



A Semantic Analysis-Based Biomedical Repository and Research Recommendation System for Improving Research Discovery

Norma Hermawan, Wike Septiani, Benedicta S. P. Pratanjana, Achmad Arifin

Department of Biomedical Engineering, Faculty of Intelligent Electrical and Informatics Technology, Institut Teknologi Sepuluh Nopember, Surabaya 60111, Indonesia

ARTICLE INFORMATION

Received: June 2, 2025
Revised: April 26, 2026
Accepted: July 30, 2026
Available online: July 30, 2026

KEYWORDS

database, digital local repository, final project, query, search engine

CORRESPONDENCE

Phone: +62 (31) 5923644
E-mail: norma@its.ac.id

A B S T R A C T

The rapid growth of biomedical research publications has created challenges for students and researchers in efficiently discovering relevant research topics and previous studies. Universities typically provide institutional repositories; however, access to department-specific final project collections is often limited. This study aims to develop a local biomedical repository and research recommendation system using a semantic analysis approach. The proposed system integrates an internal repository of final year projects with external academic databases, including IEEE Xplore and ScienceDirect, through Google Custom Search. Semantic analysis is applied to improve search relevance and generate research recommendations based on user queries and topic interests. The system was implemented as a web-based platform called BMEArchive. System evaluation was conducted using black-box testing and usability testing with the System Usability Scale (SUS) involving 10 student participants. The results show that the system achieved an average search and recommendation accuracy score of 86, while the usability evaluation produced a SUS score of 84.75, which falls into the “Excellent” category. These results indicate that the proposed system effectively assists students in discovering relevant biomedical research topics. Future work will focus on expanding the repository dataset and integrating advanced artificial intelligence and machine learning methods to improve recommendation accuracy.

INTRODUCTION

The growing demand for rapid information has driven the creation of fast, accurate, and up-to-date information technology, making it a relevant and essential solution. The demand for information technology has shifted from being a secondary need to becoming a primary necessity. Its implementation has expanded across various fields, including libraries. Libraries, as repositories for collecting, processing, preserving, and disseminating information, must continuously adapt to technological advancements over time [1].

The ease of online information dissemination is now also supported by government initiatives aimed at enhancing accessibility and transparency in information sharing. Through the Circular Letter from the Directorate General of Higher Education (DIKTI) No. 2050/E/T/2011, issued on December 30, 2011, regarding the policy for uploading scientific works and journals, the government mandates all academic products of faculty and students be made available online. According to the regulation, as of August 2012, all student scientific works must be accessible via institutional websites. The policy to make all academic products available online aims to provide faster and easier access to scientific works for the wider public through website technology. With this policy, universities must also have

specific media and facilities for online access to all academic works from their academic community [2]. In this context, repositories serve as a vital tool for ensuring efficient academic resource management, giving rise to the term “institutional repository.”

A repository within an institution enables the systematic collection, preservation, and dissemination of digital copies of academic works produced by its scholars [2]. Serving as a digital library, it ensures structured and organized access, benefiting both faculty and students in retrieving academic materials [3]. Institut Teknologi Sepuluh Nopember Surabaya (ITS), as an instance, provides an online repository containing digital copies of academic works from all departments. However, access to the list of student project titles from the Biomedical Engineering Department is limited, as only the most recent titles are published, and they remain available in the ITS repository for only one year. This restriction aims to prevent potential plagiarism by external parties. Therefore, establishing a dedicated local repository within the Biomedical Engineering Department, equipped with an advanced search engine feature, would greatly enhance access to academic resources for its students. Institutional repositories offer significant benefits both to researchers and the institution. They play a crucial role in preserving the intellectual assets of academic communities while also enhancing the global visibility and accessibility of academic works [4].

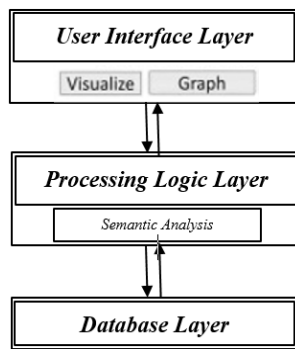


Figure 1. System Functionality

Local department repositories offer nearly the same benefits as institutional repositories but are tailored to meet the specific needs of their respective departments. These repositories exclusively collect digital copies of Final Year Projects from the department. With a dedicated local repository, accessing department-specific Final Year Projects becomes more efficient. The search filters for keyword searches can be optimized and made more precise, as the repository's focus is directed toward the distinctive topics of the department.

On the other hand, the exponential growth of scientific publications makes it increasingly difficult to find relevant research efficiently. As an instance, PubMed publishes nearly 3,000 articles daily. To address this challenge and reduce cognitive overload, academic search engines such as Google Scholar, CiteSeerX, Arnetminer, and Microsoft Academic Search assist researchers in discovering relevant publications. However, researchers often rely on top-listed results, which may not always be the most relevant. To enhance ranking accuracy, the Inverted Indices and Structure Search with Citation Analysis (ISCA) framework integrates graph-based data management, Information Retrieval (IR) language models, and citation analysis, improving search precision and efficiency [5]-[7]. Other previous studies have explored various approaches to improving academic search systems, including semantic search, citation-based ranking, and multi-criteria decision-making methods. Semantic similarity algorithms have been widely applied to improve search relevance by considering contextual relationships between words rather than relying solely on exact keyword matching [8]-[10]. These approaches demonstrate the potential of semantic analysis in enhancing research discovery and recommendation systems.

Based on this background, the objective of this research is to develop a research repository and recommendation system using semantic analysis that integrates internal departmental research data with external academic databases to assist students in efficiently identifying relevant research topics and references. The main contribution of this research lies in the integration of a semantic analysis-based recommendation mechanism within a local biomedical repository system.

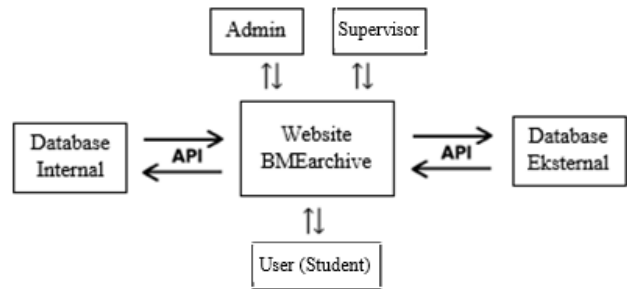


Figure 2. BMEArchive Website System Architecture Design

METHODS

Research Workflow

The research workflow consists of four main stages: (1) data collection, (2) system development, (3) semantic analysis implementation, and (4) system evaluation. Data collection involved gathering Final Year Project metadata from the Biomedical Engineering Department.

System development included database construction and web application development. Semantic analysis was implemented to process keyword queries and identify semantically related terms. Finally, system performance and usability were evaluated using functional testing and the System Usability Scale (SUS).

System Design

The proposed functional diagram in this research is depicted in Figure 1. It consists of three main components, namely the user interface layer, processing logic layer, and database layer. The user interface layer represents the display that users will see and interact with. In the processing logic layer, computations are performed to obtain search results relevant to the user's keyword query. The internal database is used for semantic analysis during the execution of keyword searches with an external API.

For the external database, queries are made to two international scholarly websites, namely ScienceDirect and IEEE. This query is performed using Google's custom search engine feature. Two databases are used: the internal database, which consists of a collection of Final Year Projects gathered and owned by the Biomedical Engineering Department, and the external database, which contains query results from search engines for international journal publications on IEEE and ScienceDirect.

In the processing logic layer, a method is implemented to support the development of a local repository and recommender system as part of the research objectives. The semantic analysis method is employed to enhance content relevance in response to topic-based search queries. This study adopts a simplified semantic analysis approach, leveraging an external open-source API to ensure feasibility within the research constraints. During semantic analysis, the entered keywords undergo processing to identify words with similar meanings, thereby improving search result relevance. The keyword analysis considers multiple factors, including titles, keywords, abstracts, and content, to enhance the accuracy of research recommendations.

Architecture of Local Repository Information System

The overall system architecture of the web-based information and research recommendation system, hereafter referred to as BMEArchive, is illustrated in Figure 2. The website developed in this research connects to two databases: an internal database and an external database.

The design process begins with data collection for database construction. The internal database comprises Final Year Project data from the Biomedical Engineering Department, obtained through the department's administration.

Since these projects are not publicly accessible to the academic community, the database serves as a structured repository for this information. The external database comprises two academic search engines, namely ScienceDirect and IEEE, which are queried together using Google's custom search engine feature. This external database consists of a collection of international journal articles stored in the two academic search engines.

In the second step, the system database is constructed using MySQL, which was selected for its efficient data management capabilities and ease of database organization. The system comprises five main tables: *db_ta*, *db_multiusers*, *db_profile*, *statistic*, and *history_search*, each serving distinct functions. Figure 3 illustrates the relationships between these tables, ensuring structured data storage and seamless retrieval to optimize user experience and research recommendations.

The development process continues with the creation of the frontend using HTML5 and CSS3, and the backend is developed using PHP. These technologies enable the construction of a user-friendly and responsive website interface. The backend processes the user input and queries the databases to retrieve relevant academic works for research recommendations.

The overall architectural design facilitates the seamless integration of internal and external databases, enabling the system to deliver relevant and comprehensive academic resources to users for their research needs. The adoption of various technologies [11]-[18] enhances the system's efficiency and user-friendliness, providing a valuable platform for students and faculty in the Biomedical Engineering Department to access and utilize academic materials effectively.

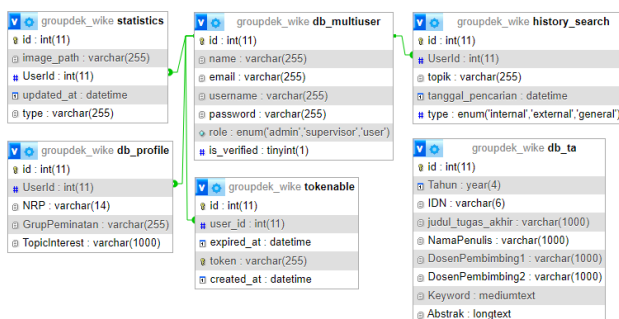


Figure 3. Table Relationships in the BMEArchive System Database

System Security

In this research, the personal data of application users, supervisors, and administrators is stored in the database. This personal data includes email, name, username (NRP), password, specialization group, and topic interest data. Such data is at risk

if accessed by unauthorized individuals. To prevent this, security measures have been implemented to ensure the protection of user information. The system enforces a privacy policy and security measures to safeguard user information.

One of the security features implemented in this web application is password encryption and password confirmation. The encryption technique used is the *bcrypt* function in PHP programming. *Bcrypt* is a hashing algorithm that can be scaled with hardware by adjusting configurable rounds. The use of the *bcrypt* hashing algorithm for passwords ensures that passwords stored in the database cannot be read, even by website administrators or database handlers.

Passwords encryption keeps the actual password values remain hidden and indecipherable even when security breach and unauthorized access to the database occurs. This feature enhances the security of the system and protects the sensitive information of users, faculty, and administrators from potential misuse. Furthermore, the system's security and privacy policies play a vital role in establishing guidelines for handling user data, ensuring that only authorized personnel have access to sensitive information, and defining protocols for data handling and breach response.

By means of these security measures, the local repository information and research recommendation system ensures a secure platform, allowing users, faculty, and administrators to interact with the system and access academic resources with confidence in the protection of their personal data. Regular security audits and updates are essential to continuously enhance the system's security and adapt to emerging threats. To make the website widely accessible, it is hosted on a commercial web hosting service with SSL (Secure Sockets Layer) certificates. The SSL security system on Bluehost utilizes SSL/TLS (Transport Layer Security) to protect data communication between the server and website visitors. This feature is designed to secure communication between users and the hosted website. SSL is a security protocol that encrypts data transmitted between a user's browser and the website's hosting server. By using SSL, transmitted information, such as personal data, is encrypted and remains inaccessible to unauthorized parties [19].

System Testing

The testing scenarios for the BMEArchive application system are conducted using three testing methods, including black-box testing for each use case. A total of 14 use cases is tested in this research. The testing process requires users to execute the functionalities of each use case. If the system responds according to the defined acceptance criteria, the test result is considered successful. However, if the system fails to meet the acceptance criteria, alternative scenarios are executed until the use case functions correctly. The use-case scenario is illustrated in Figure 4. The test is carried out using two usability testing methods, namely user interface (UI) testing to ensure that the interface is understandable for users, and user experience (UX) testing to ensure that users do not face difficulties in using this local repository and that the system functions smoothly.

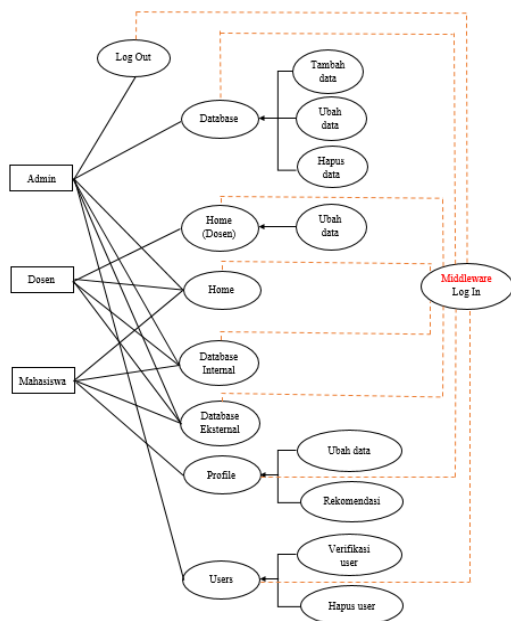


Figure 4. Use Case Scenario BMEArchive Website

These steps are taken to ensure that the software developed is performed optimally. Next, a search functionality test is conducted using specific keywords. After conducting several searches on different topics, the search history is displayed beneath the search column. Research recommendations are provided on the user's profile page, where recommendations are generated based on the user's selected topic interests. Additionally, statistical data is presented in a clear and interactive format to show the distribution of Final Year Project topics.

The subsequent step in usability testing involves using the System Usability Scale (SUS), a standard questionnaire widely used for assessing perceived usability. SUS is among the most popular usability testing tools, originally developed in 1986 [20]. It was chosen for this testing because it is a trusted, practical, and effective usability evaluation tool. In its standard form, the SUS questionnaire consists of 10 statements with five response options, including positive and negative wording [21]. General guidelines for interpreting SUS scores are presented in Table 1.

Table 1. General Guidelines For System Usability Scale (SUS) Scoring

SUS Score	Grade	Adjective Rating
> 80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51 – 68	D	Poor
< 51	E	Awful

RESULTS AND DISCUSSION

Functional Testing Using Black Box Method

Functional testing of the BMEArchive system was conducted using the black-box testing method to verify whether each feature operates according to the specified system requirements. The testing covered fourteen use cases, including user registration, login, homepage access, profile management, internal database search, external database search, data management, and logout functionality.



Figure 5. Use Case External Database Testing

Each use case was evaluated by executing predefined input scenarios and observing the corresponding system responses. If the system output matched the expected behavior defined in the acceptance criteria, the test was categorized as successful. Otherwise, alternative scenarios were executed until the system behavior met the expected functionality.

The testing results indicate that all implemented use cases functioned correctly. In particular, the external database search feature successfully retrieved relevant research articles from IEEE Xplore and ScienceDirect using Google Custom Search. Furthermore, users were able to directly access the corresponding journal articles through the provided links. This functionality confirms that the system can effectively integrate internal repository data with external academic resources, enabling users to obtain broader research references. The testing results of acceptance scenario are shown in Figures 5 and 6.

Overall, the black-box testing results demonstrate that the developed system operates reliably and meets the functional requirements defined during the system design stage.

Accuracy Testing of Search and Recommendation Features

The accuracy testing was conducted to evaluate the effectiveness of the search engine and recommendation mechanism implemented in the BMEArchive system. The testing focused on three main aspects:

1. Accuracy of internal database search results
2. Accuracy of external database search results
3. Relevance of research recommendations

The internal database search functionality was evaluated by assessing whether the system could retrieve relevant Final Year Project records stored in the Biomedical Engineering Department repository. The evaluation involved user responses regarding the accuracy of search results and the usefulness of the search feature in identifying potential research topics as listed in Table 2.

The second evaluation examined the external database search capability. The system integrates queries to external academic databases, specifically ScienceDirect and IEEE Xplore, through Google Custom Search. This feature allows users to search for international journal publications directly from the BMEArchive interface. The evaluation assessed whether the search results were relevant and whether users could successfully access the intended scientific articles.

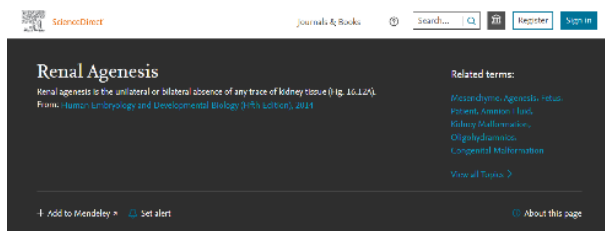


Figure 6. Use Case External Database Direct Access to International Journals and Papers Testing

The final evaluation assessed the recommendation feature, which generates research suggestions based on users' selected topic interests. The system analyzes keywords from user queries and profile preferences to provide relevant research topics and references from both internal and external databases.

The results of the accuracy testing indicate that the search and recommendation features achieved an average score of 86, suggesting that the system is capable of providing relevant search results and useful research recommendations for students.

Table 2. Search Accuracy Test Questions

No.	Question
1	Does search result within internal database accurate? do you get what you want?
2	How accurate is search result from internal database?
3	Do you feel internal database feature help to find research topic on Biomedical Engineering?
4	Does search result within external database accurate? did you get what you want?
5	How accurate is search result from external database?
6	Does the scientific article search feature in external databases ease access to the expected scientific articles?
7	Are you redirected to the right scientific article while accessing external database?
8	Does overall features help or inspire you to find research topic and scientific article?
9	How significant is the function or impact of this software?

Usability Evaluation Using the System Usability Scale (SUS)

To evaluate the usability of the BMEArchive system, a User Acceptance Testing (UAT) study was conducted using the System Usability Scale (SUS) questionnaire. The evaluation involved 10 student participants from the Biomedical Engineering Department who interacted with the system and provided feedback regarding their user experience.

The SUS questionnaire consists of 10 statements with five response options ranging from *Strongly Disagree* to *Strongly Agree*. The SUS scoring procedure was applied by subtracting 1 from each odd-numbered response and subtracting each even-numbered response from 5 as illustrated on Figure 7. The adjusted values were then summed and multiplied by 2.5 to obtain the final SUS score.

The evaluation results indicate that the BMEArchive system achieved an average SUS score of 84.75. According to the SUS interpretation guidelines, this score falls into Grade A, which corresponds to the "Excellent" usability category.

The high usability score suggests that the system interface is easy to understand and that users can interact with the repository and recommendation features effectively. Several factors contribute to this high usability score, including:

1. a simple and responsive web interface,
2. efficient integration between internal and external research databases,
3. the ability to directly access international scientific articles,
4. and the use of semantic analysis to improve search relevance.

These features enable users to efficiently identify relevant research topics and supporting literature for their Final Year Projects.

Discussion

The results demonstrate that the BMEArchive system successfully fulfills its primary objective of improving access to biomedical research resources and assisting students in discovering relevant research topics. By integrating internal repository data with external academic databases, the system provides a comprehensive research discovery platform.

Similar to the Semankey framework proposed by Abad-Navarro et al. [8], the proposed system employs semantic analysis to improve keyword-based retrieval by considering semantic relationships between terms rather than relying solely on exact keyword matching. However, while Semankey focuses on querying RDF repositories using semantic web technologies, the proposed BMEArchive system is designed specifically for departmental biomedical repositories and integrates semantic search with recommendation features and external academic database retrieval. This integration provides users with both local institutional resources and broader international scientific references within a single interface.

Khalid et al. [5] proposed the ISCA framework, which enhances scholarly search through citation network analysis and information retrieval techniques. Unlike the ISCA framework, which primarily emphasizes document ranking using citation relationships, the proposed system focuses on supporting departmental research discovery by integrating local repository data with external scholarly databases. Although citation analysis is not currently incorporated, the present system provides personalized recommendations based on semantic analysis, offering a practical solution for undergraduate research exploration.

Kumar [18] introduced an academic search engine based on multi-criteria decision making, where search results are ranked using multiple weighted criteria such as publication year, citations, and author credibility. In contrast, the proposed system prioritizes semantic relevance between user queries and available research topics. This design simplifies the search process for students who may not be familiar with selecting multiple ranking parameters while still providing relevant recommendations.

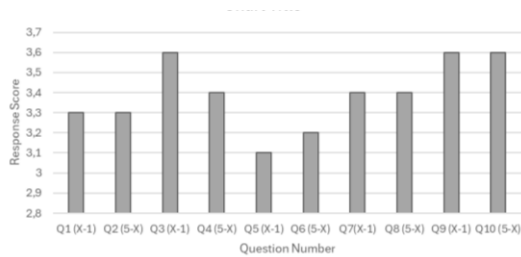


Figure 7. System Usability Scale User Acceptance Test Results

The high search relevance observed in this study is consistent with the findings of Mihalcea et al. [9], who demonstrated that semantic similarity measures provide more meaningful document matching than exact lexical matching. By identifying semantically related terms, the proposed system can retrieve relevant biomedical research even when users employ different terminology.

Limitations of the Study

Despite the promising results, several limitations were identified in this research. First, the internal repository dataset currently contains only Final Year Project data from the Biomedical Engineering Department, which limits the diversity of research topics available in the recommendation system. Second, unlike more sophisticated scholarly search systems that employ citation network analysis [5] or semantic web knowledge graphs [8], the proposed system currently relies on a simplified semantic analysis approach through an external API. While this approach improves keyword matching, recommendation quality depends primarily on semantic similarity rather than citation relationships or contextual language models. Third, the usability evaluation involved only 10 student participants, which may not fully represent the broader academic community. Future studies should involve a larger number of participants to obtain more comprehensive usability insights.

Future Research

Future research can focus on several improvements to enhance the system's capability. First, the repository dataset can be expanded by integrating additional biomedical research databases and institutional repositories. Second, advanced artificial intelligence and machine learning techniques, such as natural language processing (NLP) and deep learning-based recommendation systems, can be implemented to improve semantic understanding and recommendation accuracy. Third, the system can incorporate citation analysis and bibliometric indicators to provide more comprehensive research recommendations.

CONCLUSIONS

This study developed an application to assist the academic community of the Department of Biomedical Engineering, including students, faculty, and administrators, in managing the local repository system and providing recommendations based on their topic interests.

The main contributions of this research can be summarized as follows:

1. The development of a local biomedical repository system that organizes Final Year Project data within the Biomedical Engineering Department.
2. The implementation of a semantic analysis-based search mechanism to improve the relevance of research discovery.
3. The integration of internal repository data with external academic databases (IEEE Xplore and ScienceDirect) to provide broader scientific references for students and researchers.

The application has a main feature for processing Final Project (Tugas Akhir) data, which includes displaying, adding, modifying, and deleting Final Project records. Additionally, the application allows users to register with three main roles: student, faculty, and admin. Students have limited access to view data on the home page, which displays statistics on Final Projects in the Department of Biomedical Engineering, the internal and external databases, and the profile menu that provides research recommendations based on the entered topic interests. Faculty members have more privileges to upload statistical data, while admins have additional authorization to manage all processes on the website, including viewing, adding, modifying, and deleting Final Project records, as well as verifying and deleting users. The BMEArchive website also features a search history, which is accumulated and visualized in the form of graphs accessible from the home menu. Admins and faculty users can view the overall graph of the most searched topics by all students.

The application was tested using User Acceptance Testing on prospective users or subjects involved in this research. The testing process included an initial assessment, where subjects were asked about their experience in searching for journal and Final Project topics. The results showed that all subjects had searched for such topics, with most having accessed the ITS repository website. However, many found it difficult to obtain information about Final Project books in the Department of Biomedical Engineering's repository. Additionally, some subjects were unaware of the range of Final Project topics studied in the department. The primary challenge identified was difficulty in accessing Final Project books, while others struggled to find journals relevant to their chosen topics.

The evaluation continued with the System Usability Scale (SUS) to assess user experience and the functionality of the search and recommendation features on the BMEArchive website. The accuracy testing of these features resulted in an average score of 86, indicating that users found the system effective in providing relevant search results and recommendations. The final usability score, calculated using the SUS method, was 84.75, placing the BMEArchive website in the "excellent" category according to standard usability guidelines.

The high SUS score of 84.75 indicates that users found the system easy to learn and efficient to use. This result can be attributed to several factors, including the simple interface design, the integration of internal and external research databases, and the ability to directly access international journal articles through the external search feature. The semantic analysis approach also contributes to improved search relevance by identifying semantically related terms rather than relying solely on exact keyword matches.

REFERENCES

- [1] K. Rika and Nuraeni, "Proses Pembangunan Repository UIN Mataram," ResearchGate, vol. 2, no. 20, pp. 1–7, 2020.
- [2] Ministry of Education and Culture, "Surat Edaran Dirjen DIKTI NO.2050/E/T/2011," Directorate General of Higher Education (DIKTI), Dec. 30, 2011. [Online]. Available: <http://ldikti12.ristekdikti.go.id/tag/surat-edaran-dirjen-dikti-no-2050et2011>. [Accessed: Feb. 28, 2022].
- [3] G. Nisrina, Maharani, and R. Devita, "Pentingnya Repositori dalam Perpustakaan Digital Khususnya dalam Perguruan Tinggi," ResearchGate, 2021.
- [4] F. Harliansyah, "Institutional Repository sebagai Sarana Komunikasi Ilmiah yang Sustainable dan Reliable," Pustakaloka, vol. 8, no. 1, pp. 1–13, 2016.
- [5] S. Khalid, S. Wu, A. Wahid, A. Alam, and I. Ullah, "An Effective Scholarly Search by Combining Inverted Indices and Structured Search with Citation Networks Analysis," IEEE Access, vol. 9, pp. 120210–120226, 2021.
- [6] M. Nagpal and J. Petersen, "Keyword Selection Strategies in Search Engine Optimization: How Relevant is Relevance?," Journal of Retailing, vol. 97, no. 4, pp. 746–763, 2021.
- [7] R. Enrique-Reyes, S. Cadena-Vela, A. Fuster-Guillo, M. J. Norberto, I. L. Daniel, and S. Elena, "Systematic Mapping of Open Data Studies: Classification and Trends from A Technological Perspective," IEEE Access, vol. 9, pp. 12968–12988, 2021.
- [8] F. Abad-Navarro, C. Martinez-Costa, and J. Fernandez-Breis, "Semankey: A Semantics-Driven Approach for Querying RDF Repositories Using Keywords," IEEE Access, vol. 9, pp. 91282–91302, 2021.
- [9] R. Mihalcea, C. Corley, and C. Strapparava, "Corpus-Based and Knowledge-Based Measures of Text Semantic Similarity," in Proc. AAAI Conf. Artificial Intelligence, vol. 6, pp. 775–780, 2006.
- [10] H. Thamrin, Husni, Sabardila, and Atiqah, "Efektivitas Algoritma Similaritas Semantik Berbasis Jejaring Kata Untuk Mengukur Kemiripan Kalimat Bahasa Indonesia," MIPA Universitas Muhammadiyah Surakarta, 2014.
- [11] H. R. Vyawahare, P. P. Karde, and V. M. Thakare, "A Hybrid Database Approach Using Graph and Relational Database," in Proc. 2018 Int. Conf. Res. Intell. Comput. Eng. (RICE), pp. 31–34, 2018.
- [12] E. F. Codd, "A Relational Model of Data for Large Shared Data Banks," Communications of the ACM, vol. 13, no. 6, pp. 377–387, Jun. 1970.
- [13] D. Saputra and R. F. Aji, "Analisis Perbandingan Performa Web Service REST Menggunakan Framework Laravel, Django, dan Ruby on Rails Untuk Akses Data Dengan Aplikasi Mobile," Bangkit Indonesia, vol. 2, no. VII, Oct. 2018.
- [14] A. Achilleos, A. Yeratziotis, C. Mettouris, K. Evripidou, P. Hadjinikolaou, and G. A. Papadopoulos, "Health Monitoring Web Platform for Real-Time Expert-User Interaction," in Proc. 2017 8th Int. Conf. Inf., Intell., Syst. & Appl. (IISA), pp. 1–6, 2017.
- [15] E. Marcotte, "Responsive Web Design," A List Apart, May 25, 2010. [Online]. Available: <https://alistapart.com/article/responsive-web-design/>. [Accessed: Mar. 21, 2025].
- [16] L. Nian and Z. Bo, "The Design and Implementation of Responsive Web Page Based on HTML5 and CSS3," in Proc. 2019 Int. Conf. Mach. Learn., Big Data, Bus. Intell. (MLBDBI), pp. 373–376, 2019.
- [17] Y. A. Fawwaz and S. A. Mohammed, "Responsive Web Design Commitment by the Web Developers in Palestine," in Proc. 2018 4th Int. Conf. Comput. & Technol. Appl., pp. 69–73, 2018.
- [18] J. Kumar, "Academic Search Engine Based on Multi-Criteria Approach," Springer Link, 2021.
- [19] Bluehost, "SSL Web Hosting: How to Add HTTPS to Your Domain," Bluehost, May 23, 2023. [Online]. Available: <https://www.bluehost.com/blog/how-to-add-https-to-your-domain-and-install-an-ssl-certificate-to-protect-your-customers/>. [Accessed: Jun. 30, 2023].
- [20] J. Brooke, "SUS: A 'quick and dirty' usability scale," *Usability Evaluation in Industry*, vol. 189, no. 194, pp. 4–7, 1996.
- [21] J. Lewis, "The System Usability Scale: Past, Present, and Future," J. Hum.-Comput. Interact., vol. 34, no. 7, pp. 577–590, 2018.

AUTHORS BIOGRAPHY

Norma Hermawan

Norma Hermawan received the B.Eng. degree in Electrical Engineering from Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia, the M.Sc. degree from Darmstadt University of Applied Sciences, Germany, and the Ph.D. degree from Tohoku University, Japan. He is currently a faculty member with the Department of Biomedical Engineering, Faculty of Intelligent Electrical and Informatics Technology, Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia.

His research interests include biomedical signal and image processing, medical ultrasound imaging, biomedical informatics and embedded systems. He has authored numerous scientific publications in biomedical engineering and actively supervises undergraduate and graduate research in medical imaging and informatics.

Wike Septiani

Wike Septiani received the B.Eng. degree in Biomedical Engineering from the Department of Biomedical Engineering, Faculty of Intelligent Electrical and Informatics Technology, Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia, in 2023.

During her undergraduate studies, she actively participated in student organizations and academic activities. She served as the Secretary of the Student Advocacy and Welfare Division of the Biomedical Engineering Student Association (HMTB) in 2022 and was also an assistant at the Biomedical Instrumentation Laboratory. Her research interests include biomedical information systems, digital health, medical informatics, and healthcare information technology.

Benedicta Sabdaningtyas Pratita Pratanjana

Benedicta Sabdaningtyas Pratita Pratanjana received the B.Eng. degree in Biomedical Engineering from the Department of Biomedical Engineering, Faculty of Intelligent Electrical and Informatics Technology, Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia, in 2025.

She completed an industrial internship at the Center for Medical Device and Health Facility Security (BPAFK), Central Jakarta, where she gained practical experience in the Radiation Measurement Instrument Laboratory and the Radiation Protection and Medical Device Conformity Testing Laboratory. During the internship, she also participated in medical device conformity testing at several hospitals. She has served as a teaching assistant in the Instrumentation and Biomedical Signal Processing Laboratory and has actively participated in student organizations, including the ITS Student Executive Board and the Faculty of Intelligent Electrical and Informatics Technology Student Executive Board. Her research interests include biomedical instrumentation, biomedical signal processing, and medical device technology.

Ahmad Arifin

Ahmad Arifin received his B.E. degree in Electronic Engineering from Institut Teknologi Sepuluh Nopember (ITS), Indonesia, in 1996. Since then, he has joined the Electrical Engineering Department, ITS, as an Educational Staff. He received M.E. and Ph.D. degrees in Electronic Engineering from Tohoku University in 2002 and 2005, respectively, with a major in Biomedical Electronic Engineering. From 2015 to 2024, he served as Head of the Biomedical Engineering Department, ITS. His research activities are in the fields of human movement measurement and analysis, human movement restoration by functional electrical stimulation (FES), biomedical signal and system modelling and analysis, and fuzzy control systems. He is a member of the IEEE Engineering in Medicine and Biology Society (EMBS) and the International Functional Electrical Stimulation Society (IFESS).