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Implementation of Web Engineering in the Design and Development of the Website Portal for SMA Negeri 1 Martapura

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Abstract: This research aims to improve the quality of educational services at SMA Negeri 1 Martapura by developing a website portal that is more attractive and user-friendly. Even though SMA Negeri 1 Martapura has an accessible website, there are shortcomings in the interface and menu structure that are less attractive to users. To overcome these challenges, this research focuses on developing a new website portal using the PHP programming language and MySQL as a database. The resulting website portal is designed to improve user interaction with a more intuitive interface and more comprehensive features. By involving 53 permanent teachers (PNS/P3K), ten non-permanent teachers, and 953 active students, the development of the SMA Negeri 1 Martapura website portal aims to provide better services to the entire school community. With an attractive and easy-to-use website portal, it is hoped that it will improve the user experience in accessing information about schedules, activities, and various other educational services offered by SMA Negeri 1 Martapura. Overall, this research aims to positively contribute to increasing the effectiveness and efficiency of academic services at SMA Negeri 1 Martapura through sophisticated and user-friendly information technology.

Keywords: Website Portal; Web Based; Web Engineering.

1. Introduction

In the contemporary era of rapid technological advancement, the importance of efficient information dissemination within educational institutions cannot be overstated. As articulated by Wayne in Soebagio Atmodiwiro's book, "School is a system of social interaction, a whole organization consisting of personal interactions related together in an organic relationship. Concurrently, as defined by Law No. 2 of 1989, schools serve as educational entities tasked with organizing and perpetuating teaching and learning activities [1]. In the digital age, the accessibility and rapid retrieval of data and information are imperative. Websites, as collections of web pages housed within a domain or subdomain on the World Wide Web (WWW), have emerged

as indispensable tools. Implementing web engineering in designing and developing a website portal is a multifaceted process involving various considerations. One key aspect is the usability and adaptability of the website across different devices, which can be achieved through responsive web design [2]. This approach allows for the seamless display of content on devices with varying screen sizes and capabilities, enhancing user experience. Furthermore, the design of a web portal should consider users' emotional responses, as studies have shown that emotional evaluation plays a significant role in user engagement [3]. Employing techniques like Kansei engineering can help create user interfaces that evoke the desired emotions and enhance the overall user experience. In addition to design considerations, the quality and readability of the information presented on the website are crucial factors. Ensuring high-quality and easily understandable content is essential for user engagement and satisfaction [4]. Moreover, the development of web portals should also consider the evolving nature of information and the need for efficient retrieval methods [5]. Utilizing innovative approaches like chaotic genetic algorithms can improve the efficiency of information retrieval on portal websites. Furthermore, security is paramount in website development [6]. Conducting security assessments, such as penetration testing, can help identify and address system vulnerabilities, ensuring user data and information safety.

The ubiquitous nature of the internet in facilitating various activities underscores the significance of optimizing websites to enhance user experience. A website's appeal to users is often contingent upon its interface's attractiveness and its menu structure's intuitiveness. The user interface is pivotal in ensuring ease of use, efficiency, and user satisfaction while navigating the system. School websites serve as repositories for information and documentation within the educational domain, offering valuable insights into the institution's identity and ethos. A well-crafted school website serves as a conduit for disseminating information and functions as a powerful branding tool, influencing stakeholders' perceptions and choices. The homepage of a school website serves as a virtual gateway, signaling the institution's readiness to embrace technological advancements and engage with the global community. Implementing web engineering in designing and developing a website portal is a multifaceted process involving various considerations. One key aspect is the usability and adaptability of the website across different devices, which can be achieved through responsive web design [7]. This approach allows for the seamless display of content on devices with varying screen sizes and capabilities, enhancing user experience. Furthermore, the design of a web portal should consider users' emotional responses, as studies have shown that emotional evaluation plays a significant role in user engagement [8]. Employing techniques like Kansei engineering can help create user interfaces that evoke the desired emotions and enhance the overall user experience. In addition to design considerations, the quality and readability of the information presented on the website are crucial factors. Ensuring high-quality and easily understandable content is essential for user engagement and satisfaction [9]. Moreover, the development of web portals should also consider the evolving nature of information and the need for efficient retrieval methods [10]. Utilizing innovative approaches like chaotic genetic algorithms can improve the efficiency of information retrieval on portal websites. Furthermore, security is paramount in website development. Conducting security assessments, such as penetration testing, can help identify and address vulnerabilities in the system, ensuring the safety of user data and information [11].

SMA Negeri 1 Martapura, situated in Kota Baru Barat, Kec. Martapura, Kab. Ogan Komering Ulu Timur, South Sumatra, is a prominent educational institution operating under the auspices of the Ministry of Education and Culture. Despite possessing a website accessible at https://www.sman1mtp.sch.id/, the current portal fails to captivate users due to its unappealing interface and outdated menu structure. Furthermore, albeit modified, reliance on an open-source Joomla template exacerbates the portal's lackluster appeal. Recognizing these deficiencies, the proposed solution entails the development of a new website portal for SMA Negeri 1 Martapura. By leveraging contemporary web engineering principles and technologies, the aim is to create a visually appealing, user-friendly portal that embodies the institution's commitment to excellence in education and technology integration. This endeavor aligns with SMA Negeri 1 Martapura's aspiration to establish a robust online presence, enhancing communication, engagement, and accessibility for its stakeholders.

Several key considerations can be drawn from relevant references to implement Web Engineering effectively in the design and development of the website portal for SMA Negeri 1 Martapura. Firstly, the design of the website portal should focus on usability and adaptability across different devices, which can be achieved through responsive web design. This approach ensures that the website's content is displayed optimally on various screen sizes and devices, enhancing user experience. Moreover, incorporating emotional design elements can significantly impact user engagement. By utilizing techniques like Kansei engineering, the website can be designed to evoke specific emotions in users, thereby enhancing their overall experience and interaction with the portal. Additionally, ensuring the quality and readability of the information presented on the website is crucial. High-quality content that is easily understandable can improve user engagement and satisfaction.

Moreover, efficient information retrieval methods should be employed to cater to the evolving nature of information needs on the portal. Innovative approaches like chaotic genetic algorithms can enhance the efficiency of information retrieval on the website. By integrating responsive design principles, emotional design elements, high-quality content, efficient information retrieval methods, and robust security measures, the implementation of Web Engineering in the design and development of the website portal for SMA Negeri 1 Martapura can result in a user-friendly, engaging, and secure platform that meets the needs of its users.

2. Research Method

The methodological approach adopted in this study encompasses the Action Research method, a dynamic research methodology aimed at testing, developing, finding, and implementing innovative actions to streamline work processes and enhance implementation efficiency. Rooted in collaboration and iterative cycles of inquiry, Action Research fosters continuous improvement by engaging stakeholders in problem-solving and decision-making processes. Central to the system development method employed in this research is web engineering, a specialized software engineering model tailored for the development of web-based applications. As articulated by Roger S. Pressman (2005) [12], web engineering represents a systematic process geared toward creating high-quality web applications. While bearing resemblances to traditional software engineering, web engineering places a stronger emphasis on technical and management activities, with a focus on optimizing web-based solutions for diverse user needs and contexts. The stages delineated within the web engineering framework serve as a roadmap for guiding the development process, ensuring a systematic and structured approach to system design and implementation. These stages include:

1) Customer Communication
   Effective communication with users is paramount in eliciting and understanding their requirements. By engaging stakeholders in meaningful dialogue, developers can gain valuable insights into user needs and preferences, facilitating the translation of requirements into actionable design specifications.

2) Planning
   This stage entails the synthesis of user requirements and technical considerations to inform the development process. Through meticulous planning, developers identify the requisite software and hardware components, while soliciting feedback from users to validate and refine project objectives.

3) Modeling
   a) Analysis Modeling
      In this phase, developers analyze user requirements and identify potential solutions to address their needs. This involves conducting content, interaction, functional, and configuration analyses to delineate system functionalities and design parameters.
   b) Design Modeling
      Subsequent to analysis, designers conceptualize the system interface, incorporating elements of aesthetics, usability, and functionality. Content design entails structuring and organizing information in alignment with user needs, while database design encompasses the development of conceptual, logic, and physical data models. Navigation and architectural design considerations ensure seamless user interaction and system scalability.

4) Construction
   a) Implementation (Coding)
      Implementation involves translating design specifications into functional code, with HTML employed for web page development and PHP scripting for backend functionality. This phase focuses on realizing the envisioned system architecture and features, adhering to established design principles and coding standards.
   b) Testing
      Rigorous testing protocols are employed to identify and rectify any errors or inconsistencies within the system. This encompasses comprehensive testing of scripts, forms, navigation, and display elements to ensure optimal system performance and user experience.

5) Delivery & Feedback
   Upon completion, the system is delivered to users, accompanied by solicitation of feedback through questionnaires or surveys. This feedback serves as a valuable tool for evaluating system usability, functionality, and reliability, informing iterative improvements and enhancements.

The iterative nature of the web engineering process framework facilitates continuous refinement and optimization, ensuring the development of robust, user-centric web applications. Figure 1 illustrates the sequential flow of activities within the web engineering process, providing a visual depiction of the systematic approach employed in this research. Through adherence to this structured methodology, developers can navigate the complexities of web application development with confidence, delivering solutions that meet user needs and exceed expectations.
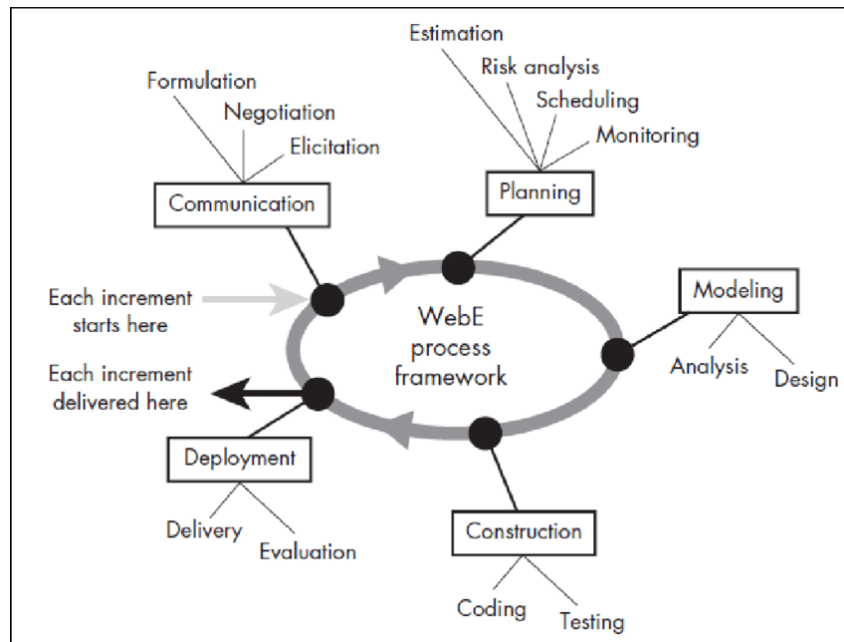

Figure 1. Web Engineering Process Framework [13]

3. Result and Discussion

3.1 Results

The research delves into the systematic analysis and design of a Public Service Information System tailored for SMA Negeri 1 Martapura, identifying the institution's pertinent needs, delineating system specifications, and crafting a comprehensive design framework to address existing challenges and streamline operational processes.

3.1.1 System Analysis

The necessity for a web-based Public Service Information System at SMA Negeri 1 Martapura arises from the fundamental requirement to provide accessible study schedule information to students and faculty members. This imperative underscores the institution's commitment to facilitating efficient communication and resource management within its academic community. The identified needs for the system encompass several crucial aspects, including robust data storage, processing capabilities, and efficient online information dissemination functionalities. Primarily, the system must be able to comprehensively store and process resident and lecturer data, ensuring the availability of accurate and up-to-date information for administrative purposes. Timely updates to resident and lecturer data are essential to reflect any changes in personnel or contact details, facilitating seamless communication and coordination within the institution. Moreover, the system should facilitate convenient access to learning and teaching schedules, enabling students and faculty members to retrieve relevant information quickly and efficiently. This feature is particularly vital in educational institutions, where schedules frequently change, and timely access to updated information is critical for effective academic planning and execution. By addressing these identified needs by implementing a web-based Public Service Information System, SMA Negeri 1 Martapura aims to enhance operational efficiency, streamline administrative processes, and improve overall communication and collaboration within its academic community. Through the systematic analysis of these requirements, the institution can develop a tailored solution that aligns with its specific objectives and organizational context, ultimately contributing to the advancement of its educational mission and objectives.

3.1.2 Needs Analysis Results

The needs analysis results have yielded comprehensive system specifications that encapsulate various aspects crucial for the successful development and implementation of the Public Service Information System at SMA Negeri 1 Martapura. These specifications encompass functional, qualitative, and ergonomic requirements, all aimed at optimizing data processing, integrity, and user experience.

1. System Specifications
   The system specifications focus on encompassing robust data processing and storage functionalities. This involves the development of a system architecture capable of efficiently managing and storing vast amounts of data related to residents, lecturers, and administrative processes. Additionally, the system must support seamless data retrieval and manipulation to facilitate smooth operations.

2. Functional Specifications
   Emphasis is placed on ensuring data integrity and processing efficiency within the system. Functional specifications outline the specific functionalities that the system must possess to achieve these objectives, including data validation mechanisms, error handling procedures, and efficient data processing algorithms.

3. Qualification Needs
   The qualification needs pertain to the categorization of users and data within the system. This involves distinguishing between various user roles, such as officers, residents, and lecturers, and implementing role-based access control mechanisms to ensure that each user can only access relevant information and functionalities based on their role and permissions.

4. Comfort Specifications
   User experience is prioritized through comfort specifications, which focus on ensuring user-friendly system navigation and operation. This involves designing intuitive user interfaces, implementing clear navigation pathways, and providing helpful feedback mechanisms to guide users through the system seamlessly. By prioritizing user comfort and ease of use, the system aims to enhance user satisfaction and promote adoption among stakeholders.

3.1.3 Current System Analysis

Despite SMA Negeri 1 Martapura's commendable efforts in computerizing data and archives, specific operational processes remain conventional, particularly those related to course scheduling for residents. This observation underscores the imperative for systematization and adopting modern technological solutions to streamline administrative tasks and enhance operational efficiency within the institution. While SMA Negeri 1 Martapura has made strides in leveraging technology to manage data and archives, the reliance on conventional methods for course scheduling indicates areas where manual processes still prevail. These manual processes may include paper-based scheduling systems, manual data entry, and communication methods lacking automation and digital platform integration. The persistence of conventional operational processes poses several challenges for SMA Negeri 1 Martapura, including resource intensiveness, risk of errors, limited accessibility, and lack of integration. To address these challenges and improve operational efficiency, SMA Negeri 1 Martapura must prioritize systematizing course scheduling processes by adopting modern technological solutions. By investing in a comprehensive scheduling system that integrates with existing administrative systems and provides automation, accessibility, and data integrity, the institution can streamline scheduling tasks, reduce administrative burden, and enhance stakeholder satisfaction.

3.1.4 System Design

The system design phase encompasses the delineation of information storage and transmission modalities, emphasizing PHP-based web file storage and hosting. User engagement is pivotal in ascertaining system requirements and functionalities, facilitating stakeholder interviews, and needs assessment. Hardware, software, and network specifications are meticulously detailed, encompassing requisite components and protocols. Thorough planning involves synthesizing user and technical requirements, culminating in a Unified Modeling Language (UML)-based visualization of system functionalities. Use case and activity diagrams are instrumental in depicting system interactions and events. The design phase entails translating user and system requirements into a coherent system architecture, culminating in database design and program coding. Critical to system functionality, database design encompasses the delineation of essential file attributes to facilitate data input and retrieval. Program coding involves the implementation of system design specifications, incorporating HTML and PHP to realize system functionalities. Notable design elements include the Main Menu Page, which facilitates intuitive navigation and data access. Profile Page: Offering comprehensive institutional information. Gallery Page: Showcasing institutional activities through multimedia. Login Page: Ensuring secure
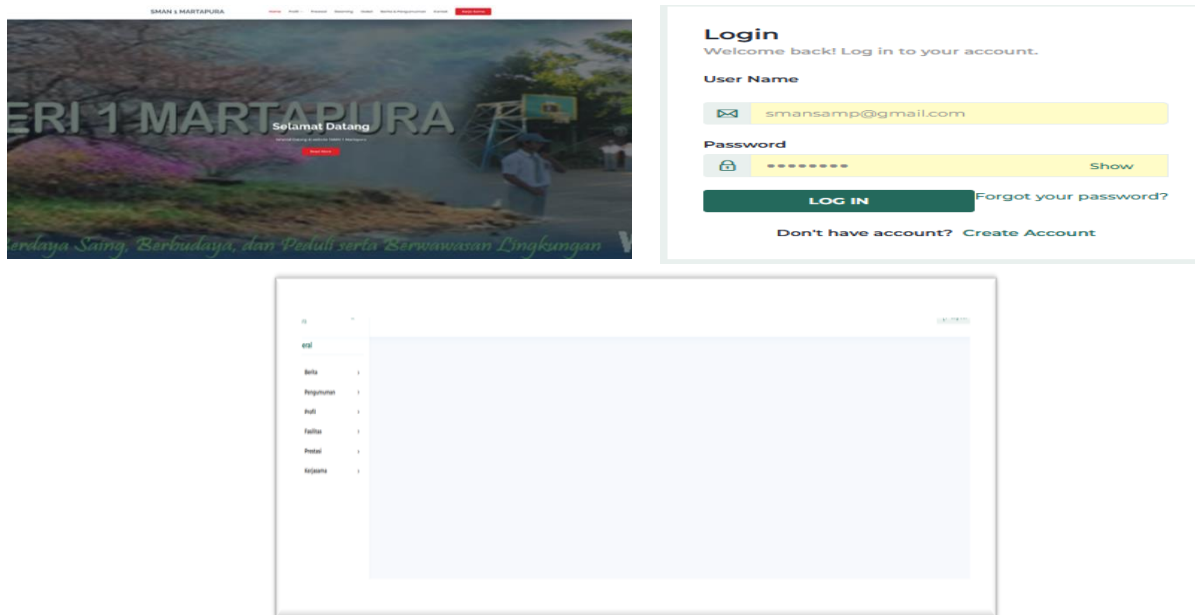
access to system functionalities.

Figure 2. Design System

The research culminates in developing an internet-accessible Public Service Information System tailored for SMA Negeri 1 Martapura, catering to the community's diverse needs and facilitating online public service submissions. Through meticulous system analysis, design, and construction, the envisioned system promises to streamline administrative processes and enhance service delivery efficacy, fostering digital transformation and community empowerment. The implemented Public Service Information System heralds a paradigm shift in service delivery mechanisms, embodying SMA Negeri 1 Martapura's commitment to innovation and excellence in education administration. As depicted in the accompanying figures, the system's main page, login interface, and administrative functionalities underscore its user-centric design and functional robustness, paving the way for enhanced community engagement and administrative efficiency.

3.2 Discussion

The discussion segment of this study delves into a detailed analysis of the system design phase, elucidating critical insights gleaned from the planning and execution of the Public Service Information System for SMA Negeri 1 Martapura. During the initial system design phases, extensive user communication was pivotal in elucidating user requirements and functionalities. Stakeholder interviews and needs assessments were crucial in synthesizing hardware, software, and network specifications to ensure seamless system implementation. The project team successfully integrated user input with technical requisites through meticulous planning, culminating in a comprehensive system design framework. Unified Modeling Language (UML) facilitated the visualization of system functionalities, with use case and activity diagrams serving as invaluable tools in depicting system interactions and events. By aligning user needs with technical specifications, the project team laid a robust foundation for the subsequent phases of system development. Its database design is central to the system's efficacy, which underpins data processing, storage, and retrieval functionalities. The meticulous delineation of file attributes and database structures ensured optimal data management, facilitating seamless information access and manipulation. As the project progressed to the construction phase, program coding entailed the translation of design specifications into tangible system components. Implementing HTML and PHP facilitated the realization of system functionalities with notable design elements, including the main menu page, profile page, gallery page, and login interface. These design elements were meticulously crafted to prioritize user experience and system usability, ensuring intuitive navigation and secure data access for end-users. The developed Public Service Information System holds immense promise in streamlining administrative processes and enhancing service delivery efficacy at SMA Negeri 1 Martapura. The system embodies the institution's commitment to innovation and excellence in education administration by leveraging modern web technologies and adhering to user-centric design principles. Moving forward, ongoing monitoring and evaluation will be paramount to gauge the system's performance and identify areas for refinement and optimization. Additionally, stakeholder feedback and

continuous user engagement will drive iterative improvements and ensure the system remains aligned with evolving user needs and technological advancements. The discussion underscores the importance of robust system design methodologies in realizing the vision of a modern, efficient, and user-friendly Public Service Information System for SMA Negeri 1 Martapura. Through collaborative stakeholder engagement, meticulous planning, and diligent execution, the project team has laid a solid foundation for digital transformation and administrative modernization within the institution.

4. Related Work

Research in educational institution management and website development offers valuable insights into best practices and innovative approaches that can inform the development of the Public Service Information System for SMA Negeri 1 Martapura. While specific studies directly addressing similar systems in educational settings may be limited, broader research in software engineering, information systems, and educational technology provides relevant frameworks and methodologies for consideration. Studies on software engineering methodologies, particularly those focusing on web-based application development, provide insights into effective system design and implementation approaches. Leveraging principles from established processes such as Agile, Waterfall, or Spiral models ensures systematic planning, execution, and evaluation throughout the development lifecycle. Additionally, research on web engineering frameworks and processes offers valuable guidance on structuring development activities, managing project timelines, and addressing technical challenges inherent in web-based solutions.

In the realm of information systems, studies exploring the design and implementation of educational management systems offer insights into specific requirements and functionalities essential for effective school administration. Developers can identify key features to incorporate into the Public Service Information System by examining case studies and best practices from similar institutions. Furthermore, research on information system security and data management informs the implementation of robust security measures and data protection protocols to safeguard sensitive information and ensure regulatory compliance. Research in educational technology and e-learning platforms sheds light on innovative approaches to enhancing communication, collaboration, and information dissemination within academic institutions. By exploring emerging technologies such as learning management systems (LMS) and virtual classrooms, developers can identify opportunities to enhance the functionality and user experience of the Public Service Information System. Moreover, user experience (UX) design studies offer valuable insights into designing intuitive interfaces and optimizing user engagement for stakeholders accessing the system. While direct application of existing research to the development of the Public Service Information System for SMA Negeri 1 Martapura may require adaptation to suit the institution's specific needs, leveraging insights from related work provides a solid foundation for informed decision-making and implementation of best practices. By drawing upon established frameworks, methodologies, and technological innovations, developers can ensure the successful design, development, and implementation of a robust and user-centric system tailored to the unique requirements of SMA Negeri 1 Martapura.

Furthermore, research by Rieh (2002) highlights the importance of information quality and cognitive authority in the web context. Implications for web design that support information quality and authority assessment can be a crucial basis for building a trustworthy and high-quality website portal [14]. Additionally, the study by Abdi and Greenacre (2020) discusses website design approaches based on students' emotional responses. Considering users' emotional evaluations, the website portal design can be tailored to trigger positive responses and enhance user interaction [15]. Moreover, research by Remus (2007) identifies critical success factors in implementing corporate portals. By taking these factors into account, the development of the website portal for SMA Negeri 1 Martapura can be guided by proven best practices in previous implementation projects [16]. By integrating findings from the last research highlighting information quality, user emotional responses, and success factors in portal implementation, the same theories can be developed to support the effective and competitive design and development of the SMA Negeri 1 Martapura website portal. Considering these aspects, the resulting website portal is expected to improve efficiency, user engagement, and stakeholder satisfaction within the school environment.

5. Conclusion

In conclusion, the research and experimentation undertaken in this study have yielded significant insights and implications for developing a website portal system at SMA Negeri 1 Martapura. Firstly, implementing this system has demonstrated its potential to enhance the efficiency and effectiveness of website administrators in managing and disseminating information about daily school operations. Secondly, by providing a centralized platform for accessing pertinent updates, events, and announcements, the system significantly improves accessibility and convenience for members of the school community, including parents and students. The successful deployment of such a system holds promise for fostering greater transparency, communication, and engagement within the school ecosystem, thereby contributing to its overall organizational effectiveness and stakeholder satisfaction.

References

[1] Atmodiwirio, S. (2000). *Manajemen Pendidikan Indonesia*. Jakarta: Adadizya Jaya.

[2] Wicaksono, R. (2017). *Rekayasa Perangkat Lunak*. Jakarta: Seribu Bintang.

[3] Hutahaean, J. (2018). *Konsep Sistem Informasi*. Yogyakarta: Deepublish.

[4] Kuswara, H., & Kusmana, D. (2017). *Sistem Informasi Absensi Siswa Berbasis Web Dengan SMS Gateway Pada Sekolah Menengah Kejuruan Al – Munir Bekasi*. *Indonesian Journal on Networking and Security, 6*(2), 17–22. https://doi.org/10.14778/ijns.6.2.2017.17-22

[5] Pramana, H. W. (2012). *Aplikasi Inventory Berbasis Access 2003*. Jakarta: PT. Elex Media Komputindo.

[6] Abdulloh, R. (2016). *Easy dan Simple Web Programming*. Jakarta: Elex Media Komputindo.

[7] Barbara, A. M., Dobbins, M., Iorio, A., Lavis, J. N., Raina, P., & Levinson, A. J. (2016). The McMaster Optimal Aging Portal: Usability Evaluation of a Unique Evidence-Based Health Information Website. *JMIR Human Factors, 3*(1), e14. https://doi.org/10.2196/humanfactors.4800

[8] Turumugon, P., Baharum, A., Nazlan, N. H., Noh, N. A. M., Noor, N. A. M., & Rahim, E. A. (2019). Users' Emotional Evaluation Towards Kansei-Based Higher Learning Institution Website Using Geneva Emotion Wheel. *Indonesian Journal of Electrical Engineering and Computer Science, 16*(3), 1547. https://doi.org/10.11591/ijeecs.v16.i3.pp1547-1554

[9] Hong, S. W., Kang, J., Park, J. H., Park, H., & Kim, E. (2023). Quality and Readability of Online Information on Hand Osteoarthritis. *Health Informatics Journal, 29*(1), 146045822311692. https://doi.org/10.1177/14604582231169297

[10] Zhao, T., & Tai, J. (2022). Fast Retrieval Method of Portal Information Based on a Chaotic Genetic Algorithm. *Mathematical Problems in Engineering, 2022*, 1-10. https://doi.org/10.1155/2022/1770046

[11] Madhavan, J., Ko, D., Kot, Ł., Ganapathy, V., Rasmussen, A., & Halevy, A. (2008). Google's Deep Web Crawl. *Proceedings of the VLDB Endowment, 1*(2), 1241-1252. https://doi.org/10.14778/1454159.1454163

[12] Pressman, R. (2005). *Software Engineering: A Practitioner's Approach*. New York: McGraw-Hill.

[13] Hidayat, Y. W., Abdillah, L., Prayuda, I., Kusumo, A. J., Pranata, D. U., & Syarriansyah, M. (2020). Designing Palembang's Typical Culinary Information Systems Based on Website and Social Media. *SISTEMASI: Jurnal Sistem Informasi*.

[14] Rieh, S. Y. (2002). Judgment of Information Quality and Cognitive Authority in the Web. *Journal of the American Society for Information Science and Technology, 53*(2), 145. https://doi.org/10.1002/asi.10017

[15] Abdi, S. J., & Greenacre, Z. A. (2020). An Approach to Website Design for Turkish Universities, Based on the Emotional Responses of Students. *Cogent Engineering, 7*(1), 1770915. https://doi.org/10.1080/23311916.2020.1770915

[16] Remus, U. (2007). Critical Success Factors for Implementing Enterprise Portals. Business Process Management Journal, 13(4), 538-552. https://doi.org/10.1108/14637150710763568.