Jurnal Teknologi Sistem Informasi dan Aplikasi **ISSN: 2654-3788**
Penerbit: Program Studi Teknik Informatika Universitas Pamulang **e-ISSN: 2654-4229**
Vol. 7, No. 4, Oktober 2024 (1439-1450) **DOI: 10.32493/jtsi.v7i4.43215**

Design and Development of a Website-Based Power Bank Rental Monitoring System Using a Framework and Blackbox Testing Method

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Submitted Date: August 20th, 2024 Reviewed Date: October 24th, 2024
Revised Date: October 25th, 2024 Accepted Date: October 31st, 2024

Abstract

This research shows that in today's digital era, users of electronic devices such as smartphones often experience difficulties in managing their battery power needs, especially when using power banks. Uncertainty in the availability and maintenance of power bank rentals can cause inconvenience to users. Therefore, a system is needed that can facilitate the process of renting and managing power banks. This research aims to design a website-based power bank rental monitoring system. The methods used in this research include a framework for designing the system and testing using black-box testing to ensure application functionality. System development was conducted through five stages: planning, analysis, design, implementation, and testing. RFID technology was applied to facilitate the payment process, while Wi-Fi was used for interaction between the user and the application. The features in the system include dashboard, member data, power bank data, and transaction data, which are designed to make it easier for administrators to manage rental data. The research shows that the developed application successfully simplifies the process of purchasing, paying, and returning power banks with easily accessible features and timely notifications. This application not only provides a practical solution for users in managing power bank rentals, but also helps admins in handling transactions and generating reports. Thus, this system is expected to fulfill users' needs for battery power more efficiently.

Keywords: Power Bank Rental; Website Application; Transaction Monitoring; RFID Card.

1 Introduction

Smart phones are wearable devices that contain features that help people perform tasks, including portable computing systems, recording devices, and enhanced memory, making them a common social phenomenon (Mehmood et al., 2021). Smart phone usage is mostly used by those aged 21-30 in China, which reached 68.4% in 2011 and continues to increase every year. Adults and teenagers check their smart phones 150 times a day, or every 6 minutes. Recent studies have shown that the frequency of smartphone addiction reaches 60% in the elderly population. Although smart phones are useful and beneficial products, their excessive use, especially among young people, has led to the addition of alarming numbers, becoming a social problem.

Smartphone battery storage capacity is a time when used in the activity and mobility of using applications on smartphones can quickly drain battery capacity (Narayan R & Venkateswarlu M, n.d., 2020). Busy work and a lot of moving places has become the lifestyle of most people, this makes communication devices such as smartphones a necessity, but also very annoying. may work outside the home because of the battery power system. Using a power bank as a portable charging device has many advantages (Syafriwel & Yayang Martua Naibaho, 2019). Including easy portability, keeping devices handy in places without electricity, and the ability to charge multiple devices at the same time. Therefore, the importance of renting a power bank is increasingly felt (Chan, 2023). Renting a power bank is a practical solution to the sudden need for additional battery power.

Electronic banking systems offer many payment options, ranging from cash payments to contactless transactions and RFID cards, thus increasing the value of services among different groups of people (Sunanda et al., 2020). Not only do users have quick and easy access to backup batteries, but they also like the ease of ordering, paying, and returning devices. These functions allow power banks to be an effective and efficient solution to the challenges of battery consumption in the digital lifestyle.

This research addresses the implementation of instant payments that enable users to charge their portable devices within minutes through the use of price tags (Azzahra et al., 2022). The study highlights the growing demand for rapid charging solutions, particularly in public spaces or during travel. The methodology involves developing an integrated system that combines smart price tags with a user-friendly interface, allowing users to select their devices and specify the amount of power they wish to transfer from the power bank. This intuitive process minimizes transaction time and incorporates feedback mechanisms to enhance user experience. Results show that the instant payment system significantly reduces charging time compared to traditional methods, increases convenience by allowing multiple devices to be charged simultaneously, and eliminates the need for extensive wiring. Overall, the research provides valuable insights into integrating payment systems with charging solutions, addressing a critical need in today's digital lifestyle.

This research focuses on the analysis and design of websites that meet contemporary needs (Woody et al., 2020). This research highlights the important role played by websites in various industries, including companies, organizations, and individuals. The problem addressed in this research is the need for an effective online presence in an increasingly digital world. The methodology used was to analyze existing website designs and identify key features that improve user interaction and accessibility. The findings show that websites have evolved to be more than just a display of information; they are now an important tool for brand building, improving accessibility and driving user engagement. Overall, this research underscores the importance of effective website design in achieving business and organizational goals in the digital age.

This research explores the development of a solar panel-based power generation system that utilizes the Internet of Things (Nurunnisa & Thalib, 2022). This research addresses the problem of managing costs related to charging electronic devices such as smartphones, so that they can be used in public places without relying on additional electricity costs from PLN. The method used involves building a device equipped with three types of sensors: RFID Reader RC522 sensor to read and detect the presence of RFID cards, digital clip meter to measure the voltage of electrical circuits on solar panels, and pyrometer sensor to assess the intensity of sunlight throughout the day. The results show that the system effectively supports the use of solar energy for device charging, significantly reducing operational costs while encouraging sustainable energy solutions in public areas. Overall, this research demonstrates the potential of IoT technology in improving the accessibility and efficiency of solar panel-based charging systems.

In this context, the objective of this research is to create and implement an online electronic banking system that facilitates data management for managers. The system includes features such as dashboards, user data, electronic bank data, and transaction data to simplify the management process. This research uses a prototyping method that allows the development and customization of the system based on user feedback. The constraints found include various features such as the use of RFID cards as part of the lease, minimum inventory requirements, as well as authentication requirements with ID cards or student cards for security and power bank returns. In addition, the balance on the RFID card cannot be exchanged for cash. This research is expected to be useful, among others, to facilitate users in finding and renting power banks according to their needs, as well as transaction management and reporting by managers. By using this system, it is expected that e-wallet rental can be done more quickly and easily by users and operators.

2 Method

This research method uses a framework to plan and organize ideas based on objectives. Furthermore, the research activities used in this method are described as shown in Figure 1.

ISSN: 2654-3788
e-ISSN: 2654-4229
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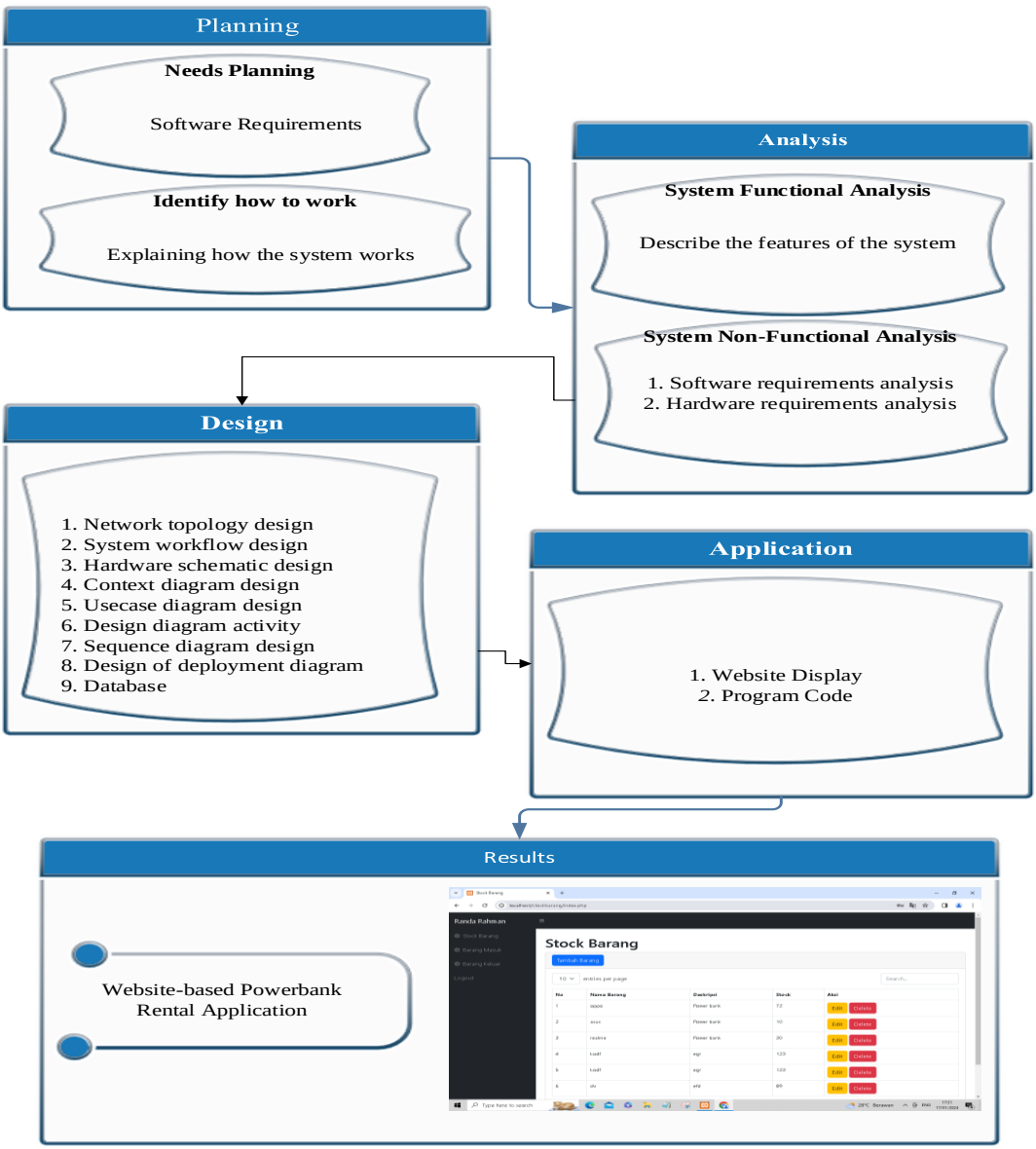

Figure 1. Thinking Framework

2.1 Planning

At this planning stage, outline specific goals for the power bank charging system, which improve user experience and efficiency. Analysis of market needs and user risks was methodically conducted, including the use of action plans to mitigate risks. In addition, resource allocation, such as budget and manpower, was conducted, and a project schedule was designed to ensure that all participants understood the tasks and timelines to be adhered to, thus creating a structured working environment for project execution.

2.2 Analysis

During the analysis stage, Tim evaluated each aspect of the power bank requirements by examining the important features that should be included, such as user registration and transaction processing. In addition to functional analysis, non-functional aspects such as system performance and security are also examined. The result of this analysis is an accurate document that serves as an important guideline during the design phase. It is intended to ensure that the implemented system can reduce user risk and conform to industry standards.

2.3 Design

During the design phase, developed prototypes and user interface sketches for the power bank charging system. This process describes the functionality of the application and the user's interaction with the system, as well as the technical structure that supports the overall functionality of the system. After receiving feedback from the community of interest, a final design was created to ensure that the user interface was not only visually appealing but also intuitive and easy to use before moving on to the implementation phase.

2.4 Implementatation

At the implementation stage, the developers build the application according to the predetermined design. This process includes writing down the code, establishing a data base, and integrating technologies like RFID to make the payment process easier. The outcome of this phase is the functional prototype of the power bank system, where the initial test indicates that all of the primary features function properly and provide a strong foundation for further extensive testing.

2.5 Testing

During the testing phase, the system is thoroughly evaluated to identify and fix any bugs or issues that may arise. Different types of tests are performed to ensure that all functions work as expected and the integrity of the system is maintained. The results of the investigation showed that the system was functioning well, although there were some minor issues that needed to be fixed. Feedback from users showed a high level of satisfaction, which indicates that the system is not only functional but also easy to use, and this confirms that users have provided accurate feedback throughout the development process.

3 Result

3.1 Planning

Based on the problems raised by researchers, it is expected that this power bank rental monitoring application requires a website that can provide all the functions needed to rent power banks efficiently, including the process of ordering, paying, returning, and reporting in general.

A. Needs Planning

Software requirements planning is a systematic process for identifying, documenting, and planning requirements. Requirements that must be met by the software system to achieve the desired goals. This process includes several important steps to ensure that the developed software meets user expectations and other functional and non-functional requirements.

B. Identify Ways of Working

Identify current system performance, which is the process of understanding, analyzing, and documenting the system functions that are currently active or operating in a particular environment. This process is important for various purposes, such as updating the system, integration with other systems, or migration to a new system. Here is a more detailed description of this process.

3.2 Analysis

In this phase, researchers conducted a needs analysis which was divided into two parts, namely functional systems and non-functional systems, the purpose of these two parts was to take care of all the functional needs of the website.

A. System Functional Analysis

Functional system analysis is a process that describes how the system works to meet user needs. In this case, the website created should allow administrators to log in and manage power bank data, member data, and transactions in detail. Further explanation for this is as follows.

B. System Non-functional Analysis

Non-functional system requirements analysis falls into two categories: software requirements analysis and hardware requirements analysis. Hardware analysis aims to facilitate the process of designing and implementing this system.

1. Software requirements analysis This analysis is needed to determine the minimum specifications needed to create the software.
2. Hardware Requirements Analysis Minimum laptop hardware specifications required for users to run the website.

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3.3 Design

3.3.1 System Workflow

Here is a screenshot of the workflow design of the power bank rental site. This specification is presented in the form of a flow chart, shown in Figure 2.

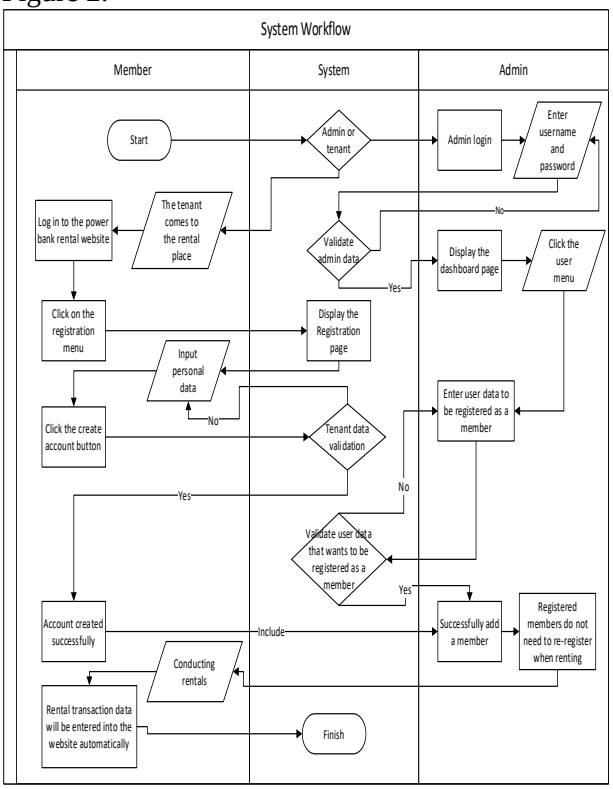

Figure 3. System Workflow

3.3.2 Context Diagram

A context diagram is a visual representation of a system that describes the relationship between the system and the external entities that interact with it. This diagram serves as a communication tool that helps understand the system's boundaries and the main data flows between the system and its environment. This can be seen in Figure 4.

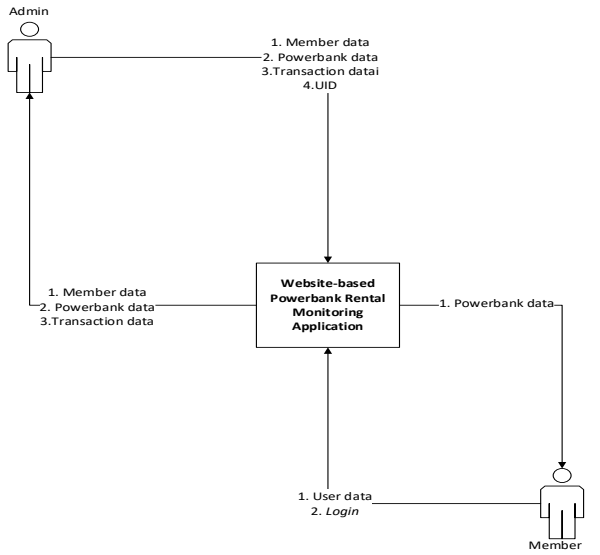

Figure 4. Context Diagram

3.3.3 Use Case Diagram

A use case diagram describes the desired functionality of a system. This diagram shows the benefits of the system. The use case diagram is shown in Figure 5.

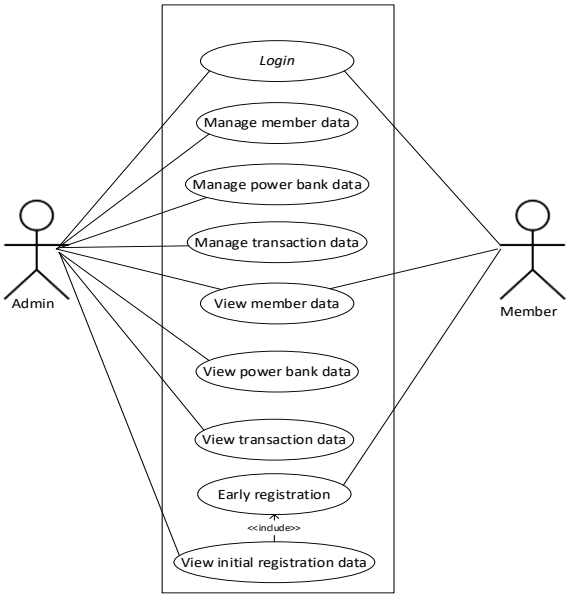

Figure 5. Use Case Diagram

3.3.4 Activity Diagram

Activity diagrams are used to visually represent the steps involved in various activities, such as business processes and user scenarios. This graphic not only illustrates the steps that are taken, but it also models the actions that will be taken

when a certain action is completed. Diagrams of activities are useful for modeling several aspects of a system: diagram aktivitas login illustrates the process of logging in to the system; diagram aktivitas mengelola data anggota indicates the steps to add, remove, or modify data anggota; diagram aktivitas mengelola data power bank illustrates the process of gathering information related to power banks; and diagram aktivitas mengelola data transaction indicates the steps to improve power bank transactions. In this way, an activity diagram provides clear illustrations of many processes that occur inside a system.

1) Login Activity Diagram

In this section, administrators and members enter the system. Here is a task diagram that shows the steps that admins and members take when logging in. This can be seen in figure 6.

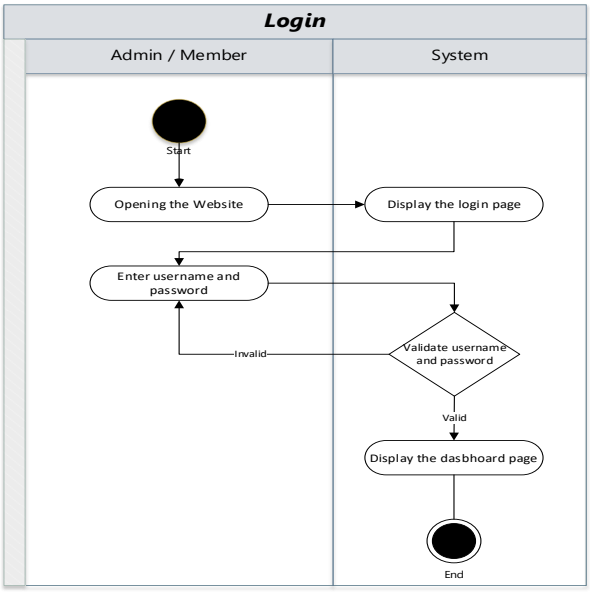

Figure 6. Login Activity Diagram

2) Activity Diagram of Managing Member Data

In this section, the administrator manages member data. The following activity diagram shows the steps taken by the administrator when managing member data. This can be seen in Figure 7.

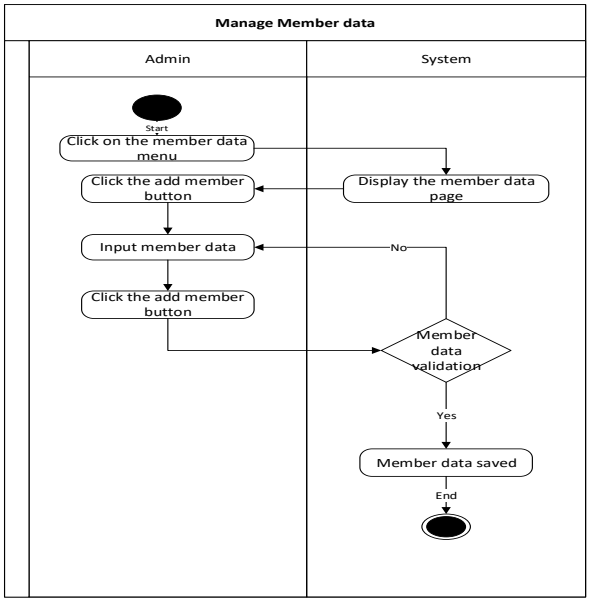

Figure 7. Activity Diagram of Managing Member Data

3) Activity Diagram of Managing Power Bank Data

In this section, the administrator manages the power bank data. Here is a task diagram showing the steps taken by the administrator when managing power bank data. This can be seen in Figure 8.

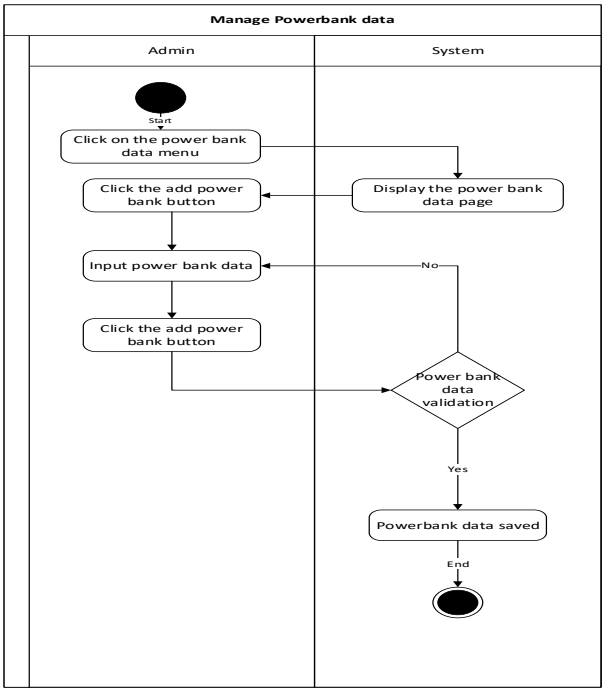

Figure 8. Activity Diagram of Managing Power Bank Data

Jurnal Teknologi Sistem Informasi dan Aplikasi **ISSN: 2654-3788**
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4) Activity Diagram of Managing Transaction Data

In this section, the administrator manages member data. Below is a task diagram showing the steps taken by the administrator when managing member data. This can be seen in Figure 9.

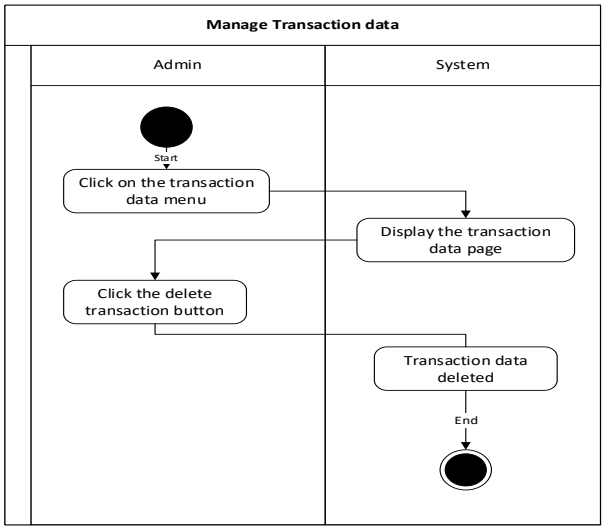

Figure 9. Activity Diagram of Managing Transaction Data

3.4 Implementation

In the software design implementation stage, where the entire system design is carried out and the hardware and software system requirements are identified. At this stage, several important components are included: login source code, which is used to implement the user login process; index.php, namely the main application that functions as the initial interface for users; member.php, which is a script that contains information about the user, such as password, password and password; power bank.php, which is a script that is responsible for loading information about the power bank; and transaction.php, which is a script that contains information about the power bank transaction process, including maintenance and transactions. In this case, the implementation phase focuses on developing and maintaining system requirements.

1. Source code login, in the energy bank rental application, enter . php functions as a security gate that requires users to authenticate before accessing certain functions by accessing the .php program code like this:

Figure 10. Source Code Login

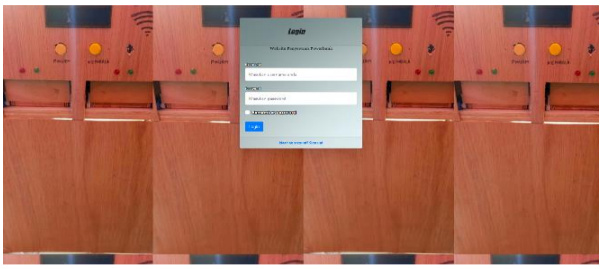

Figure 11. View Login

2. index.php is the main file of the power bank rental application which functions as the main entrance to the system, indexing the program code.php is like this:

Figure 12. Source Code Dashboard

Figure 13. View Dashboard

3. Member.php is a page that displays information about members registered with the energy bank rental system, the member program code.php is like this:

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Figure 14. Source Code Member

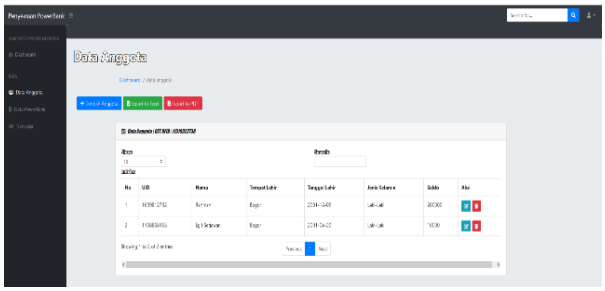

Figure 15. member data

4. PowerBank.php is the home page of the power bank rental system, which is responsible for displaying a list of power banks available for rent. power bank program code.php is like this:

Figure 16. Source Code power bank data

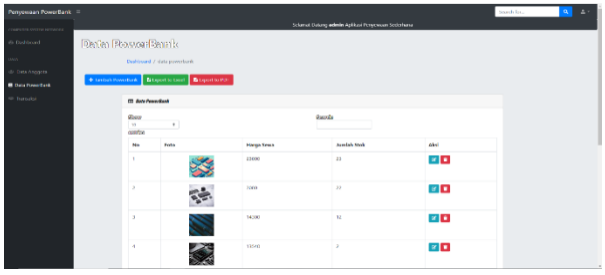

Figure 17. View power bank data

5. Transaction.php is a site that facilitates the process of renting power banks online. Through this page users can make power bank rental transactions as needed, the transaction software code.php is like this:

Figure 18. Source Code transaction data

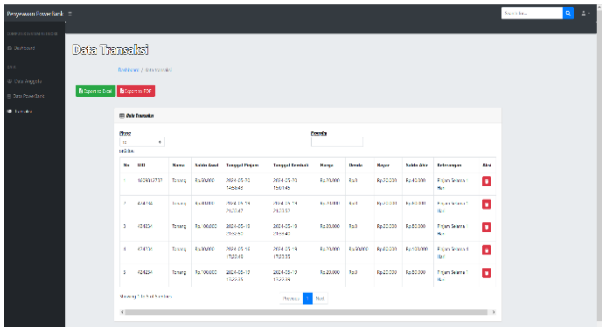

Figure 19. View transaction data

4 Testing

Testing of this application is done using the black box testing method. The black box testing method involves testing different software and applications to find out whether the software and applications are working properly and optimally or not. This was done with the following steps:

1) 1.Run the application.
2) Observe the application process and check if it fulfills the objectives stated on the test sheet.
3) Complete the test sheet based on the observation of the application.

Table 1 Testing

Test ID	Description	Expected Result	Test Result	Conclusion
1	Successful Login: Open the login page at http://localhost/penyewaan/index.php. In the login form, enter a valid username and valid password (example, username: admin, password: admin123) and click the login button.	The system verifies credentials and, if valid, redirects the user to the dashboard page. The dashboard should display key options and the user's name at the top.	The system redirects to the dashboard with user information visible.	Valid
2	Failed Login (Invalid Data): Open the login page and enter an invalid username and password (example, username: wrongUser, password: wrongPass), then click the login button.	The system checks the credentials, detects them as invalid, and displays an error message: Username not registered or password incorrect. The system stays on the login page.	An error message Username not registered or password incorrect is displayed, and the login page remains.	Valid
3	View Dashboard: After a successful login, navigate to the main menu and click on Dashboard.	The system should load the dashboard page, displaying all relevant information such as user statistics, notifications, and recent activities. All elements should be fully loaded.	The dashboard page loads with all sections visible and accessible.	Valid
4	View Member Data: After logging in, navigate to the main menu and click on Member Data.	The member data page loads, displaying a table with all registered members, their details, and options for editing and deleting each entry.	The member data page displays the table of members with edit and delete options for each entry.	Valid
5	Add Member Data: After logging in, click on Add Member in the main menu. Fill out the form with new member information (example, name: Randa Rahman, contact: 123456789), then click Save.	The system saves the new member data and displays it in the member list. The new entry should be visible in the member data table with correct details.	The new member appears in the member list with the entered details.	Valid
6	Edit Member Data: After logging in, go to the Member Data section, select a member to edit, click Edit, change the details (example, update contact information), and click Save.	The system updates the member data in the database. The edited member's updated details should appear in the member list without any data errors.	The member's data updates successfully and is reflected in the list.	Valid
7	Delete Member Data: After logging in, go to the Member Data section, select a member, click Delete, and confirm the deletion.	The system removes the selected member from the database. The member should no longer appear in the member list.	The selected member is removed from the member list.	Valid
8	Export Member Data History: After logging in, go to Member Data History and click Export PDF.	The system generates a PDF file containing the member data history. The PDF should either display on-screen or	The system generates and displays/downloads the PDF with the	Valid

Test ID	Description	Expected Result	Test Result	Conclusion
		automatically download,	correct member data history.	
9	View Power Bank Data: After logging in, navigate to Power Bank Data in the main menu.	The power bank data page loads, displaying a table with all registered power banks, their models, and specifications. Options for editing and deleting each entry should also be available.	The power bank data page displays with all entries and options visible.	Valid
10	Add Power Bank Data: After logging in, click Add Power Bank in the main menu, enter the new power bank details (example, name: o-like, rental price: Rp.10.000), and click Save.	The system saves the new power bank data and displays it in the power bank data list. The new entry should appear with the correct details.	The new power bank is added and appears in the list with correct details.	Valid
11	Edit Power Bank Data: After logging in, navigate to Power Bank Data, select an entry, click Edit, change the name (example, update name), and click Save.	The system updates the power bank data in the database. The edited entry should appear in the power bank list with the updated information.	The power bank's data updates successfully and is reflected in the list.	Valid
12	Delete Power Bank Data: After logging in, go to Power Bank Data, select an entry, click Delete, and confirm the deletion.	The system removes the selected power bank entry from the database. The deleted entry should no longer appear in the list.	The selected power bank entry is removed from the list.	Valid
13	Export Power Bank Data History: After logging in, go to Power Bank Data History and click Export PDF.	The system generates a PDF file containing the power bank data history. Depending on browser settings, the PDF should display on-screen or download.	The system generates and displays/downloads the PDF with correct data history.	Valid
14	View Transaction Data: After logging in, navigate to Transaction Data in the main menu.	The transaction data page loads, displaying a table of transactions, including dates, amounts, and statuses.	The transaction data page displays with all transaction details visible.	Valid
15	Export Transaction Data History: After logging in, go to Transaction Data History and click Export PDF.	The system generates a PDF file with the transaction data history. Depending on browser settings, it either displays on-screen or automatically downloads.	The system generates and displays/downloads the PDF with correct transaction history.	Valid
16	Logout: After logging in, click the Logout button in the main menu.	The system successfully logs the user out, clears the session, and redirects to the login page.	The system logs the user out and displays the login page.	Valid

5 Conclusion

This research creates a web-based rental application that is able to manage member data, power banks and transactions. With this system, administrators can manage and monitor member data, power bank data and transaction data. This

application can provide an effective solution to energy bank rental needs on websites and increase the efficiency of managing transactions carried out by administrators. allows the admin to monitor the identity of members who rent and return power banks.

Overall, this research shows that a web-based power bank rental monitoring application using RFID technology has succeeded in providing an effective, safe and easy-to-use solution for users and service providers. This application not only improves transaction efficiency and rental management, but also improves user experience, thereby making an important contribution to the development of web-based rental systems.

References

Akritidis, L., Alamaniotis, M., & Bozanis, P. (2023). FLAGR: A flexible high-performance library for rank aggregation. SoftwareX, 21. https://doi.org/10.1016/j.softx.2023.101319

Akritidis, M. (2024). Monopoly dynamics and the rise of UK single-family rental. Geoforum, 148. https://doi.org/10.1016/j.geoforum.2023.103907

Amadi, H. O., Abubakar, A. L., Abdullahi, R. A., & Abubakar, A. G. (2023). The Neonatal Rescue Scheme (NRS) concept reduces mortality by over 85% in Niger State Nigeria – A lesson for Nigeria and other LMICs. Journal of Neonatal Nursing. https://doi.org/10.1016/j.jnn.2023.07.003

Ari Prabowo, F., & Syani, M. (2019). Sistem Informasi Pengolahan Sertifikat Berbasis Web Di Divisi Training Seamolec. In 2016) Jmii (Vol. 2, Issue 1). https://journal.mediapublikasi.id/index.php/

Azzahra, G., Putri, W., & Chairy, C. (2022). The 6 th International Conference on Family Business and Entrepreneurship Investigating Consumer Intentions On Online Power Bank Rental Self-Service Retailing. SSN (Online) : 2620-3863. ejournal.president.ac.id/presunivojs/index.php/ICFBE/article/view/3765/1195

B., B. K., & Prasad, D. (2019). Design & Implementation of Power Bank using Supercapacitor. International Journal of Engineering and Advanced Technology, 9(1), 1224–1228. https://doi.org/10.35940/ijeat.A9592.109119

Blanch, X., Guinau, M., Eltner, A., & Abellan, A. (2024). A cost-effective image-based system for 3D geomorphic monitoring: An application to rockfalls. Geomorphology, 449, 109065. https://doi.org/10.1016/j.geomorph.2024.109065

Chan, V. K. Y. (2023). An Infrastructure of battery swapping and charging stations in smart cities to "disrupt" the current ecosystem of battery usage: A schematic design. Procedia Computer Science, 219, 864–869. https://doi.org/10.1016/j.procs.2023.01.361

Cheema, S. M., Tariq, S., & Pires, I. M. (2023). A natural language interface for automatic generation of data flow diagram using web extraction techniques. Journal of King Saud University - Computer and Information Sciences, 35(2), 626–640. https://doi.org/10.1016/j.jksuci.2023.01.006

Chen, F., Zhang, L., Lian, X., & Niu, N. (2022). Automatically recognizing the semantic elements from UML class diagram images. Journal of Systems and Software, 193. https://doi.org/10.1016/j.jss.2022.111431

Daw, Z., & Cleaveland, R. (2022). Comparing model checkers for timed UML activity diagrams. Science of Computer Programming, 111(P2), 277–299. https://doi.org/10.1016/j.scico.2015.05.008

Falaschetti, L., Manoni, L., Leo, D. Di, Pau, D., Tomaselli, V., & Turchetti, C. (2022.). A CNN-based image detector for plant leaf diseases classification. https://doi.org/10.1016/j.ohx.2022.e00363https://doi.org/10.17605/OSF.IO/UCM8D

Fathan Aulia, M., & Avorizano, A. (n.d.). JUTIKOM: Jurnal Teknik Informatika dan Komputer Penerapan Teknologi Single Page Application (SPA) pada Sistem Surat Disposisi Online (Sudion) di Universitas Muhammadiyah Prof Dr Hamka. In JUTIKOM (Vol. 1, Issue 1). https://journal.uhamka.ac.id/index.php/jutikom

Gardarin, A., Capowiez, Y., Teulé, J. M., Wetzel, G., & Hedde, M. (2023). Assessing ground predation by invertebrates in crops: Camera observations clarify the relevance of aphid cards and coleopteran sentinel prey. Basic and Applied Ecology, 71, 111–118. https://doi.org/10.1016/j.baae.2023.07.002

Jadali, N., Zhang, M. J., Schulz, A. K., Meyerchick, J., & Hu, D. L. (2023). ForageFeeder: A low-cost open source feeder for randomly distributing food. HardwareX, 14. https://doi.org/10.1016/j.ohx.2023.e00405

Juansyah, A. (2019). Jurnal Ilmiah Komputer dan Informatika (Komputa) Pembangunan Aplikasi Child Tracker Berbasis Assisted-Global Positioning System (A-Gps) Dengan Platform Android. Vol. 1 Agustus 2015 ISSN : 2089-9033

Karampure, R., Wang, C. Y., & Vashi, Y. (2021). UML sequence diagram to axiomatic design matrix conversion: A method for concept improvement for software in integrated systems. Procedia CIRP, 100, 457–462. https://doi.org/10.1016/j.procir.2021.05.104

Mehmood, A., Bu, T., Zhao, E., Zelenina, V., Alexander, N., Wang, W., Siddiqi, S. M., Qiu, X., Yang, X., Qiao, Z., Zhou, J., & Yang, Y. (2021). Exploration of Psychological Mechanism of Smartphone Addiction Among International Students of China by Selecting the Framework of the I-PACE Model. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.758610

Mokroš, M., Mikita, T., Singh, A., Tomaštík, J., Chudá, J., Wężyk, P., Kuželka, K., Surový, P., Klimánek, M., Zięba-Kulawik, K., Bobrowski, R., & Liang, X. (2021). Novel low-cost mobile mapping systems for forest inventories as terrestrial laser scanning alternatives. International Journal of Applied Earth Observation and Geoinformation, 104. https://doi.org/10.1016/j.jag.2021.102512

Montazeaud, G., Langrume, C., Moinard, S., Goby, C., Ducanchez, A., Tisseyre, B., & Brunel, G. (2021). Development of a low cost open-source ultrasonic device for plant height measurements. Smart Agricultural Technology, 1. https://doi.org/10.1016/j.atech.2021.100022

Narayan R, & Venkateswarlu M. (n.d.). Studies on portable power banks for recharging electronic gadgets. International Research Journal of Engineering and Technology. Volume: 05 Issue: 03 | Mar-2020, www.irjet.net

Nazarious, M. I., Mathanlal, T., Zorzano, M. P., & Martin-Torres, J. (2020). Pressure Optimized PowEred Respirator (PROPER): A miniaturized wearable cleanroom and biosafety system for aerially transmitted viral infections such as COVID-19. HardwareX, 8. https://doi.org/10.1016/j.ohx.2020.e00144

Noer, Z., Fathurrahman, M., Novita, A., Siregar, P., Awanda, M., Abduh, M., Agus, A., & Siahaan, L. F. (2023). Solar-Based Smartphone Charging Stations with Voltage, Current, and Power Monitoring. Journal of Technomaterial Physics Journal Homepage, 05(02), 111–117. https://doi.org/10.32734/jotp.v5i1.13348

Nurunnisa, D., & Thalib, F. (2022). Rancang Bangun Sistem Penyewaan Charging Elektronik Dengan Daya Panel Surya Berbasis IOT. Jurnal Teknologi, 9(2), 32–42. https://doi.org/10.31479/jtek.v9i2.133

Ogan Ilir, I., & Jauhari, J. (2019). Upaya Pengembangan Usaha Kecil dan Menengah (UKM) dengan Memanfaatkan E-Commerce. Jurnal Sistem Informasi (JSI), 2(1), 159–168. http://ejournal.unsri.ac.id/index.php/jsi/index

Ohyver, M., Moniaga, J. V., Sungkawa, I., Subagyo, B. E., & Chandra, I. A. (2019). The comparison firebase realtime database and MySQL database performance using wilcoxon signed-rank test. Procedia Computer Science, 157, 396–405. https://doi.org/10.1016/j.procs.2019.08.231

Permatasari, I., Adhania, F., Putri, S. A., & Nursari, S. R. C. (2023). Pengujian Black Box Menggunakan Metode Analisis Nilai Batas pada Aplikasi DANA (Vol. 3, Issue 2).

Permatasari, I., Adhania, F., Putri, S. A., & Nursari, S. R. C. (2023). Pengujian Black Box Menggunakan Metode Analisis Nilai Batas pada Aplikasi DANA (Vol. 3, Issue 2).

Ratih, R. M., Yasyak, M. I., Nugroha, H., & Fadlilah, U. (2020). Powerbank Piezoelektrik Menggunakan Tekanan Tangan. In Jurnal Teknik Elektro (Vol. 20). doi:10.23917/emitor.v20i1.8597

Shivaram, A. M., & Handigund, S. M. (2021). An ameliorated methodology for the abstraction of object oriented features from software requirements specification. Procedia Computer Science, 62, 274–281. https://doi.org/10.1016/j.procs.2015.08.450

Sibanda, V., Munetsi, L., Mpofu, K., Murena, E., & Trimble, J. (2020). Design of a high-tech vending machine. Procedia CIRP, 91, 678–683. https://doi.org/10.1016/j.procir.2020.04.133

Sunanda, N., Hrushikesava Raju, S., Faiayaz Waris, S., & Koulagaji, A. (2020). Smart Instant Charging of Power Banks. IOP Conference Series: Materials Science and Engineering, 981(2). https://doi.org/10.1088/1757-899X/981/2/022066

Syafriwel, R., & Yayang Martua Naibaho, dan. (2019). Rancang Bangun Power Bank Charger Alternatif Untuk Alat Komunikasi Dengan Energi Terbarukan Solar Cell Mini. Universitas Tjut Nyak Dhien Jln Gatot Subroto Gg. Rasmi No.28, Sei Sikambing C. II, Kec. Edu Elektrika Journal, 11(2).

Vargas, T. R., Guerri, J. C., & Arce, P. (2022). DASH Streaming traffic influence over energy efficient ethernet to improve energy savings. Ad Hoc Networks, 136. https://doi.org/10.1016/j.adhoc.2022.102951

Woody, M., Arbabzadeh, M., Lewis, G. M., Keoleian, G. A., & Stefanopoulou, A. (2020). Strategies to limit degradation and maximize Li-ion battery service lifetime - Critical review and guidance for stakeholders. Journal of Energy Storage, 28. https://doi.org/10.1016/j.est.2020.101231