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WEB APPLICATION DEVELOPMENT FOR HEALTH SERVICE MANAGEMENT (E-HEALTH SYSTEM)
PENGEMBANGAN APLIKASI WEB UNTUK MANAJEMEN LAYANAN KESEHATAN (E-HEALTH SYSTEM)

Ninda Pradana[1], Kausar Rusdin[2], Zulfikar Isnansah[3], Arman Rusdin[4], Dhimas Tribuana[5], Dayanti[6]
Universitas Muhammadiyah Kolaka Utara, Lasusua, Indonesia[1,2,3,4,5,6]
nindapradana04@gmail.com[1], kausarrusdin@gmail.com[2], zulfikarisnansah157@gmail.com[3], armankolut724@gmail.com[4], d.tribuana@gmail.com[5], dayanti.fattah@gmail.com[6]

ABSTRACT

Digital transformation has driven healthcare systems to shift from conventional service models toward more integrated, efficient, and accessible care delivered through web-based e-health platforms. Web-based e-health applications have become the backbone of this transformation by offering innovative solutions to improve service quality, medical data accuracy, and patient satisfaction. This study aims to systematically map the technological architectures, functional features, implementation challenges, and impacts of web application development for healthcare service management (E-Health Systems) through a Systematic Literature Review (SLR) approach. The research method employed a systematic review of 20 scholarly articles published between 2020 and 2025, retrieved from reputable databases including IEEE Xplore, ScienceDirect, Scopus, and Google Scholar, based on clearly defined inclusion and exclusion criteria. The synthesis results indicate that modern architectures based on React.js, Node.js, microservices, and cloud computing are widely adopted to support intelligent Electronic Medical Records (EMR), integrated telemedicine ecosystems, and healthcare data analytics modules. The most frequently implemented features include web-based EMR, comprehensive telemedicine services, and data analytics platforms for clinical decision support. However, several key challenges remain, particularly advanced cybersecurity risks, interoperability gaps despite the adoption of standards such as FHIR, and socio-technical barriers affecting system acceptance and utilization by healthcare professionals and patients. These findings emphasize that the successful implementation of web-based e-health applications depends heavily on the integration of reliable technologies, user-centered interface design, and ethical data governance to ensure secure, inclusive, and patient-centered healthcare services.

Keywords: *e-health, web applications, healthcare management, electronic medical records, telemedicine, systematic literature review.*

ABSTRAK

Transformasi digital mendorong sistem kesehatan global beralih dari layanan konvensional menuju model pelayanan yang lebih terintegrasi, efisien, dan mudah diakses melalui platform e-health berbasis web. Aplikasi web e-health kini menjadi tulang punggung inovasi layanan kesehatan dengan menawarkan solusi untuk meningkatkan kualitas layanan, akurasi pengelolaan data medis, serta kepuasan pasien. Penelitian ini bertujuan untuk memetakan secara sistematis arsitektur teknologi, fitur fungsional, tantangan implementasi, serta dampak pengembangan aplikasi web dalam manajemen layanan kesehatan (*E-Health System*) berdasarkan pendekatan *Systematic Literature Review* (SLR). Metode penelitian menggunakan tinjauan literatur sistematis terhadap 20 artikel ilmiah yang dipublikasikan pada periode 2020–2025 dan diperoleh dari basis data terpercaya seperti IEEE Xplore, ScienceDirect, Scopus, dan Google Scholar, dengan menerapkan kriteria inklusi dan eksklusi yang ketat. Hasil sintesis menunjukkan bahwa arsitektur modern berbasis React.js, Node.js, *microservices*, dan komputasi awan banyak diadopsi untuk mendukung Rekam Medis Elektronik (RME) yang cerdas, ekosistem telemedicine terintegrasi, serta modul analitik data kesehatan. Fitur utama yang dominan meliputi RME berbasis web, layanan konsultasi jarak jauh, dan analitik data untuk pengambilan keputusan klinis. Namun demikian, tantangan utama masih mencakup risiko keamanan siber, keterbatasan interoperabilitas meskipun telah mengadopsi standar seperti FHIR, serta hambatan sosio-teknis yang memengaruhi tingkat adopsi oleh tenaga kesehatan dan pasien. Temuan ini menegaskan bahwa keberhasilan implementasi e-health sangat bergantung pada integrasi teknologi yang andal, desain antarmuka berorientasi pengguna, serta tata kelola data yang aman dan etis.

Kata Kunci: e-health, aplikasi web, manajemen layanan kesehatan, rekam medis elektronik, *telemedicine*, tinjauan literatur sistematis.

INTRODUCTION

Healthcare systems in many countries are currently facing increasing pressure due to population growth, rising life expectancy, the growing prevalence of chronic diseases, and limited healthcare resources. These conditions are further exacerbated by disparities in access to healthcare services, particularly between urban and rural areas, making conventional healthcare service models increasingly unable to meet societal needs in an equitable and efficient manner (World Health Organization [WHO], 2022).

In addition, reliance on manual processes and fragmented information systems further degrades the quality of healthcare services. Poor system integration leads to service delays, increases the risk of clinical errors, and limits policymakers' ability to monitor healthcare system performance in real time. Consequently, traditional healthcare delivery models are proving increasingly inadequate in addressing the demands of modern societies that require fast, accurate, and sustainable services (Buntin et al., 2021).

The digital revolution has emerged as a response to these challenges. Over the past decade, digital transformation has driven a paradigm shift in healthcare delivery from fragmented systems toward more integrated, patient-centered, and location-independent services. This transformation has been enabled through the adoption of information and communication technologies (ICT) in the form of various e-health solutions (Keesara et al., 2020).

E-health is generally defined as the use of information and communication technologies to support and enhance healthcare services, health system management, and clinical decision-making. Compared to native mobile applications that depend on specific platforms, web-based applications offer advantages such as cross-device accessibility via web browsers, simpler update processes, and relatively lower development and maintenance costs (Alam et al., 2021).

The development of web-based e-health applications is no longer limited to health information portals. Many web-based e-health systems have evolved into integrated healthcare service management platforms, encompassing patient registration, electronic medical record management, teleconsultation services, and health data analytics to support data-driven decision-making (Hassan & Zhou, 2023). This integration plays a crucial role in improving service efficiency, patient care quality, and healthcare system transparency.

Although numerous studies on health information systems and e-health have been conducted, research that specifically maps the technological landscape, functional features, and implementation challenges of web-based e-health applications for healthcare service management remains relatively limited, particularly in recent publications. Therefore, a comprehensive review is needed to provide an up-to-date overview of technological developments and implementation practices of web-based e-health systems. The following sections present the SLR methodology, the results of the literature synthesis and discussion, as well as implications, limitations, and recommendations for future research.

METHODS

To ensure the breadth and depth of the analysis, this study employed the Systematic Literature Review (SLR) method. SLR is a systematic, explicit, and replicable secondary research method used to identify, evaluate, and synthesize all relevant studies related to specific research questions. The procedures followed in this study adhere to a standard SLR protocol, which includes the following stages:

1. Planning and Formulation of Research Questions:
   The research questions in this study were formulated as follows: (RQ1) What are the trends in technological architectures used in the development of web applications for healthcare service management during the 2020–2025 period? (RQ2) What functional features are most commonly implemented in web-based e-health applications? (RQ3) What are the main challenges reported in the development and implementation

processes? (RQ4) What impacts have been reported on service quality and healthcare management?

2. Literature Search Strategy:
   The literature search was conducted across four major academic databases, namely IEEE Xplore, ScienceDirect, Scopus, and Google Scholar, covering publications from January 2020 to December 2025 and limited to English and Indonesian languages. Boolean keyword strategies were developed and validated by two researchers to ensure relevance and consistency. The search strings included, among others: ('web application' OR 'web-based system') AND ('e-health' OR 'digital health' OR 'healthcare management'); ('electronic health record' OR 'EHR') AND ('web platform'); ('telemedicine' OR 'telehealth') AND ('web development'); and ('health information system') AND ('cloud computing').
3. Inclusion and Exclusion Criteria:
   - Inclusion criteria comprised: (1) empirical research articles (quantitative, qualitative, or mixed methods) and systematic literature reviews; (2) publications in reputable journals or conference proceedings between January 2020 and December 2025; (3) studies that explicitly discuss the development, implementation, or evaluation of web-based applications for healthcare services; and (4) availability of full-text articles in English or Indonesian. These criteria were selected to ensure that the analyzed studies were methodologically sound, up-to-date, and relevant to the focus on web-based e-health application development.
   - Exclusion criteria included: (1) articles that exclusively discuss native mobile applications without a web component; (2) studies focusing on medical hardware without integrated web-based management systems; and (3) editorials, opinion papers, or case reports lacking empirical data. These articles were excluded because they do not provide sufficient scientific evidence related to the design and implementation of web-based e-health applications.
4. Study Selection and Data Extraction Process:
   The literature selection process was conducted in stages following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow. During the identification stage, a total of 152 articles were retrieved from the initial searches across IEEE Xplore, ScienceDirect, Scopus, and Google Scholar. Subsequently, during the screening stage based on titles and abstracts, 96 articles were excluded due to irrelevance to the research focus, leaving 56 articles for the next stage.
   The full-text eligibility assessment was performed on the remaining 56 articles, of which 36 were excluded for not meeting the inclusion criteria, such as focusing on mobile applications without web components or failing to comprehensively address healthcare service management. As a result, 20 articles met all inclusion criteria and were included in the final synthesis.
   Each selection stage was independently conducted by two researchers, with discrepancies resolved through discussion until consensus was reached. Data from each article were extracted using a standardized template that was pilot-tested on several preliminary studies. The extracted data included research context and objectives, methodology and study design, technologies and architectures used, implemented system features, measured performance indicators, key findings, and reported technical and socio-technical challenges.
5. Data Synthesis and Analysis:
   - Prior to synthesis, the methodological quality of each article was assessed using a checklist evaluating clarity of objectives, appropriateness of research design, transparency of procedures, and completeness of result reporting. Articles of very low quality were noted separately and not used as primary evidence in drawing

conclusions.

- Data synthesis was conducted narratively through a thematic coding process. Two researchers independently categorized findings into initial categories (e.g., technological architecture, system features, implementation challenges, and impacts), then discussed discrepancies to derive consistent overarching themes across the studies. These themes formed the basis for the results and discussion sections.

RESULTS AND DISCUSSION

Based on the literature selection process using the Systematic Literature Review (SLR) approach and the PRISMA flow, a total of 20 articles that met all inclusion criteria were analyzed in depth. These articles were published between 2020 and 2025 and discuss the development of web applications for healthcare service management (E-Health Systems) from various perspectives, including technological architecture, functional features, and implementation challenges.

To provide a comprehensive and structured overview of the main findings from the reviewed literature, Table 1 presents a summary of the SLR results, including authors and year of publication, technologies used, implemented system features, and key findings from each study.

Table 1. Summary of Systematic Literature Review Results

No	Authors & Year	Technologies Used	Main System Features	Key Findings
1	Smith et al. (2022)	React.js, Node.js, FHIR API	Electronic Health Records (EHR), Interoperability	Improved service efficiency and healthcare data exchange
2	Hassan & Zhou (2023)	WebRTC, Node.js	Telemedicine	Enhanced quality of remote healthcare services
3	Johnson & Gupta (2023)	Microservices, Docker	Healthcare Service Management	Improved system scalability and performance
4	Kurniawan & Pratama (2021)	Cloud Computing, PHP	Electronic Medical Records	Reduced medical record documentation errors
5	Yamada (2023)	HL7 FHIR	Data Interoperability	More efficient inter-system data exchange
6	Oliveira et al. (2024)	Web Security Framework	Security and Privacy	Highlighted the need for stronger cybersecurity measures
7	Setiawan (2022)	PHP, MySQL	Telemedicine	Increased healthcare access in regional hospitals
8	Brown (2024)	IoT, Web Dashboard	Patient Monitoring	More effective real-time patient monitoring
9	Nguyen & Lee (2024)	UX Design, Web-based UI	User Interface	Reduced digital divide in healthcare services
10	Zhang et al. (2024)	Artificial Intelligence, Web-based EHR	Clinical Decision Support System (CDSS)	Supported data-driven clinical decision-making
11	Al-Harbi et al. (2023)	Cloud Platform	Healthcare Service Management	Improved operational efficiency
12	Putri et al. (2022)	Web-based System	System Usability	Increased user satisfaction
13	Rojas & Lee (2024)	Blockchain	Medical Data Security	More transparent medical data audit trails
14	Fernandez (2023)	Big Data Analytics	Health Surveillance	Supported public health policy decision-making
15	Widodo & Rahmawati (2021)	WebRTC	Telemedicine	Effective solution for remote and rural areas

No	Authors & Year	Technologies Used	Main System Features	Key Findings
16	Liu et al. (2024)	FHIR API Gateway	Interoperability	Reduced data silos across healthcare institutions
17	Santos (2023)	Microservices	System Architecture	More stable system performance
18	Prabowo (2022)	Cybersecurity Framework	EHR Security	Reduced risk of medical data breaches
19	Kim & Park (2024)	AI-assisted Triage System	Telehealth	Accelerated patient triage processes
20	Costa et al. (2024)	UX-driven Web System	Digital Health Services	Increased user acceptance and adoption

Based on the SLR results table summarizing the 20 selected articles, it is evident that research on web applications for healthcare service management (E-Health Systems) has developed rapidly and encompasses a wide range of technological approaches, system architectures, and implementation contexts. The synthesis of these findings enables a more comprehensive mapping of common patterns, gaps, and implications for E-Health development.

Addressing RQ1 regarding technological characteristics and system architecture, the majority of studies indicate the dominance of microservices architecture combined with cloud computing. This approach is favored due to its ability to enhance scalability, development flexibility, and ease of integration across system modules, particularly for electronic medical records, telemedicine services, and web-based patient monitoring systems. Several studies also incorporate FHIR-based APIs to support cross-platform data exchange, indicating a shift from monolithic systems toward more modular and interoperable architectures.

Furthermore, addressing RQ2 concerning the main features and functions of E-Health systems, the SLR results show that the most frequently implemented features include web-based electronic medical records, telemedicine services, e-prescriptions, and health analytics dashboards. The integration of supporting technologies such as artificial intelligence, the Internet of Things (IoT), and big data analytics has also become increasingly common to enhance clinical decision-making quality and enable real-time patient condition monitoring. These findings indicate that E-Health web applications no longer function merely as administrative systems but have evolved into intelligent, patient-centered platforms supporting clinical services.

However, in addressing RQ3, the SLR results table also reveals consistent challenges reported across studies. These challenges primarily relate to patient data security and privacy, including risks of data breaches and weak access control mechanisms. In addition, limited system interoperability, low levels of user digital literacy, and dependence on network infrastructure pose significant barriers to E-Health implementation, particularly in resource-constrained regions. Several studies also highlight regulatory ambiguity as a factor hindering widespread technology adoption.

Based on this synthesis, in response to RQ4, it can be concluded that the positive impact of E-Health web applications on improving healthcare service quality can only be achieved when technological development is accompanied by a holistic socio-technical approach. This includes strengthening data security governance, standardizing interoperability, enhancing user digital literacy, and providing regulatory support alongside cross-stakeholder collaboration. Thus, the success of E-Health is not determined solely by technological sophistication but also by organizational readiness, human resources, and a supportive policy ecosystem.

CONCLUSION

Based on the synthesis of 20 research articles published between 2020–2025, web-based applications for healthcare service management (E-Health Systems) have proven to be

a critical component in the digital transformation of the healthcare sector. The findings of this study address RQ1 and RQ2 by demonstrating the dominance of microservices architecture and cloud computing, combined with intelligent electronic medical records, telemedicine, e-prescription, and data analytics features to enhance operational efficiency, service accessibility, and support patient-centered clinical decision-making.

Addressing RQ3, the reviewed literature identifies major challenges including patient data security and privacy, limited interoperability between systems, gaps in user digital literacy, as well as unclear regulations and ethical frameworks for digital healthcare services. Therefore, in response to RQ4, the positive impact of E-Health web applications can only be maximized when technological innovation is balanced with ethical data governance, organizational readiness, and cross-stakeholder collaboration.

As a practical implication of the SLR findings, the development of E-Health web applications should be directed toward: (1) strengthening data security and interoperability through end-to-end encryption and the adoption of HL7 FHIR standards; (2) implementing user-centered system design to enhance digital literacy and service inclusivity; (3) reinforcing governance through multi-stakeholder collaboration; and (4) aligning regulations and ethical frameworks to ensure legal certainty and the sustainability of E-Health implementation.

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REFERENCES

Al-Harbi, A., Alotaibi, M., & Rahman, S. (2023). Cloud-based healthcare management system using web technologies. IEEE Access, 11, 25641–25655.

Brown, K. (2024). IoT-enabled patient monitoring through web dashboard integration. Sensors, 25(10), 2041–2056. https://doi.org/10.3390/s25102041

Costa, G., Silva, M., & Pereira, R. (2024). User acceptance of web-delivered digital health services: A UX-driven study. BMC Health Services Research, 24, 1–15.

Fernandez, M. (2023). Big data analytics for public health surveillance through web-based platforms. International Journal of Medical Informatics, 182, 105012. https://doi.org/10.1016/j.ijmedinf.2023.105012

Hassan, M., & Zhou, Y. (2023). Telemedicine platform using WebRTC technology: Enhancing remote healthcare quality. In Proceedings of the International Conference on Digital Health (pp. 88–94). IEEE.

Johnson, L., & Gupta, P. (2023). Microservices architecture for scalable e-health systems. Journal of Medical Systems, 47(4), 1–12.

Kim, J., & Park, Y. (2024). Web-based telehealth application with AI-assisted triage. Computer Methods and Programs in Biomedicine, 243, 107770. https://doi.org/10.1016/j.cmpb.2024.107770

Kurniawan, R., & Pratama, A. (2021). Implementasi cloud pada layanan rekam medis elektronik berbasis web. Jurnal Teknologi Informasi dan Kesehatan, 6(2), 45–55.

Liu, X., Zhang, H., & Chen, Y. (2024). FHIR-based API gateway to improve interoperability in web e-health systems. Health Informatics Journal, 30, 1–13.

Nguyen, P., & Lee, H. (2024). User-centered interface design for e-health: Reducing digital health disparity. International Journal of Medical Informatics, 185, 105046. https://doi.org/10.1016/j.ijmedinf.2024.105046

Nugroho, A. (2021). Desain sistem informasi manajemen rumah sakit berbasis web. Jurnal Sistem dan Teknologi Informasi, 12(3), 144–153.

Oliveira, F., Santos, R., & Lima, D. (2024). Security and privacy challenges in web-based e-health applications. IEEE Internet Computing, 28(3), 50–59.

Prabowo, R. (2022). Penerapan keamanan siber pada sistem rekam medis berbasis web. Jurnal Keamanan Siber, 3(2), 33–42.

Putri, S., Hidayat, M., & Anggara, L. (2022). Evaluasi usability sistem informasi kesehatan berbasis web. Jurnal Teknologi Informasi, 9(2), 77–85.

Rojas, E., & Lee, T. (2024). Blockchain for secure medical data sharing in web-based EHR. Sensors, 24(15), 5150–5168. https://doi.org/10.3390/s24155150

Santos, L. (2023). Performance evaluation of microservices-based e-health architectures. In Proceedings of the International Conference on HealthTech (pp. 211–219). IEEE.

Setiawan, D. (2022). Pengembangan sistem telemedicine berbasis web pada rumah sakit daerah. Jurnal Sistem Informasi, 16(1), 22–31.

Smith, A., Johnson, R., & Lee, K. (2022). Web-based electronic health record system with FHIR integration. IEEE Access, 10, 155623–155635.

Widodo, A., & Rahmawati, S. (2021). Optimasi telemedicine untuk daerah terpencil berbasis WebRTC. Jurnal Informatika Kesehatan Indonesia, 5(1), 12–22.

Yamada, S. (2023). Improving interoperability in healthcare information systems using HL7 FHIR. Health Informatics Journal, 29, 1–14.

Zhang, B., Li, X., & Wang, Y. (2024). AI-based decision support in web-integrated electronic health records. Computers in Biology and Medicine, 163, 107072. https://doi.org/10.1016/j.compbiomed.2024.107072