 425–435, Nov. 2024, doi: 10.35134/KOMTEKINFO.V11I4.595.

[34] D. Nurdiana, D. Astuti Aprijani, F. Amastini, M. Riyan Maulana, M. Rizky Putra Aji Utama, and A. Info Kata Kunci, "Pengembangan Sistem Informasi Pengelolaan Pembimbing Lapangan Praktik Kerja Lapangan (PKL) Prodi Sistem Informasi Universitas Terbuka," *Decode: Jurnal Pendidikan Teknologi Informasi*, vol. 4, no. 2, pp. 418–436, May 2024, doi: 10.51454/DECODE.V4I2.433.

[35] R. Setiawan, D. Kurniadi, and H. Bunyamin, "Perancangan Sistem Pengelolaan Penanggulangan Bencana Alam Garut Berbasis Sistem Informasi Geografis," *Jurnal Algoritma; Vol 14 No 2 (2017)*, vol. 14, no. 2, pp. 215–221, 2017, [Online]. Available: http://journals.sttgarut.ac.id/index.php/algoritma/article/view/44

[36] R. Febriani, T. Mary, and A. Y. Pernanda, "Sistem Informasi Monitoring Praktik Kerja Lapangan (PKL) Berbasis Web di SMK Negeri 1 Sintuk Toboh Gadang," *Jurnal Pustaka Data (Pusat Akses Kajian Database, Analisa Teknologi, dan Arsitektur Komputer)*, vol. 2, no. 2, pp. 95–102, Dec. 2022, doi: 10.55382/JURNALPUSTAKADATA.V2I2.291.

[37] Z. Aini, N. Nurwijayanti, S. Supriyanto, and H. E. Susanto, "Strategi Pengembangan Transformasi Sistem Informasi Manajemen Rumah Sakit (SIM-RS) di RSUD dr. Iskak Tulungagung," *Journal of Community Engagement in Health*, vol. 5, no. 2, pp. 128–139, Sep. 2022, doi: 10.30994/JCEH.V5I22.383.

[38] M. Muslim and S. Windarti, "Analisis Dan Perancangsan Sistem Informasi Manajemen Rumah Sakit (SIMRS) Menggunakan Transformasi Metode Togaf Adm," *Jurnal Inovatif*, vol. 3, no. 2, pp. 156–165, Aug. 2024, doi: 10.58300/INOVATIF-WIRA-WACANA.V3I2.942.

[39] K. Chrisanta, B. Program, S. Kajian, A. R. Sakit, D. Administrasi, and K. Kesehatan, "Transformasi Digital sebagai bagian dari Strategi Pemasaran di Rumah Sakit Siloam Palangka Raya Tahun 2020," *Jurnal ARSI : Administrasi Rumah Sakit Indonesia*, vol. 8, no. 2, p. 4, Jun. 2022, doi: 10.7454/arsi.v8i2.5547.

[40] M. Syahid Pebriad, P. Salman, and T. Kemal Fattah, "Implementasi Use Case Diagram dan Activity Diagram dalam Perancangan Aplikasi

Kalkulator Pajak Bagi UMKM," *MULTITEK INDONESIA*, vol. 17, no. 1, pp. 44–58, Jul. 2023, doi: 10.24269/MTKIND.V17I1.6024.

[41] D. Goelman and I. Y. Song, "Entity-Relationship Modeling Re-revisited," *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 3288, pp. 43–54, 2004, doi: 10.1007/978-3-540-30464-7_5.