

Customer Data Management Information System at PT. Wifi Ceria Using PIECES

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ABSTRACT

Purpose: This research was conducted with the aim of exploring, developing, and improving the customer data processing system. This is done to improve efficiency, accuracy, and responsiveness in facing increasingly dynamic market competition.

Subjects and Methods: Currently, PT. Wifi Ceria still faces several problems in the customer data processing process, such as recording new customers, installing WiFi services, managing complaints, processing payments, and preparing company reports. All of these processes still use conventional methods.

Results: In this study, we apply the PIECES concept (Performance, Information, Economy, Control, Efficiency, and Service) in developing a customer data processing system. The main goal is to increase the effectiveness and efficiency in managing and analyzing customer data.

Conclusions: In designing a website using the Unified Modeling Language (UML) method and implementing it with the Html programming language. To test the system, we apply the Black Box Testing method. The result of this study is a web-based information system that makes it easier for PT. Wifi Ceria to provide services to customers.

INTRODUCTION

The role of technology is very important in facilitating the processing of data and information (Sher & Lee, 2004). Speed, accuracy, and efficiency in managing data and information are key in increasing productivity, controlling costs, and saving time in various types of companies or agencies, including business people (Fachrihusaini et al., 2023). The rapid advancement of information technology has significantly transformed how organizations manage, process, and utilize data. In the digital era, companies are required to operate with high levels of speed, accuracy, and efficiency to remain competitive and responsive to customer needs (Hadi, 2025; Gunasekaran et al., 2008). Effective data management not only improves operational performance but also strengthens decision-making processes that directly influence service quality.

In service-oriented industries, such as internet service providers, the ability to handle large volumes of customer information is essential (Demirkan & Delen, 2013). PT. Wifi CERIA, as one of the companies operating in this sector, increasingly relies on information technology to support its operational activities. With growing customer demand and expanding service coverage, the company faces the challenge of ensuring that all customer-related processes remain well-organized and efficient.

Currently, the number of active customers subscribing to PT. Wifi CERIA's internet services continues to increase. This growth is accompanied by more complex operational activities, including handling new installation requests, processing service relocations, responding to network disturbances, and preparing routine operational reports. As these processes expand, the need for a structured and integrated information system becomes more urgent (Nadkarni & Prügl, 2021).

Despite having standard operational procedures, PT. Wifi CERIA still encounters several obstacles in managing customer interactions. When customers experience service issues or require technical assistance, their only option is to contact the technician through a designated phone number. This method, which relies heavily on manual communication, often results in unstructured problem handling and delays in service response.

The lack of an integrated reporting system also creates inefficiencies in managing service disturbances (McNally et al., 2017; Lopes et al., 2007; Churet & Eccles, 2014). With a large and growing customer base, tracking complaints, identifying recurring issues, and prioritizing urgent cases becomes increasingly difficult. These challenges hinder the company's ability to maintain consistent service quality and respond effectively to customer needs.

In addition to operational issues, the finance department faces significant challenges in managing customer billing data. Financial activities such as invoice issuance, payment tracking, and bill verification require accuracy and consistency. Without a centralized system, discrepancies may occur between recorded transactions and actual payments, leading to potential misunderstandings and delays.

According to Gharaibeh et al. (2017), the absence of an integrated customer data management system further complicates the overall administrative process. Customer profiles, service histories, billing records, and complaint logs are often stored separately, making cross-checking and data retrieval time-consuming. This fragmented approach limits the company's ability to conduct data analysis for service improvement.

To address these challenges, the development of a Customer Data Management Information System becomes necessary. Such a system can provide a centralized platform that integrates customer information, service requests, billing processes, and reporting functions. This integration is crucial for improving responsiveness, ensuring data accuracy, and enhancing operational efficiency across departments.

This study utilizes the PIECES framework Performance, Information, Economics, Control, Efficiency, and Service to evaluate the weaknesses in the current system and propose a structured solution. Through this framework, the research aims to identify system gaps, analyze performance needs, and develop an information system design that supports PT. Wifi CERIA in delivering more reliable, efficient, and customer-oriented services.

LITERATURE REVIEW

Blackbox testing is a software testing method that tests the functionality (input and output) of each feature in the software without testing for errors/errors in the program code. Testing is carried out only focusing on the execution results (inputs and outputs) through test data and checking its functionality without knowing what is actually happening to the logic of the program code. Khan & Sadiq (2011) said that, Black Box Testing It is a type of software testing in which the tester does not need to know the internal structure or source code of the system being tested.

This test focuses on function or behaviour system based on the inputs given and the outputs produced, regardless of how the system works inside. Customer data is information collected and

stored by companies or organizations related to individuals or entities that use their products or services. This data is essential for managing customer relationships, understanding their needs, and providing better and more efficient services. And also, Customer data must be managed with the utmost care to protect privacy and avoid misuse (Putra et al., 2021).

PIECES is a framework used in the analysis and evaluation of information systems, which helps to identify problems or challenges that exist in the system and design the right solution. PIECES analysis is very important to be carried out before the system development stage is carried out to find problems that occur in the old system, so that it will make it easier when determining the needs for the new system.

The reliability of a system is the first variable of PIECES which has an important role to see the extent and how reliable an information system is in processing or processing data to produce information and expected goals. (Indrawati., 2020). PT. Wifi Ceria is a service of a company for services to manage customer data for wifi installation. This wifi is now widely used in the community due to the need for. Nowadays, Wifi is used by the public for a wide variety of purposes. With the development of technology and the improvement of internet access, people use the internet for various activities that include aspects of personal, social, educational, and business life.

Unified Modeling Language (UML) is a visual modeling language used to describe, design, and document software systems. UML has a very important role in modern software development because it helps the development team to clearly understand how the structure and behavior of the system to be built is and effective.

METHODOLOGY

A research method is an approach used by researchers to collect, analyze, and interpret data with the aim of answering a research question or achieving a specific research objective. Research methods function as a guide or framework that assists researchers in planning and carrying out research studies in a structured and documented manner. Therefore, the role of research methods is crucial in generating legitimate, trustworthy, and relevant knowledge. The selection of the right method will have a great influence on the quality and success of the research conducted.

Design Method

The system design method is an approach or process used in the planning, development, and implementation of computer systems or information systems. This approach helps to set the steps needed to create an efficient, reliable, and user-specific system. The system analysis method is an approach used to understand, evaluate, and design information systems or other systems. The purpose of system analysis is to identify user needs, analyze existing problems, and formulate appropriate solutions. To identify problems, an analysis of performance, information, economy, control, efficiency, and service must be carried out.

This guide is known as the PIECES (Performance, Information, Economic, Control, Efficiency, Service) analysis. The analysis was carried out on an old information system in the form of hard copies such as brochures if the band was going to hold a performance. From this analysis, several problems are usually obtained and finally the main problem can be found. By applying this method, the PIECES method greatly helps organizations in identifying problems, formulating solutions, and improving the overall performance of information systems. By using the PIECES method, organizations can ensure that the information systems they use are effective, efficient, and meet the needs of users.



Figure 1. Pieces Method

The PIECES research method is an acronym used in the context of research methodology to describe important steps or components in the research process. Each letter in PIECES represents a specific step that needs to be followed in order to carry out a systematic and structured research. Here is an explanation of each component in the PIECES research method: Performance The reliability of a system is the first variable of the PIECES Framework which has an important role in seeing the extent and how reliable an information system is in processing or processing data to produce information and expected goals (Indrawati et al., 2020). Information (Information and Data) is what is needed or provided by the company, this is one of the main factors that affect the progress of a company. The information and data generated by the information system must have a useful value for decision-making by the company (Sari & Nurmiati, 2021; Breiter & Light, 2006)

Economics (Economic Value) is the one that analyzes how the costs used in the operation of the system as well as the added value of the benefits during the use of the system (Fitrah & Muawwal, 2022). Control and SecurityIn a system, it is necessary to have a control or supervision so that the system runs properly. This analysis is used to determine the extent of supervision and control carried out so that the system runs properly (Prayogi et al., 2021). EfficiencyThe use of time is not maximized due to the frequent occurrence of repeated data checks so that there are no errors in data processing, thus affecting the report making process (Nurhayati & Suchyo, 2021). ServiceThe service dimension evaluates the quality of service provided by the system to customers. This includes the ease of use of the system, the clarity of instructions in payment, as well as the technical support available to users. Service assessment also involves how the system assists Sales in providing better service to customers (Cheung et al., 2003).

System Testing Methods

System testing methods refer to a series of steps, techniques, and approaches applied to conduct thorough testing of software systems or computer systems. The goal is to check the performance of the system to match the specifications that have been determined and meet the needs of the user. This system testing aims to identify potential failures, errors, or problems that may occur in the system before it is widely used.

RESULTS AND DISCUSSION

Planning

Use Case Diagram

In the process of developing an information system, understanding the interaction flow between users and the system is crucial. Each actor, both administrators and end users, has different roles and needs, so the system must be able to provide features that align with their respective responsibilities. To clearly illustrate these relationships, use case diagrams are used as visual aids, showing the main functions accessible to each actor in the system. Use case diagrams allow developers and stakeholders to see the overall feature structure before the system is built. These diagrams also help identify functional requirements and ensure that every process required by users is accommodated. With this understanding, the following is an explanation of the use case diagram depicted in the image above.

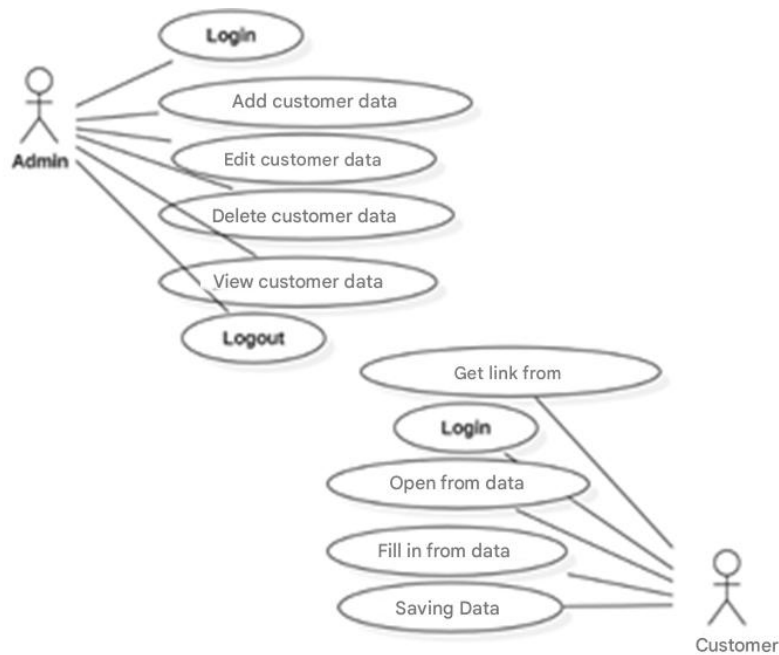


Figure 2. Use Case Diagram

Actor Description

Admin

The admin plays a key role in managing the entire information system. The admin is responsible for creating, updating, and controlling data within the system. The admin has full access to all features, including managing customer data, handling outage reports, processing new installation requests, transferring services, and monitoring network status. In addition, the admin also verifies financial transaction data, inputs or corrects data in the event of discrepancies, and ensures that the system workflow complies with the company's operational standards. The admin is responsible for ensuring data security, maintaining information integrity, and granting authorization to other internal users when necessary. In other words, the admin serves as the operational control center, ensuring that the system runs optimally, regularly, and accurately.

Customer

The customer is the actor who uses the internet services provided by the company, whether for personal or business purposes. The customer acts as the end user who interacts with the system primarily to register for services, request new installations, view the status of current services, and submit complaints or report outages. Customers can also view information related to billing, payment status, and service usage history. Information provided by customers, such as personal data, installation addresses, and service package preferences, is used by the system to tailor needs and expedite the service process. Customers are the primary source of operational data and the basis for company analysis, making their role crucial in supporting system smoothness, improving service quality, and developing company development strategies.

Description of Use Case

The login process is the initial step that verifies each user's access rights before entering the system. Through this process, the system ensures that only users with valid accounts and authorization can access the available features. After successfully logging in, users are directed to the Dashboard, the main page that displays a summary of various important information related to customer data processing. The Dashboard acts as a control center, presenting concise data such as the number of customers, new installation requests, outage reports, and service status.

Next, there is the Customer Registration feature, a registration process that prospective customers must complete before subscribing to internet services. At this stage, customers are asked to enter personal information such as name, address, contact information, and other supporting data. The data obtained from this registration stage serves as the basis for the company to process customer service requests. After registration, customers will proceed to the Service Order process, where they select an internet package that best suits their needs. Here, customers can view the various package options offered, select the desired service, and then pay the service fee in accordance with applicable terms and conditions.

Once payment has been successfully verified, the system will proceed to the Customer Data Input section, where the admin enters customer information into the system as a new installation request. The data entered by the admin will be forwarded to the technician as a basis for them to carry out work in the field. The final stage is WiFi Network Installation, which is the process of installing a WiFi network by the technician based on the customer data that has been received. At this stage, the technician installs the device, checks the network, and ensures that the internet service can be used properly by the customer. This entire series of processes is designed to create a structured, efficient, and easily monitored service flow for the company.

Activity Diagram

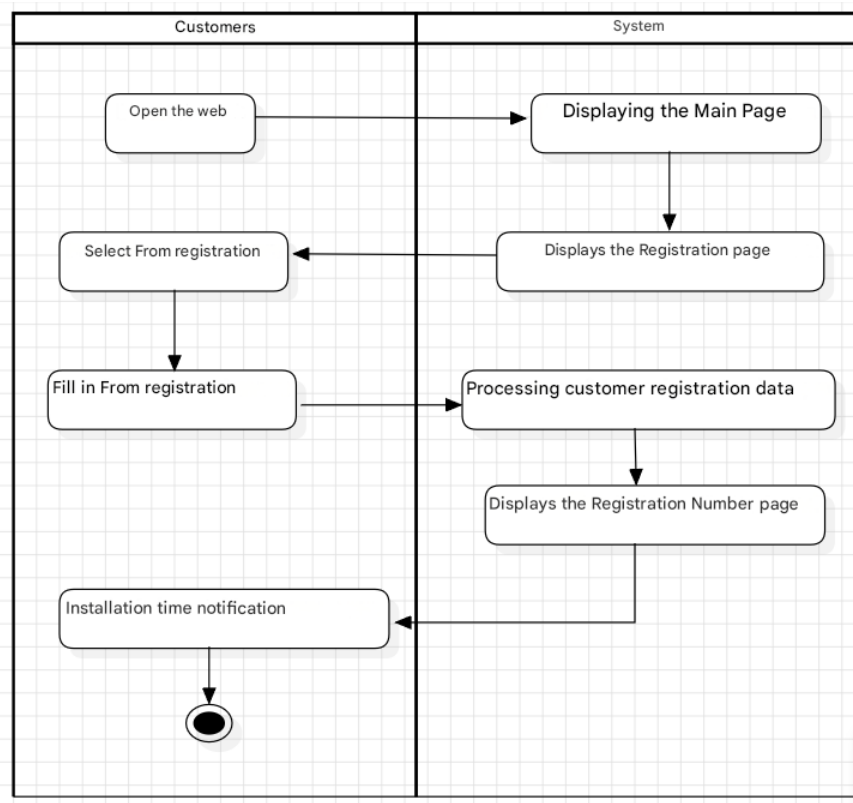


Figure 3. Activity Diagram

In the process flow depicted in the Activity Diagram for the Customer Data Processing System website development system, there are two main symbols in the flowchart that play a crucial role: the "start" and "finish" symbols. The "start" symbol is used to mark the starting point of a process or activity in the system, indicating when the workflow begins to run. Meanwhile, the "finish" symbol indicates that the entire series of activities in the diagram has been completed. These two symbols serve as clear boundaries for the beginning and end of the process flow, making it easier for readers to understand the logical structure of the activities within the system. Conceptually, Activity Diagrams are used to depict the workflow within a business process or information system. In the development of the Customer Data Processing System website, these diagrams are crucial because they help demonstrate how activities are interrelated, how data flows from one stage to the next, and how decisions or branching occurs within the system. Thus, Activity

Diagrams provide a visual depiction of the dynamics of the process, from customer registration and service selection to admin verification and network installation by technicians.

As explained by Ramadona et al. (2020), Activity Diagrams are a development of Use Case Diagrams, expanding and describing activity flows in greater detail. While Use Case Diagrams only show the relationships between actors and system functionality, Activity Diagrams outline the step-by-step execution of these functionalities in the form of activity flows. In other words, Activity Diagrams provide a structured representation of how a system operates from start to finish based on the scenarios outlined in the Use Case Diagram. By using clear and structured Activity Diagrams, system developers can more easily analyze processes, identify potential bottlenecks, and ensure that the entire activity flow aligns with user needs and system objectives. This makes Activity Diagrams a crucial element in developing a Customer Data Processing System website, both during the design and evaluation stages.

Class Diagram

A class diagram describes the structure of a system in terms of defining the classes that will be created to build the system. (Nistrina & Rahmania, 2021). Class Diagram in the Android-based Smart Warehouse system serves as a visual representation that describes the structure and relationships between classes or objects in this system. Therefore, class diagrams are an important element in the process of designing an Android-based Smart Warehouse system. These diagrams help in the creation of efficient and structured models, planning, and system development.

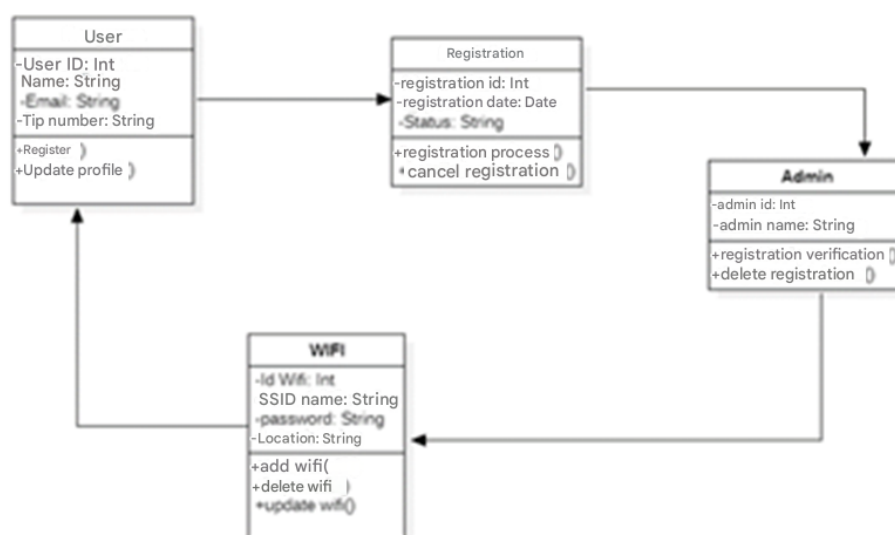


Figure 4. Class Diagram

System Implementation

The design of this Web-Based Customer Data Management Information System uses two users, namely customers and admins. From this research, we can know that the research has been carried out.

Home Page

In developing a digital service, an informative and easy-to-understand interface is a crucial element in determining user experience. A website's homepage serves not only as a gateway but also as a platform to introduce its identity, services, and benefits. Therefore, the homepage design must create a positive first impression while conveying information clearly to visitors. Besides serving as a source of information, the homepage also plays a role in building user trust in the quality of the service provided. A neat layout, attractive color choices, and communicative language can help users understand the website's functionality and the services offered. With these aspects in mind, the following is an explanation of the homepage of the "Wifi Ceria" service, as seen in the image above.



Figure 5. Porch

In Figure 5, it can be seen that the home page is a front-facing page to enter the login. This page is a landing page that directly gives consumers access to explore various catalog options. The homepage of PT. Wifi CERIA's customer data management information system is designed to serve as the main control center, making it easy for users particularly admins and customer service staff to access information and efficiently carry out daily operations. The website interface adopts user-centered design principles, focusing on ease of navigation, speed of information access, and informative visual presentation of data. This aligns with the principles contained in the PIECES framework (Performance, Information, Economics, Control, Efficiency, and Service).

At the top of the page, a header displays the company logo and the main navigation menus, including Home, Customer Data, Subscriptions, Payments, Reports, and Logout. This menu placement provides clear controls for users to quickly navigate between system modules (Control & Efficiency). The center of the homepage features a hero section, which welcomes users with a large system title and descriptive subheading. Quick action buttons, such as "Add New Customer" and "View Customer Data," also support daily operational efficiency.

Login Page

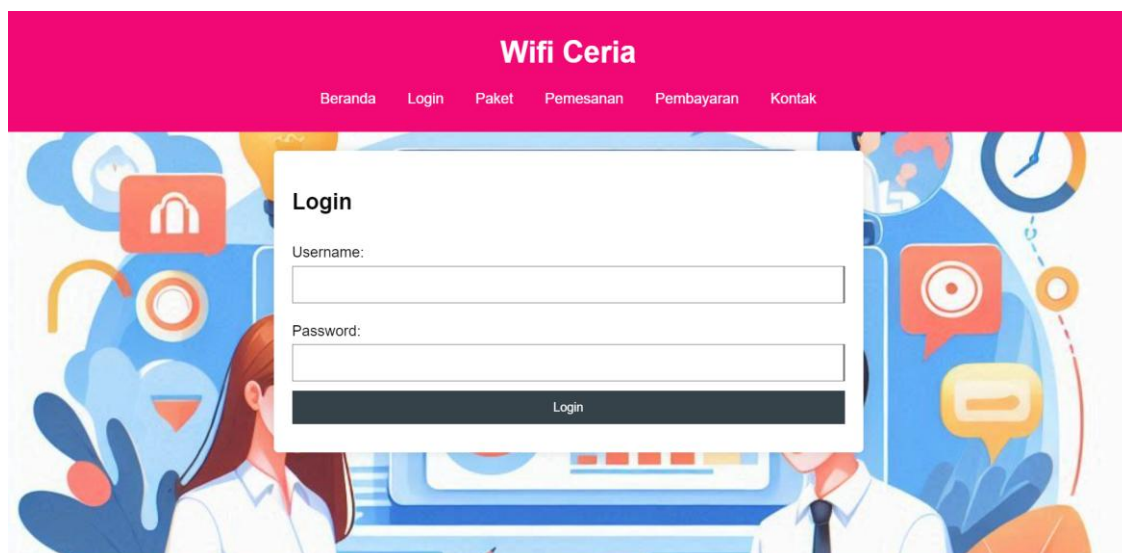


Figure 6. Login Page

In Figure 6, it can be seen that the login page is a page on a website or application where the user is asked to enter authentication information (usually in the form of a username and password) to access their account. The system then presents concise information in the form of a metrics dashboard comprising four main data cards: the number of active customers, total billings for the

month, number of customer complaints today, and average service response time. This data presentation aims to improve the quality of information available quickly and accurately (Information & Performance). From a control perspective, login serves as a security filter that restricts access to the system. Only users with valid credentials can log in and use the customer data module. Furthermore, the system utilizes password encryption (hashing) and brute-force protection as part of its customer data security mechanism. Informationally, the login page also provides relevant information to users, such as notifications if a login error occurs ("Incorrect Username or Password") or if the system is undergoing maintenance. This helps avoid confusion and increases user confidence in the system's reliability. Economically, a good login page prevents unauthorized access and potential data leaks that can lead to significant losses. This initial investment in security reduces future risks. Efficiency is reflected in the fast login process, minimalist yet clear forms, and the system's ability to remember user sessions if enabled (the "Remember Me" feature). Users can be redirected directly to the homepage after logging in without the need for numerous additional clicks.

Ceria Wifi Package Page

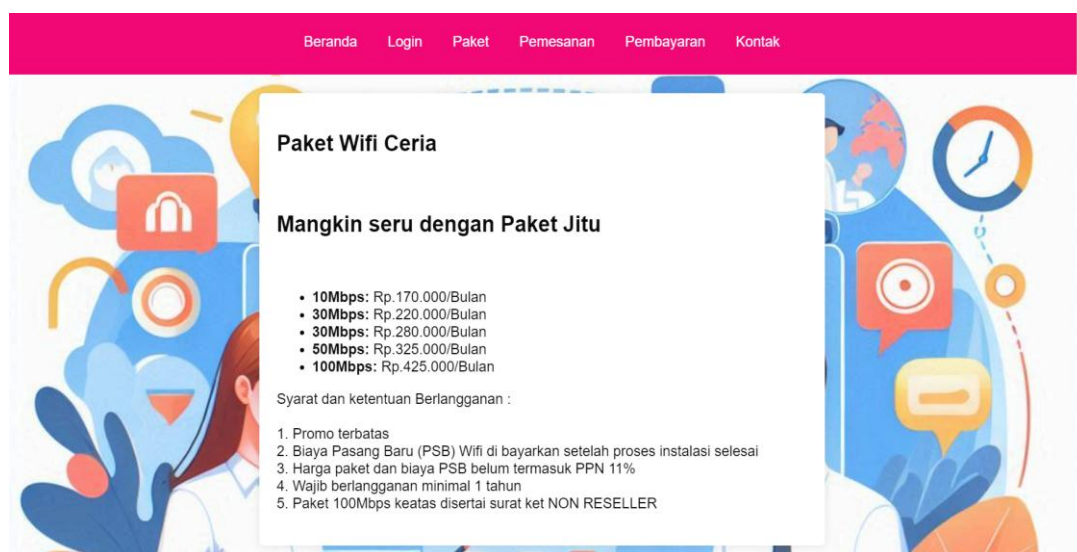


Figure 7. Ceria Wifi Package

In figure 7, the Package Page is a page to display the available wifi packages on the Wifi Web page. This page contains detailed information on the prices and types of plans offered by Wifi. Furthermore, a table of recent customers displays concise information such as customer name, subscription status, and payment status. This feature allows staff to monitor recent activity without having to access other modules, directly improving performance and efficiency. With the PIECES approach, the login page in PT. Wifi Ceria's customer data management information system serves not only as a gateway but also as a crucial part of the system's security and convenience management. Its robust functionality, professional appearance, and advanced security integration make it a key foundation for modern and trusted customer data management.

Booking Page

In providing digital services, the ordering process is a crucial step that must be designed to be simple, clear, and easily accessible for users. A well-organized ordering form can help users fill in their data more quickly and without confusion. Therefore, the interface must provide an intuitive flow so that all users, both those familiar with technology and beginners, can place orders without any hassle. Besides serving as a data collection tool, the ordering display is also an element that influences the overall user experience. An attractive design, the use of conversational language, and an organized information structure can provide users with a sense of security and comfort during transactions. With these considerations in mind, the following is an explanation of the "WiFi Ceria" service ordering page, as seen in the image above.

Figure 8. CERIA Wifi Package Booking

In figure 8, the order page method refers to the process or steps used in the creation or management of an order page on a website or application, which allows users to place orders for products or services. On the right side of the page, there's a notification panel and automatic reminders that inform customers who haven't made payments or have been sent reminders. This feature strengthens the customer control and service function (Control & Service).

Payment Method Page

Figure 9. Payment Methods

In Figure 9, The payment method page refers to the section that provides information or options for users to make a payment after selecting the wifi product or service they want to purchase. The homepage also features visual charts, such as the number of customers by region and a chart of payment status (paid/pending). These visualizations strengthen the aspect of efficient and easy-to-understand data-driven decision-making (Economics & Efficiency). The Payment Method Page is a vital part of the customer data management information system at PT. Wifi CERIA. This page not only serves as a means of recording and processing customer transactions, but also directly contributes to the company's operational efficiency, customer satisfaction, and financial control. In its development, this page was designed and analyzed using the PIECES approach (Performance, Information, Economics, Control, Efficiency, Service).

Performance, the payment method page is designed for high responsiveness and fast processing times. When a customer makes a payment or an administrator wants to verify a transaction's

status, the system automatically updates the data in the database and displays the current status (paid, pending, or failed). This ensures that every transaction is recorded promptly and without delay. Economics, by integrating various payment methods, such as bank transfers, e-wallets (OVO, Dana, GoPay), QRIS, and auto-debit, this system helps reduce the potential for payment delays that impact a company's cash flow. Furthermore, reducing administrative costs through payment system automation results in significant cost efficiencies. Control, the system provides limited access rights for users based on their role.

Only admins or finance officers can change or verify payment status. Each transaction is automatically recorded in an activity log, which can be audited at any time. This strengthens oversight and accountability in internal financial processes. Efficiency, using an integrated system makes the payment process faster and more accurate. Customers simply select a payment method, follow the instructions displayed, and a confirmation will appear automatically after the system receives a notification from the payment gateway. Compared to manual systems, this drastically reduces payment recording and confirmation time. Service, the payment method page also includes customer service features such as chat support, FAQs regarding payment methods, and a help button in case of technical issues. Additionally, customers receive automatic notifications via email or SMS after a successful transaction, as well as reminders before the payment due date. This shows that the system service is oriented towards user satisfaction.

Page Contact

Figure 10. Contact

In figure 10, the Contact Page is a page to display Contacts and updated info against the Wifi Web page. This page contains information on how to contact the call canter available by Wifi. Finally, the page footer contains company contact information, copyright information, and the current system version. Overall, the system's homepage is designed to improve customer service performance, provide accurate information, enhance internal controls, and create a responsive user experience. The PIECES approach not only served as a reference for the initial analysis but also served as a foundation for designing and implementing a system that adapts to PT Wifi CERIA's operational needs. The Contact Page on PT. Wifi CERIA's Customer Data Management Information System (CDMIS) is designed as a communication tool between customers and the company. This feature is a crucial element in supporting responsive and professional customer service, while also reflecting the company's commitment to transparency and service accountability. With a PIECES approach (Performance, Information, Economics, Control, Efficiency, Service), this contact page serves as more than just static information it becomes a strategic bridge in customer relationships.

Discussion

The implementation of a customer data management information system at PT. Wifi Ceria demonstrates how digitalization can simplify a previously manual and fragmented service chain. Findings from the implementation phase show that the service flow, from registration to network installation, has become significantly more structured after the system's implementation. This indicates that technology acts as a key link between work units from admin and technicians to finance by providing a consistent and easily traceable data-driven workspace. Thus, the system not only accelerates operational processes but also strengthens accountability and transparency in service delivery to customers. Sun et al. (2010) said that, significant changes are also evident in the management of transaction data and service status. Before the system was developed, the process of recording payments, customer complaints, and new installation requests often experienced delays or inaccuracies due to a reliance on informal communication. The developed system successfully mitigates these risks by providing an automatic verification mechanism, real-time status updates, and a track record of activities that can be audited at any time (Montalvo & Quishpe, 2024). This not only improves internal efficiency but also provides a strong foundation for faster and more targeted problem resolution.

Furthermore, the consistency of the system's interface and navigation structure also impacts the user experience. The use of a concise yet informative dashboard helps admins quickly understand operational conditions without having to navigate through numerous menus. This clarity of information demonstrates that the system is designed not only to record data but also to support evidence-based decision-making. This implication is crucial for internet service providers that require rapid response to disruptions and new service requests. From the customer perspective, digitizing the ordering and payment process reduces reliance on direct interaction with staff. This creates a more efficient experience, especially for customers who need immediate assurance of service status. The automatic notification feature and the provision of various payment methods also extend customer flexibility, while increasing the company's opportunity to reduce payment delinquencies (Weichert, 2017). This demonstrates that the system plays a strategic role in maintaining smooth cash flow and operational stability.

On the other hand, the existence of a well-documented system encourages companies to develop more disciplined and measurable work patterns. Each process has a clear flow, thus minimizing errors due to procedural inconsistencies. As a result, technicians have more definitive installation guidelines, administrators have more accurate data control, and customers receive more structured service. Thus, the system serves as the foundation for more professional internal governance. Furthermore, the results of this study indicate that technology integration not only resolves technical issues but also brings about changes in work culture. Migrating manual processes to a digital platform requires discipline in data updates, cross-divisional coordination, and continuous monitoring of service quality. These changes reflect that information systems are not just tools but also instruments for operational management transformation.

Meanwhile, the presence of a payment module equipped with automatic validation leads to improved financial control. The system can reduce the potential for recording errors and the risk of fraud because every transaction is automatically recorded and traceable (Feng et al., 2020). In the context of an ISP company with a growing customer base, accuracy in financial management is a crucial element in determining the company's sustainability. Another interpretable finding is the company's increased ability to monitor service performance. Through graphical presentations, customer status summaries, and automated reports, the company can map service areas requiring improvement, assess the effectiveness of technical responses, and predict equipment needs in the field. In other words, the system provides an analytical framework that can be used for long-term planning (Satchwell & Hledik, 2014). Ultimately, this study demonstrates that developing a web-based information system not only simplifies processes but also creates strategic value for the company. The integrated system enables PT. Wifi Ceria to improve service quality, accelerate work processes, optimize resource utilization, and maximize customer satisfaction. This confirms that investments in information technology have a direct impact on operational effectiveness and company competitiveness in the increasingly competitive internet service industry.

CONCLUSION

From the analysis and discussion that has been carried out, it can be concluded that the application of information technology in customer data management at PT. Ceria Wifi is essential to improve the efficiency and effectiveness of the service. With an integrated information system, the process of installing, moving, and disconnecting services can be carried out more quickly and in a structured manner. In addition, good customer data management will help companies in understanding customer needs and providing better services. However, there are still some obstacles in the current system, such as unstructured handling of customer problems and inefficient data collection. Therefore, the application of PIECES analysis has become very relevant to identify existing problems and design appropriate solutions. Integrated System Implementation Develop an information system that facilitates customer service management. Black Box Testing in Thorough testing to ensure that the system functions according to specifications. HR training is provided to employees to improve the use of the system and handle problems. Customer Data Analysis uses data to understand customer behavior and adjust services. Improved Customer Service in a better support system to handle complaints efficiently. Periodic Monitoring is routinely evaluated to ensure that the system remains relevant and effective. Hereby, PT. Wifi Ceria can improve operational efficiency and customer satisfaction.

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