TIFDA JOURNAL
Technology Information and Data Analytic
Website Jurnal : http://jeptira.id/index.php/tifda
e-ISSN : 3064-0660

Development of Billboard Rental Information System at PT Tecma Mitratama Advertindo

Endang Ayu Susilawati[1*], Eva Novianti[2], Sultan Satrio Ichsan[3]
[1,2,3] Information System Department, Darma Persada University
[1,2,3]Jl Taman Malaka Selatan No.8, Jakarta Timur, 13450, Indonesia
*endangdosensi@gmail.com

Abstract — The billboard rental process at PT Tecma Mitratama Advertindo currently encounters issues, particularly in calculating rental prices for periods outside the predefined options of one, three, six, and twelve months. When customers request rental durations beyond these standard periods, prices must be calculated manually using a calculator, resulting in delays in issuing rental offer letters. This study aims to develop a web-based Billboard Rental Information System specifically designed to automate and digitize the rental workflow within the marketing division of PT Tecma Mitratama Advertindo. The system is designed to support dynamic rental period calculations, automate offer letter generation, and manage transaction data across multiple user roles. The development process follows a structured approach consisting of requirements analysis, Unified Modeling Language (UML)-based system design, relational database modeling, and front-end and back-end implementation using Next.js and Firebase. The system enables real-time tracking of billboard availability, customer order management, and administrator-controlled validation features. The evaluation results indicate that the proposed system significantly reduces manual operations, minimizes processing delays, and enhances the overall operational efficiency of the marketing team

Keywords – billboard, information system, marketing, rental

I. INTRODUCTION

Out-of-home (OOH) advertising is one of the most widely used media in the marketing world. It is designed to deliver high-impact messages in public spaces to broad audiences. Among OOH formats, billboards remain the most dominant due to their ability to attract attention in strategic physical locations. A billboard is defined as a large signage structure installed in high-traffic areas to convey promotional messages, often for branding or campaign purposes [1]. Despite the rise of digital media, billboards remain relevant—especially when integrated with modern digital technologies that enhance efficiency in operations and campaign management [2].

PT Tecma Mitratama Advertindo is a private company that has been active in the creative advertising industry since 1989. It offers services such as billboard, videotron, and banner rental, with operations across Jakarta, Yogyakarta, and Lampung. However, the current billboard rental process still involves several manual procedures. For instance, customers can only choose predefined rental durations 1, 3, 6, or 12 months. When a request falls outside of these options (e.g., 45 days), the marketing team must manually calculate the price using spreadsheets or calculators. This causes delays in issuing rental offer letters and impacts customer satisfaction. Internal coordination across the marketing, admin, and production divisions is also done manually, leading to scattered communication and repeated verification steps.

These manual methods are known to hinder efficiency in business processes, especially in the advertising industry. Research has shown that traditional administrative practices in service delivery often result in delays, inconsistent pricing, and a high risk of human error [3]. To overcome such inefficiencies, many organizations have adopted workflow-based information systems—systems designed to automate repetitive tasks, standardize information flow, and improve operational control [4].

One of the most commonly used models for developing such systems is the Waterfall model, which follows a structured and linear development approach. The model includes distinct stages: requirements analysis, system design, implementation, testing, and maintenance [5]. Because of its clarity and sequential structure, the Waterfall model is suitable for system development projects where requirements are well defined from the start [6-7].

While many businesses use Customer Relationship Management (CRM) or Enterprise Resource Planning (ERP) systems, these general-purpose platforms often lack flexibility to support domain-specific processes like billboard rentals. Rental durations, location-based pricing, creative design submissions, and departmental approval flows are unique features that require specialized system logic [8-9]. Previous studies have shown the benefit of developing custom information systems tailored to the specific context of advertising logistics, especially when integrated with geographic and scheduling components [10-11].

Based on the issues identified, this study aims to design and develop a web-based Billboard Rental Information System tailored to PT Tecma Mitratama Advertindo's internal workflow. The system will automate the rental process, support flexible rental durations, generate digital offer letters, and enable real-time tracking of transaction status. The development follows the Waterfall model and integrates role-based access for customer, admin, and production users.

II. METHODOLOGY

This research adopts the Waterfall model for system development. The Waterfall model is a widely used methodology that emphasizes a structured, sequential approach to software development. It consists of several defined stages: planning, analysis, design, implementation, and testing. This approach is ideal for business process automation where requirements are clearly scoped from the beginning.

A. System Before Development

Prior to the development of the system, the billboard rental process at PT Tecma Mitratama Advertindo was fully manual. Rental pricing was only available for fixed durations (1, 3, 6, or 12 months). If a customer requested a non-standard period (e.g., 45 days), staff would manually calculate the price using a calculator and refer to printed tables or spreadsheets. The offer letter was then prepared manually, typically within 1–2 business days, causing service delays. Additionally, communication between the marketing, finance, and production divisions was conducted via email or WhatsApp, resulting in fragmented workflows, frequent follow-ups, and duplicated records.

B. System Planning and Requirements Analysis

System requirements were collected through interviews with the Head of Administration and through direct observation of existing workflows. The planning process identified three user roles—Customer, Admin, and Production—with respective functions ranging from rental submission to payment validation and design file handover. Each role required tailored access and interface functionality.

To formalize the functional scope, the system's structure was visualized using Unified Modeling Language (UML) diagrams. A Use Case Diagram was developed to show interactions between each user and the system features. Figure 1. Showed the use case diagram of rental system that developed in this study.

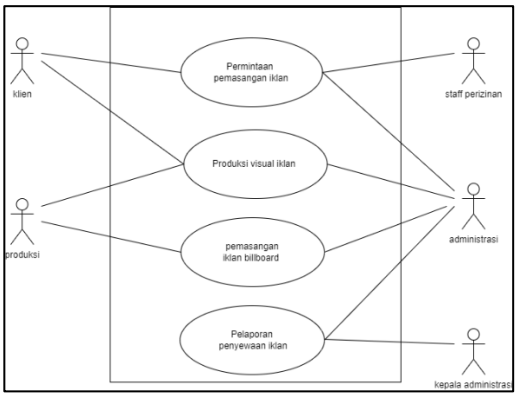

Figure 1. Use Case Diagram of Billboard Rental System

The billboard rental workflow begins when a client submits a request for a quotation. In response, the administrative staff provides a price list outlining available rental packages. Once the client receives the pricing information, the administration further explains the location options included in the quotation. Following this, the staff inquires about the type of advertisement the client intends to display. The client then submits a sample of the advertisement design for review.

The submitted design is forwarded to the licensing staff for evaluation. If the content is deemed inappropriate or non-compliant, the licensing staff rejects the design. The administrative staff then informs the client by returning the rejected design. Upon receiving the rejected version, the client is expected to revise the design accordingly. If the design is approved, the licensing staff notifies the administration of the approval status.

Once the design is approved, the client proceeds to select the desired billboard location. After the location is confirmed, the administrative staff calculates and provides the total price. The client then makes the payment, which is received and verified by the administration. Finally, the administration issues a receipt, which is delivered to and acknowledged by the client.

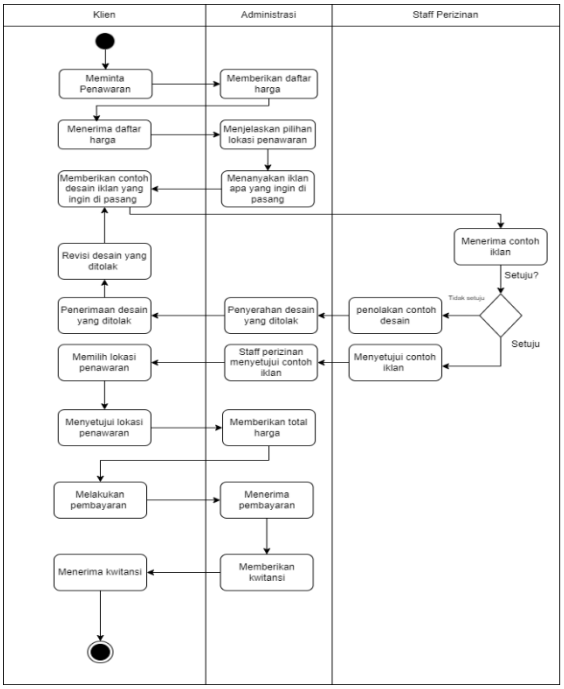

Figure 2. Activity Diagram of Rental System

Additionally, an Activity Diagram was created to illustrate the workflow from customer registration through offer generation, payment validation, and content transfer to production. This diagram is shown in Figure 2. Activity Diagram of Rental Workflow.

C. *System Design*

User interface mockups were also created for each role to ensure user-friendliness and data consistency. Special focus was placed on the admin dashboard, which supports payment approval, design file verification, and transaction tracking. As shown below Figure 3 is one of the mockup for Admin Dashboard.

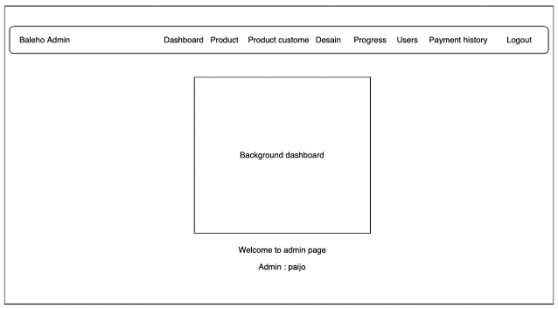

Figure 3. Mockup of Admin Dashboard

During the design stage, a relational database structure was developed using an Entity Relationship Diagram (ERD) to represent the entities, relationships, and attributes that form the system's backend. The ERD includes entities such as Users, Transactions, Design, Transaksisewa, Customer, Product and Payment. The complete ERD is displayed in Figure 4. Entity Relationship Diagram of the System.

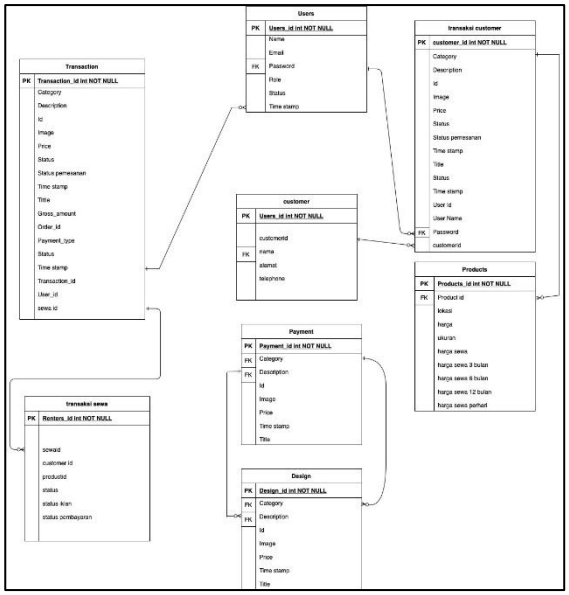

Figure 4. Entity Relationship Diagram

D. *System Implementation*

The system was implemented using Next.js for front-end development and Firebase as the backend service. Firebase provides real-time database capabilities, cloud storage for file uploads, and authentication services. Customers can register, browse billboard availability, select flexible rental periods, upload design drafts, and view rental status. Admins handle customer data, verify payments, approve designs, and generate offer letters. Production staff access finalized design data and update project completion progress.

This implementation approach follows recent case studies that emphasize domain-specific system development for managing rental operations.

E. *System Testing and Comparison*

After implementation, functional and comparative testing were conducted. All major features—including form submission, file upload, transaction approval, and dashboard tracking—were tested for correctness (see Table 1). Additionally, a performance comparison was made between the manual and automated systems. Previously, calculating non-standard rental periods and issuing rental quotes could take up to 30 minutes to several days depending on complexity. In the new system, these processes were completed in less than 5 minutes with automated price computation and real-time PDF offer letter generation. By eliminating manual steps, the developed system enhances workflow speed, improves transparency, and reduces administrative workload—aligning with digital transformation principles in service-based industries.

III. RESULTS AND DISCUSSION

The developed Billboard Rental Information System was successfully implemented using the Next.js framework for the front end and Firebase as the database backend. The system consists of three user roles: Customer, Admin, and Production. Each role has specific access and functionalities to support the rental process.

Customer: can register an account, browse available billboard locations, submit design drafts, select rental durations (with flexibility beyond the fixed 1, 3, 6, and 12-month options), and make payments. The system records these actions and provides real-time updates on the rental status.

Admin: Manages user data, approves design submissions, verifies payments, and oversees rental transactions.

Production: Accesses finalized design files and payment confirmations to proceed with billboard printing and installation.

The new system eliminates the manual calculation of rental prices for non-standard periods, which previously caused delays in issuing rental offer letters. By automating this process, the application enhances accuracy, reduces administrative burden, and improves service delivery speed

A. Functional Testing

Functional testing was conducted on the major features of the system to ensure their effectiveness showed in Table 1.

Table 1. Functional Testing Result

Access Level	Page	Action	Result
Customer	Signup/Login	Form Submission / Login	Success
Customer	Product	Add/Remove from cart	Success
Customer	Design Upload	Upload and delete designs	Success
Admin	Transaction Page	Approve payment	Success
Production	Dashboard	View progress and design	Success

These test results confirm that all key system functionalities are working according to expectations. The developed system directly addresses the core problem identified in the research: the inefficiency caused by fixed-period billing and manual calculations. With this new system, rental periods can now be customized and automatically calculated, streamlining the quote generation process. This aligns with the goals of the marketing division to accelerate service delivery and improve customer satisfaction. Shown below is Customer's page for monitoring renting progress.

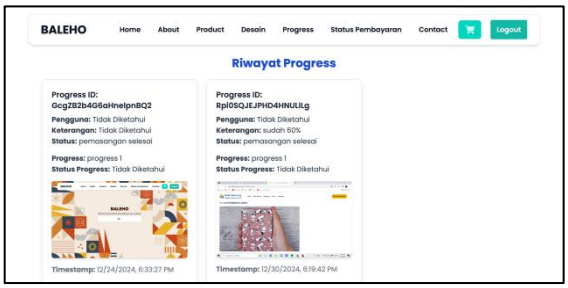

Figure 3. Renting Progress in Customer's page

Additionally, Table 2. Performance Comparison Before and After System Implementation compares task execution times before and after implementation, showing significant improvement.

Table 2. Performance Comparison

Activity	Manual process time	Automated system time
Rental calculation (custome)	10-30 minutes	<1 minutes
Offer letter issues	1-2 days	<5 minutes
Design approval and routing	Manual via email	Real-time via dashboard
Rental status tracking	Via phone / email	Real-time system

From a broader perspective, this implementation demonstrates the benefits of digital transformation for traditional industries like OOH advertising. It serves as a practical example of how information systems can enhance workflow efficiency and customer engagement through modern technologies.

IV. CONCLUSION

The development of the Billboard Rental Information System at PT Tecma Mitratama Advertindo has successfully fulfilled the objective of this research, which was to design a system that streamlines the rental workflow and assists the marketing division in carrying out the rental process more efficiently. The implementation of the system has replaced manual calculations for non-standard rental periods with automated price computation, thereby accelerating the issuance of rental offer letters and reducing delays. Additionally, the system provides clear visibility into the rental status through a user-friendly interface accessible to customers, administrators, and production staff. By integrating all relevant processes—from customer registration, product selection, design submission, approval, to

payment confirmation—into a single digital platform, the system enhances coordination across departments and improves overall service delivery. This outcome demonstrates that the system not only addresses the operational challenges identified in the existing manual process but also supports the company's goal of offering more responsive and transparent advertising services.

ACKNOWLEDGEMENT

The writer would like to express sincere gratitude to Universitas Darma Persada for providing the academic environment and support throughout the completion of this research. Special thanks are also extended to PT Tecma Mitratama Advertindo for allowing the study to be conducted within the company and for the valuable insights and data that greatly contributed to the development of this system.

REFERENCES

[1] De Pelsmacker, P., Geuens, M., & Van den Bergh, J. (2018). Marketing Communications: A European Perspective (6th ed.). Pearson Education.

[2] Rahmawati, N., & Syarifuddin, A. (2020). Analisis Strategi Media Iklan Luar Ruang (Billboard) di Era Digital. Jurnal Komunikasi, 12(2), 123–131.

[3] Sari, R. N., & Subagyo, H. (2020). Analisis Efisiensi Sistem Manual pada Proses Penawaran Jasa Periklanan. Jurnal Sistem Informasi, 16(1), 65–72.

[4] Utami, R., & Prasetyo, A. (2021). Development of Workflow-Based Information Systems for Marketing Operations. Jurnal Teknologi dan Sistem Informasi, 6(3), 210–219.

[5] Sommerville, I. (2016). Software Engineering (10th ed.). Pearson Education.

[6] Pressman, R. S., & Maxim, B. R. (2014). Software Engineering: A Practitioner's Approach (8th ed.). McGraw-Hill Education.

[7] Nugroho, A. (2019). Rekayasa Perangkat Lunak Menggunakan UML dan Java. Yogyakarta: Andi

[8] Wibowo, R. A., & Fauzan, M. (2022). Development of Location-Based Advertising System with Rental Period Optimization. Journal of Information Technology Development, 13(2), 87–94.

[9] Gunawan, I., Ahmadi, H., & Said, M. R. (2021). Rancang Bangun Sistem Monitoring dan Pemberi Pakan Otomatis Ayam Anakan Berbasis Internet of Things. *Infotek: Jurnal Informatika dan Teknologi*, 4(2), 151–162.

[10] Hermawan, D., & Andriani, N. (2022). Design of Rental Application Information System Based on Website. Journal of Information Systems and Technology, 10(2), 55–62.

[11] Dewi, K. P., & Pratama, I. M. (2021). Digitalization of Advertisement Services in Creative Industry: A Case Study. International Journal of Information Systems and Business, 9(1), 45–54