Scholarship Application with Decision Support System Feature using Progressive Web App

Sri Andriati Asri[1], I Gusti Ngurah Bagus Caturbawa[2], Putu Manik Prihatini[3], Ni Wayan Rasmini[4], I Made Riyan Adi Nugroho[5], and Elina Rudiastari[6]

[1,2,3,5,6] Information Technologi Department, Politeknik Negeri Bali, Bali Indonesia
[4] Electrical Engineering Department, Politeknik Negeri Bali, Bali Indonesia
sriandriati@pnb.ac.id

Abstract. One service offered to students is the provision of scholarships, yet, they often require help in acquiring current information and navigating the intricate application procedure. The development of an online application is necessary to enhance the quality of this service. This web application will offer comprehensive information and functionalities to apply for scholarships. Furthermore, it will provide exceptional performance and be compatible with various system platforms. To fulfill these criteria, the scholarship application will be created as a Progressive Web App (PWA). Furthermore, the system will have a Decision Support System (DSS) functionality to streamline the campus's assessment and allocation of scholarships according to predetermined standards. This application will facilitate students in acquiring knowledge and conveniently submitting applications for educational grants. Furthermore, it would augment the scholarship services of the institution by enhancing the efficiency of service by implementation of automated assessment of scholarship requirements and streamlining the application procedure.

Keywords: Decision Support System, Progressive Web App Introduction, Scholarship Application

1 Introduction

As a higher education institution, campus offers a range of services to students in diverse formats. Various types of services provided to students encompass healthcare, comprehensive infrastructure amenities, and scholarship programs. To enhance the quality and availability of services, the institution will make efforts to transition mostly administrative services to online platforms. The objective of this service is to enhance the quality of service, while also providing online-based services that facilitate the implementation of the green campus. The Green Campus will prioritize services by specifically highlighting resource conservation and paperless administration.

The objective of this study is to create an internet-based scholarship application utilizing Progressive Web App (PWA) as a service for students. This application has

A. A. N. G. Sapteka et al. (eds.), *Proceedings of the International Conference on Sustainable Green Tourism Applied Science - Engineering Applied Science 2024 (ICoSTAS-EAS 2024)*, Advances in Engineering Research 249,
https://doi.org/10.2991/978-94-6463-587-4_38

Decision Support System (DSS) capabilities to help the institution rank potential scholarship applicants based on the established criteria.

1.1 Progressive Web App

A website built with Progressive Web App (PWA) offers several benefits since it maintains compatibility with all users, irrespective of their web browser. Adapting application-based feedback to various devices allows for independent connectivity. The inclusion of a service worker feature enhances the load time process even in low-quality internet conditions and ensures offline accessibility. The Progressive Web App (PWA) is a novel architecture for developing mobile applications that offers several benefits compared to its predecessor. Designed to function with minimal or no internet connection, this application operates in the background and facilitates push notifications. What sets it apart is its remarkable progress (Magomadov, 2020). Considerable research has been undertaken on the use of Progressive Web Apps (PWA) for website development in comparison to other web applications. Included among them are the following: Studies undertaken by Reza Fauzian and Dian Nugraha demonstrate that PWA effectively manages low network connectivity and energy consumption (Fauzan et al., 2022; Nugraha et al., 2022). An extensive study conducted by Jodi S, Magomadov, Diekman, and Avinash has shown that PWAs are not a universal substitute for native applications. Critical pillars in service worker implementation include performance optimization and security considerations (Jodi et al., n.d.; Magomadov, 2020; Diekmann & Eggert, 2021; Devarapalli, 2024).

1.2 Progressive Web App

Numerous research has examined the application of Simple Additive Weighting (SAW) in Decision Support Systems (DSS). In their study, Sihombing *et al* employed the Simple Additive Weighting (SAW) approach to create a Decision Support System (DSS) to assist consumers in making well-informed choices with their Toyota C purchases (Sihombing et al., 2021). The study was carried out by Puspa M, who created a decision support system utilizing the Simple Additive Weighting (SAW) approach to choose recipients of complementary nutrition (PMT) programs (Puspa, 2019). Hadi also developed a decision support system to select supplementary food recipients based on predefined criteria and preference weights. Utilizing the Simple Additive Weighting (SAW) approach, organizational structure positioning alterations are determined by considering the skills of individual employees (Hadi et al., 2019). To determine the range of pay increases, Setiawan implemented a decision-making assistance system that utilized the SAW approach (Simple Additive Weighting) (Setiawan et al., 2018).

2 Methodology

The methodology used in developing scholarship applications using PWAs uses Evolutionary Prototyping by Nacheva (Nacheva, 2017). Figure 1 shows the Evolutionary Prototyping Methodology.

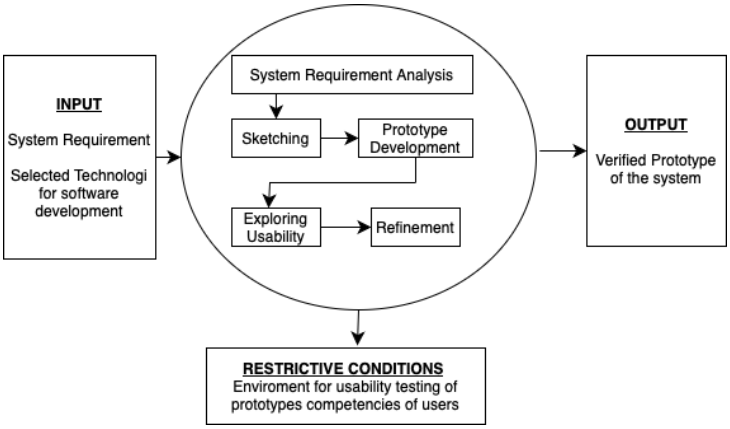

Figure 1. Evolutionary prototyping methodology

The methodology employed in this study commences with a meticulous examination of the submitted regulations and the application procedure. This entails collecting comprehensive information on policies, processes, and engagements with stakeholders to guarantee a precise comprehension of system needs. This section identifies and documents the primary actors, essential functions, and desirable behavior of the system. After establishing these precise criteria, the subsequent crucial stage is to choose the suitable technologies and programming languages for the construction of the system. The choice of the technology package, which includes programming languages, frameworks, and tools, is influenced by the particular objectives of the application. This ensures that the chosen solutions align with the operational goals, functions, and objectives of the desired purpose.

2.1 Prototyping Processes

Analysis of user attributes and behavior is crucial after data collection. This user analysis facilitates comprehension of the requirements, personal preferences, and possible obstacles that users may encounter, therefore enabling the development team to design a sophisticated and efficient system. The research provides valuable insights that inform design choices and guarantee that the end product aligns with user expectations. The design phase is the process of creating a comprehensive blueprint for the system. This stage involves the composition of the primary elements of the architecture and the meticulous design of the database structure. This involves specifying the schema, relationships, and data flow to ensure that the database can effectively fulfill the application's functionality, performance, and scalability requirements. The use case diagram of the program is depicted in Figure 2. A use case diagram that maps the actions performed by users.

Figure 2. Use case diagram scholarship application

The back-end application's relational table diagram is depicted in Figure 3.

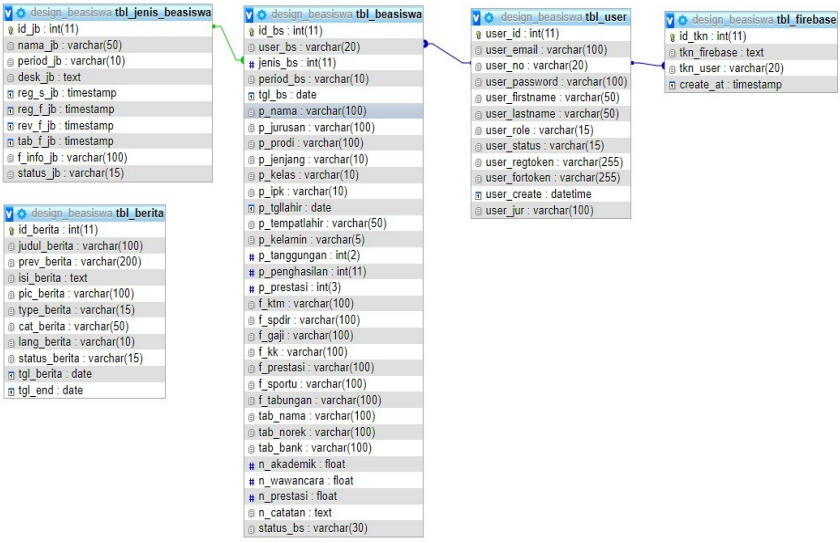

Figure 3. ER Diagram of scholarship application

The prototyping method is iterative. The application development process continues until a prototype is created that meets the user's needs.

3 Result and Discussion

3.1 Result

This study particularly examines the creation of an online scholarship application that utilizes Progressive Web App (PWA) technology and a Decision Support System (DSS) to optimize the process of selecting award applicants. The major rationale for implementing PWA is to guarantee compatibility across all platforms and enhance performance in situations with limited or no internet access. Furthermore, the incorporation of the Simple Additive Weighting (SAW) method into the DSS framework enables a methodical evaluation of scholarship candidates according to predetermined criteria.

System requirement. After observations and initial investigations, the system's functional needs have been developed to guarantee user-friendliness and accessibility for both students and administrators. Initially, the system should incorporate a User Registration and Authentication procedure, enabling students to register by providing their designated student ID and personal details. A robust authentication system should be established using email and password authentication, together with role-based access control to differentiate between student and administrator privileges. In addition, applicants must have the capability to electronically submit their scholarship applications, which includes uploading essential documents such as transcripts and financial account statements. The system should additionally alert consumers by notification upon successful submission of their application, therefore assuring transparent communication.

The system must include Application Status Tracking, allowing students to track the progress of their application, including whether it has been submitted, is available for review, or has been approved or refused. Administrators must possess the capability to accurately update the current status and promptly notify students of any decisions made. Incorporating the Simple Additive Weighting (SAW) approach, the Decision Support System (DSS) within the platform will evaluate applicants according to predetermined criteria, including academic achievement and financial necessity. Administrators have the freedom to modify the weights assigned to these criteria as necessary. In order to be classified as a Progressive Web App (PWA), the system must possess cross-platform functionality, be easily accessible through any web browser, and provide offline capabilities supported by service workers. Implementation of push notifications is necessary to efficiently give consumers with timely updates on the status of their applications.

Prototyping process. Once the system requirements have been established, the implementation of the scholarship application system will advance through a Prototyping Process. This method employs an iterative process of developing and improving prototypes by incorporating user input and adapting to changing

requirements. Initially, the prototype process involves collecting comprehensive user requirements and comprehending the fundamental capabilities and behaviors required from the system. The development of initial prototypes will be undertaken to meet these objectives and offer a concrete manifestation of the fundamental characteristics of the system.

Feedback will be gathered from users as they engage with these prototypes to pinpoint areas that need enhancement. This iterative process, driven by feedback, guarantees that the design of the system closely corresponds to user expectations and functional requirements. The design process involves creating intricate and comprehensive plans of the system's architecture, database structure, and user interface. Every successive iteration of the prototype.

Developed with Node.js, the program offers a server-side environment that is both scalable and efficient. MySQL is used to manage the database, thereby guaranteeing resilient and safe storage of data. Furthermore, the Slim Framework is employed to construct a streamlined and effective backend, therefore enhancing the overall performance of the system. This iterative methodology, in conjunction with these technologies, enables ongoing enhancement of the system to efficiently fulfill user requirements while guaranteeing exceptional performance and dependability.

Output. Following the collection of feedback from these reviews, the prototype will undergo upgrades and modifications. This iterative process persists until the product satisfies the specified criteria for performance, usability, and functionality. The ultimate deliverables will consist of a fully realized system with all essential functionalities integrated, an extensive user manual, and any requisite documentation for system installation and upkeep. Furthermore, comprehensive reports and analysis of user input and testing results will be generated to guarantee that all modifications are meticulously recorded and verified.

Figure 4 shows the landing page of the scholarship application. Furthermore, Figure 5 shows the apply scholarship menu. Students can apply for grants via this menu.

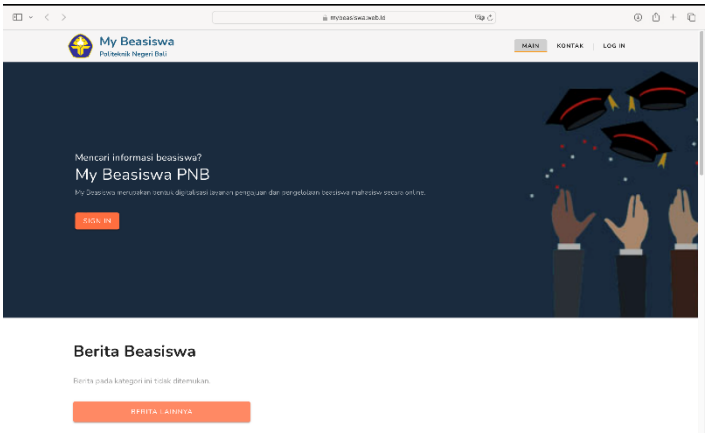

Figure 4. Landing page of the scholarship application

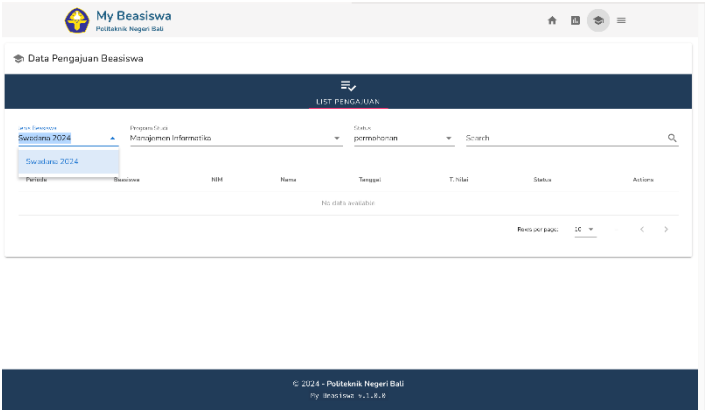

Figure 5. Apply scholarship menu

The DSS feature takes place on the ranking menu as shown in Figure 6.

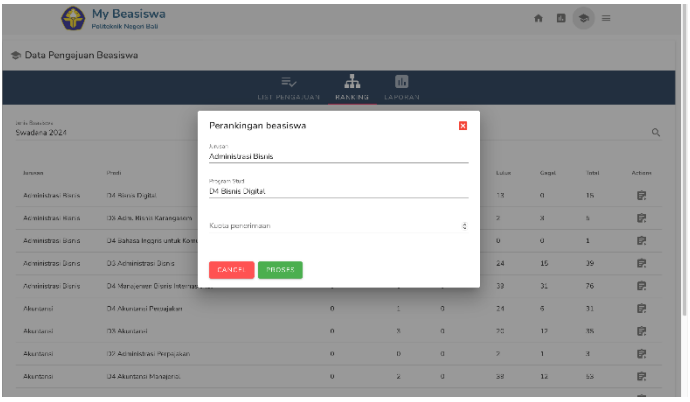

Figure 6. The DSS feature menu

3.2 Discussion

The implementation of Progressive Web App (PWA) technology and a Decision Support System (DSS) with the Simple Additive Weighting (SAW) approach in the scholarship application system is a notable improvement in the management of student services. The PWA architecture guarantees consistent accessibility on various devices and browsers, even in situations with limited bandwidth, therefore improving the inclusiveness and effectiveness of the application process. Through the provision of online application submission, document uploading, and progress tracking capabilities, the system optimizes administrative operations and contributes to the institution's Green Campus effort by minimizing paper consumption and preserving resources.

Integrating the Decision Support System (DSS) with the SAW approach enhances the fairness and transparency of the scholarship selection process. Through the

assessment of candidates using several criteria and the provision of customizable criteria weights, the system guarantees that decisions are taken based on data and fairness. The iterative prototyping approach employed in development enables ongoing improvement through user input, therefore assuring that the ultimate result is both user-friendly and fully conforms to functional requirements. The proposed methodology not only tackles the issues of accessibility and sustainability but also guarantees that the system adequately fulfills the requirements of both students and administrators.

4 Conclusion

By combining Progressive Web App (PWA) technology with a Decision Support System (DSS) that utilizes the Simple Additive Weighting (SAW) paradigm, the scholarship application system has the potential to significantly enhance student service management. By leveraging the cross-platform capabilities and offline functionality of PWA, the system ensures broad accessibility and enhanced performance, particularly in scenarios with restricted internet connectivity.

The development process, distinguished by an iterative prototyping methodology, guarantees that the result is focused on the needs of the users and conforms to the functional criteria. by employing Node.js for server-side development, MySQL for database administration, and the Slim Framework for efficient backend, the system is designed to be scalable, safe, and high-performing. The incorporation of the Decision Support System (DSS) with Simple Additive Weighting (SAW) improves the impartiality and clarity of the scholarship selection procedure. In summary, this approach enhances both the accessibility and speed of scholarship applications, while also promoting sustainable practices and providing a strong, user-friendly experience.

Acknowledgment

This study received substantial funding from the Directorate of Research and Community Service, which operates under the Director General of Development and Research Enhancement in the Ministry of Education, Culture, Research, and Technology of Indonesia.

References

Devarapalli, C. A., (2024). Progressive Web App (PWA): Optimal strategies & challenges. *International Journal of Research in Engineering and Science (IJRES) ISSN, 12*. www.ijres.org.

Diekmann, J., & Eggert, M. (2021). *Is a Progressive Web App an alternative for native app development? A prototype-based usability evaluation of a health insurance app*.

Fauzan, R., Krisnahati, I., Nurwibowo, B. D., & Wibowo, D. A. (2022). A systematic literature review on Progressive Web Application practice and challenges. *IPTEK The Journal for Technology and Science*, *33*(1), 43. https://doi.org/10.12962/j20882033.v33i1.13904.

Hadi, A.F., Permana, R., & Syafwan, H. (2019). Decision Support System in determining structural position mutations using Simple Additive Weighting (SAW) Method. *Journal of Physics: Conference Series*, *1339*(1). https://doi.org/10.1088/1742-6596/1339/1/012015.

Jodi, S., Amin, R., & Author, C. (n.d.). *Implementation of progressive web apps-based click profile on social media*. www.nusamandiri.ac.id.

Magomadov, V. S. (2020). Exploring the role of progressive web applications in modern web development. *Journal of Physics: Conference Series*, *1679*(2). https://doi.org/10.1088/1742-6596/1679/2/022043.

Nacheva, R. (2017). Prototyping approach in User Interface. *2Nd Conference on Innovative Teaching Methods*, *June*, 80–87. https://www.researchgate.net/publication/317414969

Nugraha, D., Anjara, F., & Faizah, S. (2022). *Comparison of web based and PWA in online learning*.

Puspa, M. (2019). Decision Support System for supplementary food recipients (PMT) by using the Simple Additive Weighting (SAW) Method. *Jurnal Teknik Informatika C.I.T*, *11*(2).

Setiawan, N., Nasution, M. D. T. P., Rossanty, Y., Tambunan, A. R. S., Girsang, M., Agus, R. T. A., Yusuf, M., Vebrianto, R., Purba, O. N., Fauzi, A., Perdana, S., & Nisa, K. (2018). Simple additive weighting as decision support system for determining employees salary. *International Journal of Engineering and Technology(UAE)*, *7*(14).

Sihombing, V., Siregar, V. M. M., Tampubolon, W. S., Jannah, M., Risdalina, & Hakim, A. (2021). Implementation of simple additive weighting algorithm in decision support system. *IOP Conference Series: Materials Science and Engineering*, *1088*(1). https://doi.org/10.1088/1757-899x/1088/1/012014.