


Development of a Multi-Platform Vehicle Rental Service Application using Research and Development (R&D) Methods

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Article Info	ABSTRACT
<p>Keywords: Multi-Platform Application, Vehicle Rental, Purworejo, Information System, Transportation Services.</p>	<p>Vehicle rental services still face various obstacles such as limited accessibility, manual management, and the absence of an integrated system. This study aims to develop a multi-platform web and mobile-based application model that can improve the efficiency and transparency of vehicle rental services. The research method used is Research and Development (R&D) with stages of needs analysis, system design, implementation, and testing using the System Usability Scale (SUS). Research data was obtained from direct interviews with rental owners and surveys of 21 potential users. The test results showed an average usability score of 79.4 out of 100, which is in the "good" category. This indicates that the developed application model is superior to the previous models (SDLC and RAD), which were only tested through black-box testing without measuring user usability. With these results, the research successfully introduced an R&D-based application development model that is measurable through SUS, thereby contributing scientifically to improving the effectiveness of the digital vehicle rental system.</p>
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INTRODUCTION

Rapid technological developments have brought significant changes in the field of transportation. In the past, public transportation such as angkot, oplet, and minibuses were the main choices for the community. However, with private vehicles becoming more affordable, many have switched to private vehicles. In addition, the increase in population is directly proportional to the number of vehicles, causing traffic congestion which is a challenge for public transportation (Karimullah et al., 2024).

Information and communication technology has changed the landscape of the transportation industry, driving a shift towards a modern era characterized by digital connectivity. In this context, the digital mobile approach is not merely an innovation, but a fundamental strategic step to improve and enhance the quality of public transportation services, particularly in terms of bus ticket application projects. This phenomenon is becoming increasingly important as the public's need for practical, efficient, and real-time connected solutions grows (Zulfa Nurreza & Hermanto, 2024). Various transportation technology

innovations such as e-ticketing and ride-hailing are increasingly changing the way people access transportation services with greater ease and efficiency. The development of telecommunications infrastructure supporting 4G and 5G networks is also accelerating the adoption of this technology, enabling digital-based transportation services to be accessed in real-time and responsively according to user needs in various regions. This has become the foundation for the development of multi-platform applications as a modern solution to improve the quality of vehicle rental services in line with current demands and digital developments (Arki Rifazka, 2024).

Identification of problems in vehicle rental services in many areas reveals several major obstacles, including limited access for customers who still have to come directly to the rental location to obtain information and make reservations, making it difficult for customers who are far from service centers (Arfando Saputra et al., 2024). The management of vehicle data and transactions, which is still largely done manually, poses risks of recording errors, slow service processes, and a lack of real-time transparency regarding vehicle availability (Bayu et al., 2025). To date, most rental services do not have fully integrated applications, especially in accommodating features such as vehicle management, booking, and digital payment systems that can speed up and simplify operations and user experience. This situation creates an urgent need to design and develop multi-platform applications that can overcome access limitations, replace manual systems, and provide responsive and effective integrated services (Sosial dan Teknologi et al., 2025).

Based on previous research studies, the development of vehicle rental systems still largely uses the SDLC (Software Development Life Cycle) and RAD (Rapid Application Development) development methods with black-box testing and focuses only on a single web-based platform or application (Arfando Saputra et al., 2024). Although this approach is effective in producing a functioning system, it does not measure the level of comfort and ease of use, which are important indicators of a system's success in the modern digital era. Therefore, this research was conducted using a Research and Development (R&D) approach to produce a multi-platform application that not only focuses on technical design but also on measuring the effectiveness of the model quantitatively using the SUS (System Usability Scale).

This study examines how to design and develop a multi-platform application for vehicle rental services that can overcome access limitations, replace manual systems, and provide integrated and easy-to-use services. This application model needs to be designed with the needs of users and rental managers in mind so that the vehicle rental process becomes more efficient, transparent, and secure. The development of a website and Android-based vehicle rental application system using a prototyping approach has proven to be effective in creating an application that is responsive to user needs and capable of providing important features such as vehicle advertising, searching, booking, and integrated transaction management. Additionally, an application integrated with a digital payment system facilitates transactions and speeds up the operational processes of the vehicle rental business (Wisnu & Sutopo, 2024).

The research aims to produce a multi-platform vehicle rental service application that is used to facilitate users in the booking process and assist rental owners in managing operations efficiently and in an integrated manner. This application is designed to be easily accessible through various digital devices so as to improve the convenience and speed of service for users.

This application can improve rental efficiency through systematic data management and real-time automated transactions. This system is expected to reduce errors in data processing and accelerate the business processes of vehicle rental companies. In addition, this application offers easy vehicle booking and online payment, providing a more practical, fast, and transparent service experience. This research is also expected to serve as a reference and foundation for developing similar applications with a multi-platform approach, as well as contributing to the development of vehicle rental information systems.

METHOD

This study uses a Software Engineering (R&D) approach with systematic stages consisting of needs analysis, system design, implementation, and application testing. The initial stages began with a literature study and primary data collection through direct interviews with vehicle rental owners and surveys of potential users to understand the needs and constraints in rental services.



Figure 1. Research Process

Needs Analysis

The data sources in this study were obtained through field observations, direct interviews with transportation service providers and potential users, as well as a literature review of previous studies. The data identified included:

1. Information on the manual vehicle rental process
2. Vehicle data availability and management
3. Communication patterns between tenants and landlords
4. User preferences for digital services

From the results of this analysis, it can be concluded that the manual system still predominantly used by transportation service providers causes various problems, such as data irregularities, difficulties in booking, and limited access to information on vehicles available for hire. Therefore, the application developed must provide online booking features, vehicle data management features, and real-time transportation availability tracking features.

System Design

Based on the collected data, a system design was carried out using Unified Modeling Language (UML), which included the creation of use case diagrams to identify the main

functions of the application, activity diagrams that describe the system workflow, and sequence diagrams to map the interactions between system components.

Application Development

During the implementation phase, the application was developed on multiple platforms, namely a mobile application using the React Native framework and a web application using Laravel with a MySQL database. This approach was chosen so that the application could be widely accessed through various devices, providing flexibility for users and service providers.

System Testing

Testing was conducted using the System Usability Scale (SUS) method. This method provides information on the extent to which a system is user friendly. In this study, 21 respondents completed the SUS questionnaire. The SUS questionnaire consisted of 10 questions. The final score is calculated by adding up the percentages of the questions and multiplying them by 2.5, resulting in a score ranging from 0 to 100. The usability score is mapped into categories of good, fair, and poor to assess the quality of comfort in using the application (Alvian Kosim et al., 2022). The higher the usability score, the greater its accuracy in reflecting ease of use, which indicates that the system has a positive impact on service effectiveness. In the future, this method can be expanded by comparing usability results with similar systems or previous systems to show a more measurable comparison of success rates.

RESULTS AND DISCUSSION

The results of the study show that this multi-platform vehicle rental application has significant advantages over manual systems. The use of a multi-platform vehicle rental application allows for wider and easier access to services from various devices, thereby increasing convenience and speed in the rental and payment process. The results of the needs analysis show that an effective multi-platform vehicle rental application must have a real-time booking feature to facilitate vehicle search and reservation based on availability and user needs, while an integrated digital payment system supports various secure and easy payment methods, reducing transaction barriers. The vehicle tracking feature using GPS enhances security for renters and simplifies vehicle management for rental owners. In addition, the vehicle management feature provides full control and transparency for owners in monitoring vehicle status and rental schedules in real time (Maulana Ahid, 2023) (journeyhorizon, 2025).

Vehicle management that gives owners control to monitor vehicle availability, booking status, and centralized transaction data management to improve operational efficiency (Alda et al., 2025). Overall, this combination of features is designed to provide a comprehensive and accessible vehicle rental solution for all stakeholders, from users to rental service providers.

However, this application still has limitations, namely its dependence on a stable internet connection, which can be an obstacle in areas with poor connectivity. In addition, some advanced features, such as e-wallet integration, have not been fully implemented and require further development. Potential future developments for the application include e-wallet service integration to speed up and secure the payment process, and the use of multi-tenant cloud technology to enable centralized and efficient management of multiple rental

branches. Further development could also add automatic notification and reminder features to enhance the user experience and reduce the risk of vehicle return delays.

Application Architecture

Application architecture is the process of formulating each application that will manage data and present information to organize business functions (Hakim & Wahyu, 2023). The architecture of the land transportation rental and charter application can be seen in Figure 2.

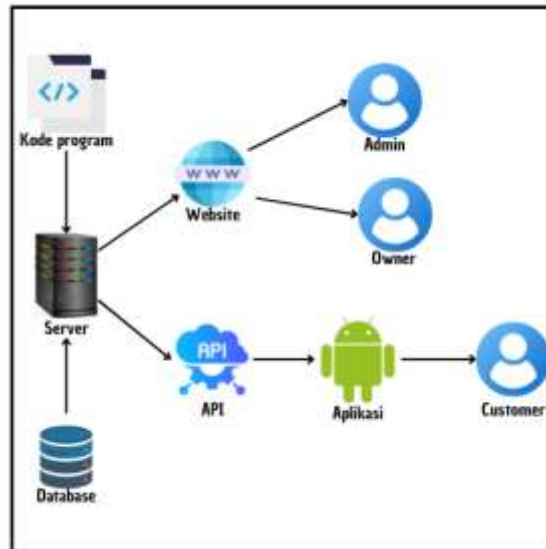


Figure 2. Application Architecture

The architecture in Figure 2 was successfully implemented in the application development and enabled all components, such as the database, ordering service, and authentication system, to run in an integrated manner. This had an impact on the reliability of the system in managing transactions and storing user data consistently.

Use Case Diagram

A use case diagram is a visual representation of a number of components, including actors, use cases, and the connections between them. This diagram illustrates the functions of a system through a number of symbols or notations. This diagram is used to design all the features of a system to be developed in the future and to explain the system design to users (Sarnoto et al., 2023). The processes that take place in the system are illustrated in the following use case diagram. Users, also known as customers or renters, vehicle owners, and administrators, are the three parties that interact with the system. Users register and access the rental and charter application, vehicle owners are responsible for the transportation to be rented, and administrators only manage the application data.

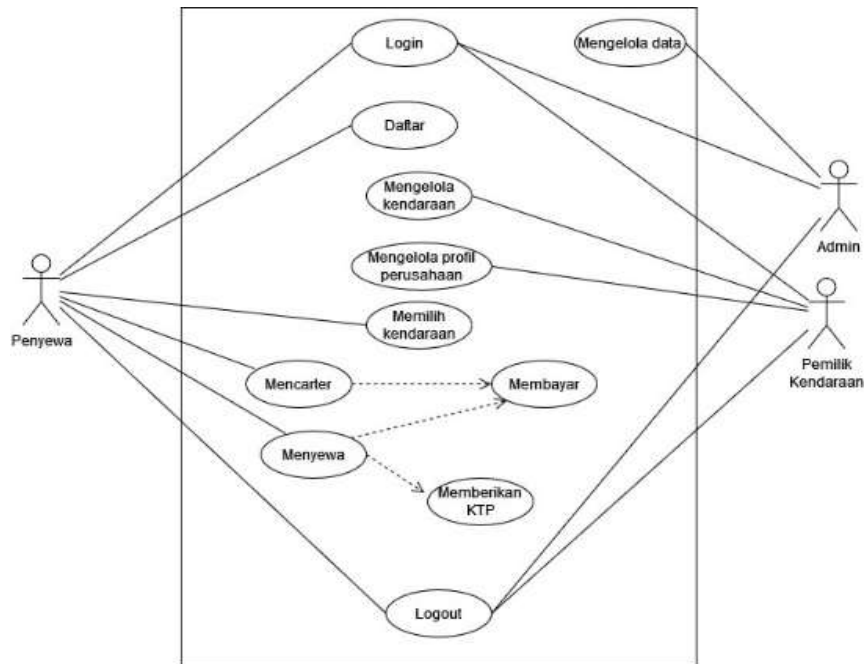


Figure 3. Use case Diagram

The implementation of the use case in Figure 3 successfully identified user needs from three main perspectives: tenants, vehicle owners, and administrators. These results form the basis for ensuring that the system is capable of facilitating a digital and structured service flow from start to finish, in contrast to manual processes that are not documented.

Activity Diagram

An activity diagram depicts the workflow or actions of a system or business process, or depicts the activities of the system rather than what the actors do, but rather the activities that the system might perform diagram (Amelia Sari Lubis et al., 2023). The activity diagram flowchart illustrates different process flows for application users and administrators or vehicle owners. Users or renters can only search for vehicles they want to rent, make payments, and review vehicles. Meanwhile, administrators and vehicle owners manage data such as user data, vehicle data, rental data, and payment data.

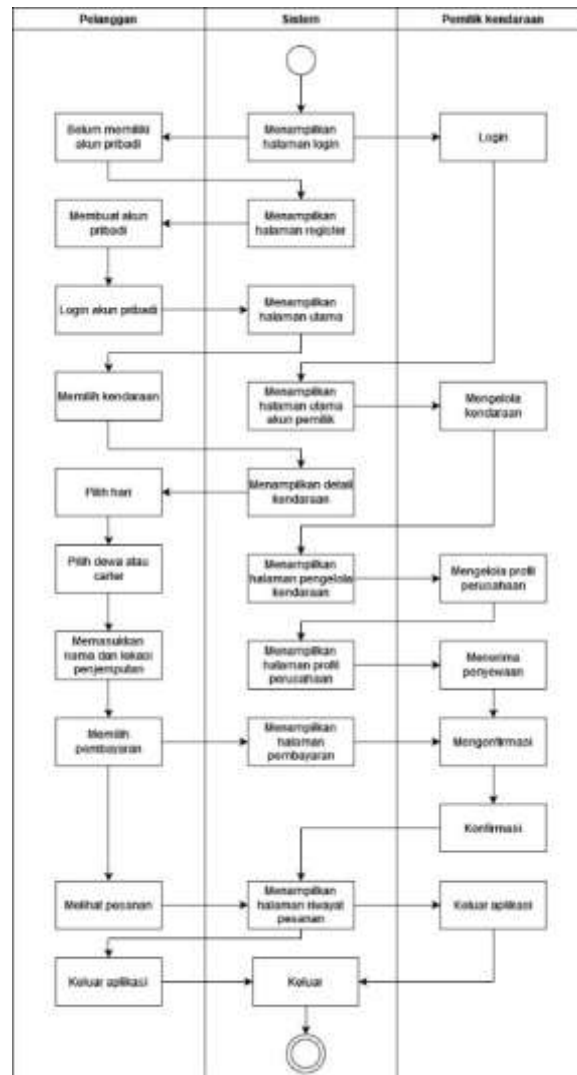


Figure 4. Activity Diagram

The activities mapped in Figure 4 show a more efficient and real-time workflow. This proves that with the application, the process of searching, ordering, and validating data can be done without direct involvement, as is the case in conventional systems.

Sequence Diagram

An interaction diagram that shows how an operation is performed in an application system is called a Sequence Diagram (Evita Sain et al., n.d.). Sequence diagrams are used to describe and illustrate the interactions between various objects in a system in depth. In addition, sequence diagrams can show messages or instructions that are sent, along with the time of execution.

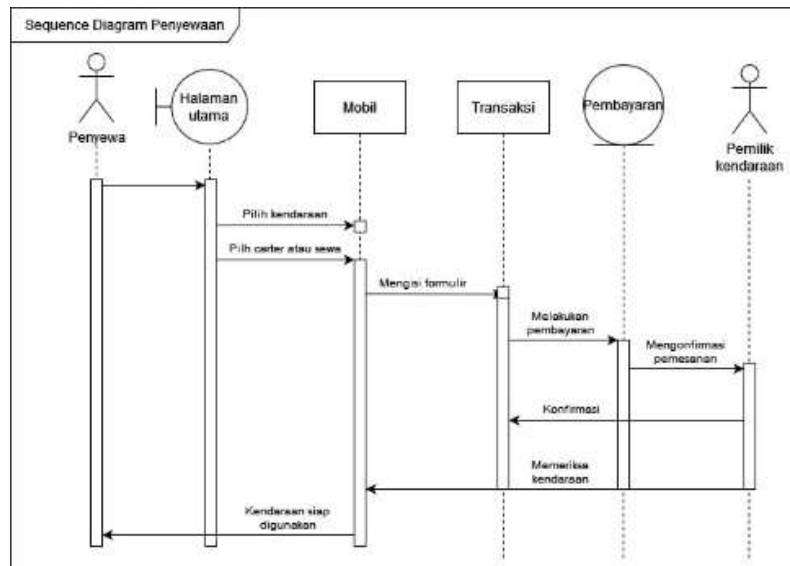


Figure 5. Sequence Diagram

The sequence diagram in Figure 5 was successfully implemented in the application to ensure that the ordering, payment, and review processes could run sequentially without any obstacles. This enhanced the user experience and minimized potential system failures in real transactions.

Admin and Owner Dashboard Display

Figure 6 shows the dashboard website used to manage vehicle data, rental data, user data, and other data.



Figure 6. Dashboard admin dan owner

Test results show that this dashboard makes it easier for administrators to manage vehicle and transaction data. Vehicle owners can also view rental status directly, which was previously done manually and not monitored in real time.

Application Display

Figure 7 shows the mobile application interface. Customers use this application to search for vehicles to rent and to rent them.

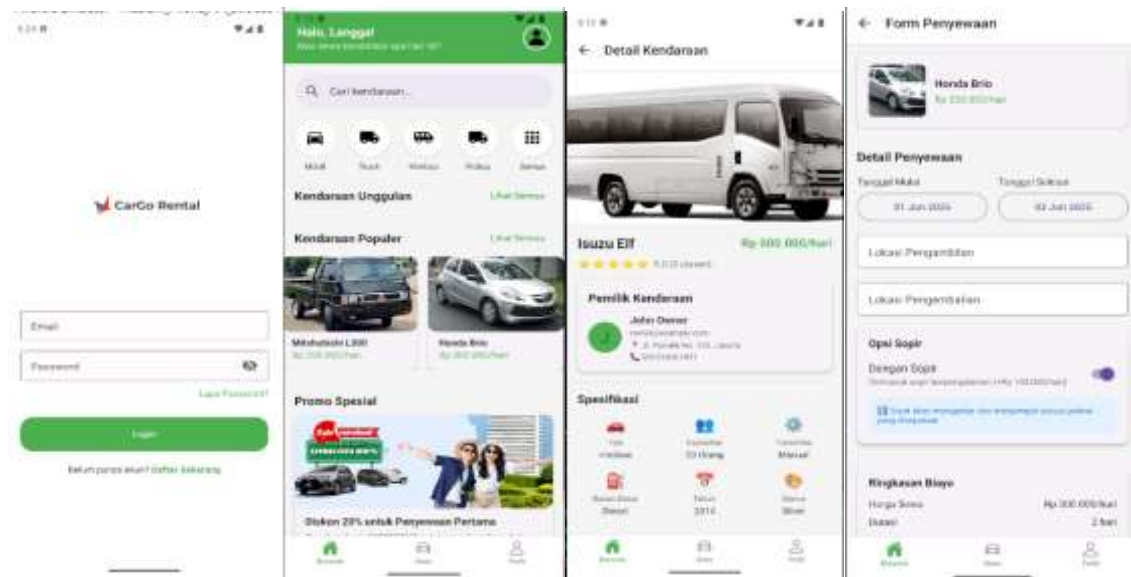


Figure 7. Mobile Application

This mobile application has proven to make it easier for users to find vehicles according to their needs and location. The rating and review feature provides transparency to the service, which was previously unavailable in the manual system.

Testing

Usability testing was conducted with 21 respondents using the System Usability Scale (SUS) method. The SUS questionnaire consisted of 10 questions with a Likert scale of 1 to 5. The questions were calculated using the standard SUS formula, whereby odd-numbered questions were scored by subtracting 1 from the value and even-numbered questions were scored by subtracting the value from 5. The average score of each respondent was then multiplied by 2.5 to obtain the final score for each respondent. All scores were then totaled and averaged to obtain the final usability score for the system.



Figure 8. Questionnaire Results

Table 1. Summary of Usability Test Results

Responden	Skor Total	Skor SUS
1	38	95.0
2	34	85.0

Responden	Skor Total	Skor SUS
3	26	65.0
4	31	77.5
5	26	65.0
...
21	34	85.0

The results of testing using the System Usability Scale (SUS) method show that the system obtained an average score of 79.4 out of 100, which is classified as “good” based on SUS interpretation standards. This score indicates that the application prototype has a high level of comfort and ease of use, and can be operated smoothly without requiring special training. Thus, the developed system is not only technically feasible, but also effective in meeting user needs. This score also reflects a 79.4% success rate in terms of usability, which provides quantitative evidence that this research is useful and has the potential for wider implementation.

Discussion

Based on the results of implementation and testing, the developed system has been successful in digitizing the land transportation rental process. The online search and booking features have proven to improve accessibility for customers and time efficiency. In addition, the high usability score indicates that users can adapt to the application interface and navigate through the flow without any obstacles. The integration of the web system with the mobile platform in a single application is an ideal solution that allows vehicle owners to manage their vehicles more easily and users to access services from most devices. The rating and review system that has been implemented extends transparency and accountability.

The multi-platform application developed has a number of significant advantages over manual systems and single-platform applications. By providing simultaneous access via the web and mobile devices, this application allows users to make reservations and payments anytime and anywhere with greater ease and speed of access. Fleet management becomes more efficient through centralized data management, which reduces the risk of recording errors and speeds up operational processes. In addition, this application also helps service providers optimize vehicle rental and maintenance schedules in real time, thereby improving service and customer satisfaction.

However, this application has several limitations, including its dependence on a stable internet connection, which can limit access in areas with weak networks. Several advanced features, such as real-time GPS vehicle tracking, e-wallet integration for digital payments, and a user rating and review system, still need to be developed further to provide greater added value and improve the transparency and security of the service.

Future application development potential may include the integration of real-time GPS technology to facilitate vehicle tracking and improve transaction security, e-wallet integration for faster and more secure payment processes, and user rating and feedback features to build trust and improve service quality. This development may also be directed towards the implementation of a multi-tenant cloud architecture to efficiently support larger and multi-branch businesses.

CONCLUSION

This research successfully addressed the issue of conventional land transportation rental systems by developing a multi-platform vehicle rental service application that provides online booking, vehicle management, and user review features. The research objective was achieved with the creation of a system capable of improving the efficiency, accessibility, and transparency of services. The success of this system's implementation was proven through testing using the System Usability Scale (SUS) method, which produced an average score of 79.4, falling into the “good” category and reflecting a usability success rate of 79.4%. This score indicates that the system is not only functional and easy to use, but also provides tangible benefits to users and has the potential for further development with the integration of digital payment systems and real-time vehicle tracking. This study successfully developed a multi-platform application model for vehicle rental services that provides easy access, efficient management, and improved services for both users and rental service providers. Usability testing showed that the application has a high level of comfort and practicality. It is recommended that further development focus on adding real-time vehicle tracking features, integrating e-wallet digital payment systems, and developing user rating and review systems to increase service transparency. Further research could also explore the application of multi-tenant cloud architecture to support broader and more centrally managed expansion of the vehicle rental business.

REFERECES

- Alda, M., Rince, L., Ritonga, P., Rahmah, A. S., Dio, M., & Panjaitan, A. (2025). RANCANG BANGUN APLIKASI RENTAL MOBIL BERBASIS ANDROID. In *Jurnal Mahasiswa Teknik Informatika* (Vol. 9, Issue 2).
- Alvian Kosim, M., Restu Aji, S., & Darwis, M. (2022). PENGUJIAN USABILITY APLIKASI PEDULILINDUNGI DENGAN METODE SYSTEM USABILITY SCALE (SUS) 1). *Jurnal Sistem Informasi Dan Sains Teknologi*, 4(2).
- Amelia Sari Lubis, F., Sahara Lubis, S., Hendrik, B., & Author, C. (2023). PERANCANGAN SISTEM INVENTORY UNTUK STOK BARANG HERBISIDA PADA UD. ANUGRAH JAYA TANI DENGAN BAHASA PEMROGRAMAN PHP DAN DATABASE MYSQL. In *Jurnal Sains Informatika Terapan (JSIT) E-ISSN* (Vol. 2, Issue 2). Bulan Juni.
- Arfando Saputra, Fajar Ratnawati, & Elvi Rahmi. (2024). Aplikasi Marketplace Penyewaan Mobil Berbasis Website menggunakan Metode Rapid Application Development. *Repeater: Publikasi Teknik Informatika Dan Jaringan*, 2(4), 48–61. <https://doi.org/10.62951/repeater.v2i4.205>
- Arki Rifazka. (2024). *Revolusi Teknologi dalam Transportasi Indonesia: Inovasi yang Mengubah Lanskap Mobilitas*. Digitaltransformation.Co.Id.
- Bayu, A., Yanto, H., Fauzi, A., & Indriyani, N. (2025). Rancang Bangun Sistem Informasi Penyewaan Mobil Listrik Berbasis Web Pada Autonet Rent. In *IMTechno: Journal of Industrial Management and Technology* (Vol. 6, Issue 2). <http://jurnal.bsi.ac.id/index.php/imtechno>

- Evita Sain, M., Yunita Sari, N., Al Husyairi, R., Arief Yulianto, M., & Hendra Widjoyo, A. (n.d.). *Perancangan Aplikasi Pemesanan Dan Pengeluaran Material Dengan Metode Single Moving Average Dan Single Exponential Smoothing Berbasis Website*.
- Hakim, A. P., & Wahyu, S. (2023). *Perancangan Model Arsitektur Sistem Informasi Monitoring Keuangan Warga Menggunakan Enterprise Architecture Planning*. 10(1), 323–338. <http://jurnal.mdp.ac.id>
- journeyhorizon. (2025). *10 must-have features for a Rental Marketplace*. Journeyhorizon. <https://www.journeyh.io/blog/10-must-have-features-for-a-rental-marketplace>
- Karimullah, A., Rizal, A., & Irawan, A. S. Y. (2024). PERANCANGAN UI/UX APLIKASI TRANSPORTASI PUBLIK BERBASIS MOBILE DENGAN METODE USER CENTERED DESIGN. *Jurnal Informatika Dan Teknik Elektro Terapan*, 12(3). <https://doi.org/10.23960/jitet.v12i3.4855>
- Maulana Ahid. (2023). *Car Rental and Reservation Systems: Mengoptimalkan Pengalaman Penyewaan Mobil*. <https://www.softwareseni.co.id>.
- Sarnoto, A. Z., Rahmawati, S. T., Ulimaz, A., Mahendika, D., & Prastawa, S. (2023). Analisis Pengaruh Model Pembelajaran Student Center Learning terhadap Hasil Belajar: Studi Literatur Review. *Jurnal Pendidikan Dan Kewirausahaan*, 11(2), 615–628. <https://doi.org/10.47668/pkwu.v11i2.828>
- Sosial dan Teknologi, J., Muhandri, B., & Setiani, H. (2025). Perancangan Aplikasi Rental Mobil (Studi kasus PT. Perkasa Satria Nusantara). *Jurnal Sosial Dan Teknologi (SOSTECH)*, 5(4).
- Wisnu, A. I., & Sutopo, J. (2024). Perancangan Fitur Manajemen Kendaraan dan Pengguna Pada Aplikasi Penyewaan Kendaraan Peer-To-Peer. *Jurnal Pendidikan Dan Teknologi Indonesia*, 4(12), 657–668. <https://doi.org/10.52436/1.jpti.446>
- Zulfa Nurreza, M., & Hermanto, N. (2024). PERANCANGAN DIGITAL MOBILE PROYEK APLIKASI TIKET BUS MENUJU ERA TRANSPORTASI MODERN. In *Jurnal Informatika dan Teknologi Interaktif* (Vol. 1, Issue 2). JIITE.