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Analysis and Design of Information System for Parking Management "ParkHere" Using Design Thinking Method

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Abstract

Finding a secure and comfortable parking space is one of the needs of automobile owners when they visit retail centers. The ability of parking lot managers to provide information on sufficient capacity and access presents a barrier to delivering parking facilities in retail centers. Due to this, a website-based parking facility management information system is required, allowing drivers to make reservations and payments online based on when they plan to visit the shopping center. The method used in the design of ParkHere information systems is design thinking which consists of empathizing, defining, ideating, prototyping, and testing stages. The output of this study shows that at the empathize stage, motorists need information about the capacity of parking lots in various shopping centers before visiting the location. At the defined stage, this shows the need for motorists for website-based and real-time parking facility information. At the idea stage, it is necessary to design an information system based on the website that provides information on the capacity of parking facilities based on the operational time of the shopping center. At the prototype and testing stages, the ParkHere information system can answer the user's needs in choosing a place and location for vehicle parking based on the specified time.

Keywords: Information System; ParkHere; Design Thinking; Parking Management

1. INTRODUCTION

The need for motorists for adequate parking facilities is one of the crucial factors in increasing customer satisfaction in various shopping centers. [1] shows that parking facility management using an intelligent parking system is very effectively applied to optimize the use of space and land in various shopping locations or crowded centers, which is safe and comfortable for motorists. On the other hand, [2] developed parking lot mapping information systems and identity detection of drivers as part of optimizing parking facility management using Location Based

Service (LBS) and Code Detection (CD) technology. This shows that the needs of motorists in using parking facilities are essential in increasing the satisfaction of visiting various shopping centers. However, optimization of parking facility management needs to be adjusted to motorists' preferences, especially in terms of ease of access to information online, before determining travel plans to shopping centers. Considering this, the design of parking facility management information systems needs to be integrated with shopping center location mapping.

The study of parking management information systems can be seen from various perspectives, one of which is a decision support system that uses a Multi-Criteria Decision Making (MCDM) approach based on criteria related to system user profiles, namely health conditions, economic conditions, and the environment [3]. This shows that the design of a parking management system needs to consider the background of the system users. Innovation of parking management information systems through e-parking applications can increase retribution and regional economy and support environmental management programs for settlements and shopping centers to be more organized [4]. To maximize regional development, a parking management information system is therefore necessary.

Innovation in parking management business processes is needed to realize efficiency and effectiveness in using applications. Parking management in urban residential neighborhoods, in this case, apartments still use parking papers with vehicle number information and time to enter the parking area [5]. On the other hand, there is an innovation in parking management in several shopping centers and apartments using an IoT-based online integrated system that makes it easier for application users to access information about the availability of parking locations in the destination area [6]. This demonstrates how parking management technology and business process innovation make it simpler for application users, especially drivers who wish to access stores and apartments. In light of this, this study uses the Design Thinking methodology to create the parking management system known as ParkHere.

Designing a parking management information system using the Design Thinking framework can solve problems and provide new experiences for application users. The problem drivers face regarding vehicle parking is a matter of safety and comfort. Therefore, an efficient and effective parking management system using information technology is needed [7]. On the other hand, information that must be appropriately managed to optimize the vehicle parking system is as follows: vehicle number; transaction date; vehicle status; parking gate number; Rider ID; quality of the driver's "smart card" parking member card; validity period of the driver's "smart card" parking member card [8]. This shows that parking management system optimization needs to be identified and analyzed comprehensively by understanding the needs of system users, problems often experienced, and expected system user experience (expectations). In light of this,

the Design Thinking methodology is appropriate for developing new vehicle parking management systems.

ParkHere is a car parking management system that was created utilizing the Design Thinking methodology based on the circumstances of this study. ParkHere is a website-based program that adapts to the size of the digital device being used, can be accessed online, and is based on the number of parking spaces available and their current state in various shopping center locations. Data collecting and parking site mapping are periodically done to optimize ParkHere and give drivers of cars and motorcycles the required information. Using the Design Thinking framework, the ParkHere system is created starting with empathizing, defining, ideating, prototyping, and testing. The design Thinking framework highlights the issues system users confront, provides the best solutions, and highlights the traits of system users [9]. In addition, the Design Thinking framework is flexible, especially at the ideate and prototype stages, where application developers can amplify ideas and solutive ideas that can solve the problems of system users, namely drivers [10]. This demonstrates how the Design Thinking framework may help motorists find parking spaces suitable for their capacity, safety, and comfort needs. As a result, the ParkHere system may be designed and optimized using the Design Thinking methodology.

Several previous studies have shown that parking management optimization has the opportunity to become a profitable and sustainable business model. One of the contributions of Local Original Revenue (PAD) in various administrative regions of districts in Indonesia is the parking tax revenue [11]. In addition, [12] indicates that each area has a percentage (%) of tax by established regulations., [13] emphasized that optimizing parking levies needs to be monitored thoroughly to minimize potential losses. Building a transparent and accountable information system to inform drivers and enhance parking management at various shopping center sites is vital. This demonstrates how the development of the parking management system affects the direction of the parking tax levy. As a result, ParkHere serves as a solution for improving information management for drivers and a platform for tracking and managing parking business models in an area.

2. METHODS

An information systems-related qualitative methodology was applied in this investigation. The design of the ParkHere application follows a Design Thinking framework, which includes the stages of empathy, defining, ideating, prototyping, and testing. The following factors were considered when designing the ParkHere application using the Design Thinking framework: first, a focus on ideas for potential solutions to issues faced by drivers of cars and motorcycles. The fundamental reason can be understood if there is a process of identifying user

needs through the empathize stage. Second, the subjectivity of the driver's thinking is influenced by the vehicle's type or size. Location, capacity, and parking facilities all play essential roles in improving the comfort and safety of motorists to motorbikes. The collective problem must therefore be precisely specified during the define stage to be understood; Third, the proposed solution for ensuring drivers' security and comfort must consider factors such as parking location, parking lot capacity, and auxiliary facilities. This demonstrates that the selection process for ideas to solve parking problems can be done at the ideate stage; fourth, ideas that are pertinent to the rider's issue, scalable, and easy to implement need to move on to the visualization stage, which can only be done through the prototype stage; and fifth, ideas for solving parking problems need to be selected until they get relevant, measurable, and easy-to-implement ideas. Fifth, prototypes must be tested to see how simple it is for consumers to utilize and comprehend the system's data. This is currently only possible during testing. ParkHere was created using design thinking in response to these factors. The design steps for the ParkHere application are shown in Figure 1.

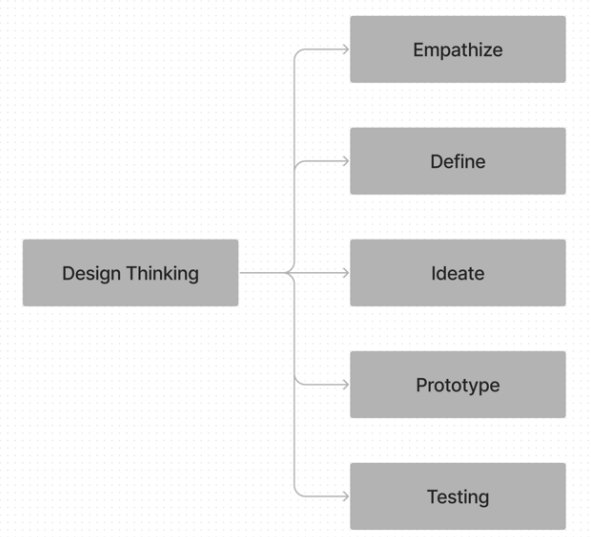

Figure 1. Design Thinking

Each phase of the Design Thinking approach used to create the ParkHere application is depicted in Figure 1. The process of determining the issues and requirements of potential system users, such as vehicle and motorbike drivers, is carried out at the Empathize stage. Driver safety issues related to vehicle facilities, driver safety issues related to driving techniques, comfort issues related to road materials and the width or area of the road, and safety and comfort issues of drivers and vehicles related to location, capacity, and vehicle parking facilities in various places, primarily shopping centers, are the results of identifying issues faced by drivers. Based on the problem identification process findings, an analysis of the

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demands of the riders—namely, their security, comfort, and safety—followed. The definition stage involves further processing of information about motorists' wants and issues that have been recognized.

At the Define stage, the problems and needs of the riders are selected according to the relevance of the field of information systems science and the capabilities of application developers in providing systems that can answer the riders' needs, solve problems and offer new experiences. In light of this, the top concerns are safety and comfort with the positioning, capability, and parking options in various shopping complexes. This demonstrates that the type of vehicle being used, its degree, or the type of material and breadth of the road along the way are only a tiny part of what determines the safety and comfort of the driver. Another factor is the location of the vehicle while it is temporarily stopped. This demonstrates the requirement for safety and comfort for the driver from when they travel until they arrive at their destination. The Ideate stage saw the continuation of numerous creative solutions to problems about vehicle safety, driver comfort, and parking lot manager advantages. To understand requirement for ParkHere application are shown in Figure 2.

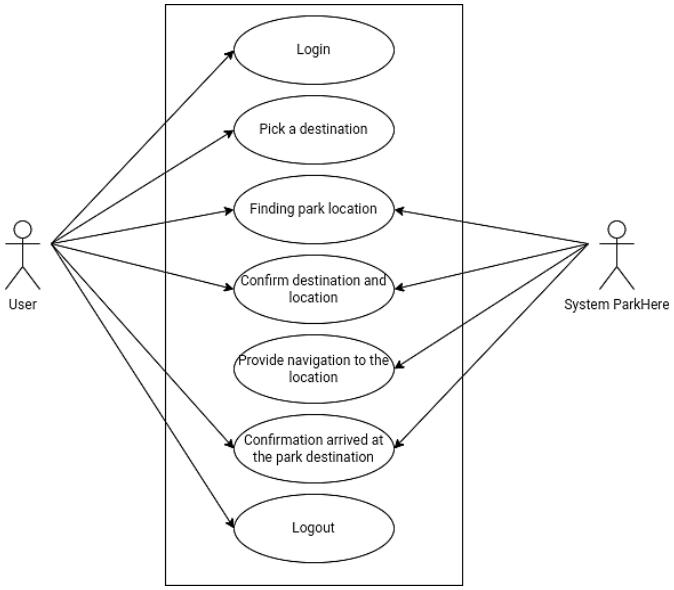

Figure 2. Use Case Diagram of ParkHere Application

The development team created a network of goals and potential solutions during the Ideate stage to create information systems pertinent to vehicle security, driver assurance, and parking lot management benefits. ParkHere information system is one of the solutions suggested, which allows information about the location, capacity, and parking facilities at shopping centers to be published on the website.

Drivers can make reservations based on anticipated arrival and departure times, pay for them, and digitally prolong the usage of parking spaces after getting an overview of the destination's capacity and parking options. Integrating parking management systems in various shopping centers and locating and mapping the location and parking lot capacity in each shopping center are challenges in developing or implementing the ParkHere information system. The benefits of creating a ParkHere information system include the simplicity with which parking spaces are identified as being available, the simplicity with which reservations for parking spaces can be made before arriving at their destination, the clarity with which parking lot managers can benefit from a digital parking space restoration and extension system, and the optimization of control or supervision of parking tax levies with a ParkHere information system. The following is the use case of the ParkHere application.

In the prototyping stage of the Figma application, the ParkHere application interface is created. Usecase and entity relationship diagrams illustrate the system's flow and functions, such as Create, Read, Update, and Delete (CRUD) features, and parts of the planned system are tested using the black box testing methodology during the testing phase. The following recommendations are made for the long-term development of the system: first, ParkHere must integrate the Google Map API to obtain unique features relating to the location of parking lots in various shopping centers that have parking facilities; second, ParkHere must be integrated with digital payment service providers to facilitate the transaction process in real-time; and third, it is crucial to maximizing the security of system user data as a driver and vehicle used. As a result, ParkHere has evolved into a website-based program that offers information services and parking space reservations.

3. RESULTS AND DISCUSSION

The "ParkHere" parking management information system may direct drivers to parking spaces in various retail complexes. A website-based information system called ParkHere gives details on parking areas for the convenience of drivers who are also clients in various retail centers as well as for the safety of their vehicles. The Content Management System (CMS), which refreshes location data and parking facilities so drivers can use them, is highlighted by the ParkHere application. This app is made to help drivers overcome challenges like not finding a convenient and secure parking spot and having to remember where their car is parked. The accompanying image shows the ParkHere application prototype in the meantime.

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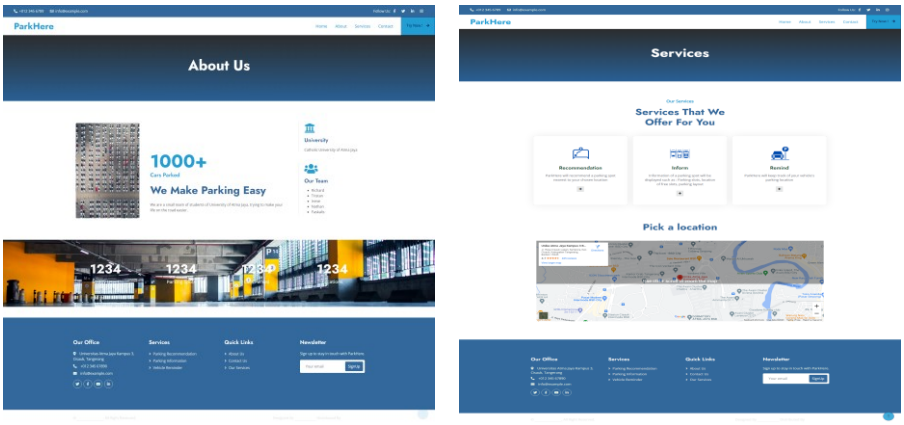

Figure 3. Prototype of ParkHere Application

The ParkHere application's user interface may be seen in Figure 3 on the services and about us page. Four options are available on the ParkHere website's home page: about, services, and contact. The home menu provides consumers access to all relevant data, such as the service provider's office or location, available services, and means to obtain more information. Menu Services offers news, parking advice, and vehicle reminders. Parking suggestions and data are adapted to the availability of parking spaces and facilities in different places based on the business process used by ParkHere. The ParkHere website also provides information on upgrading parking facility statistics depending on operational zones in shopping complexes. First, a formal cooperation agreement between ParkHere website developers and central management is required to support mapping shopping centers' locations and parking facilities. Second, system users must consent to use personal user data as driver and vehicle information. Third, system user data security must be optimized. As a result, there is a potential that the creation of ParkHere applications will be financially successful.

Scientific research has been done on the evolution of parking management system applications. However, the outcomes of digital innovation in applications still need to be expanded to office spaces, flats, housing, and retail malls for commercial optimization. Previous studies have revealed the presence of mobile applications made to propose parking locations [14]. Moreover, [15] demonstrates the growing requirement for parking spaces in office areas. This indicates that managing information on the locations and amenities in multiple office buildings, shopping malls, apartments, and residential buildings might be advantageous. As demonstrated below, a website-based application that links drivers with information providers can optimize the business process of parking information services.

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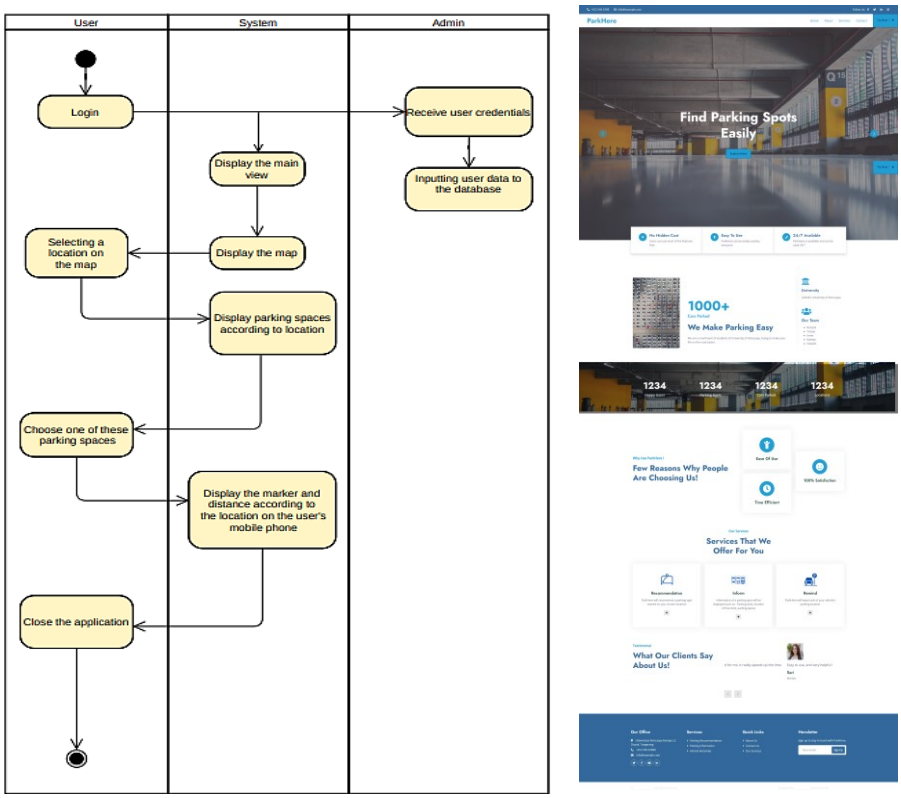

Figure 4. Homepage and Activity Diagram

Figure 4 depicts the steps involved in using the ParkHere application. After registering, users can access the system, view the website's home page, choose the parking advice service they want, and then dismiss the program after they are done. Mainly, user and vehicle data submitted must be kept private and secure by ParkHere service providers. However, getting information about parking services is possible to determine the availability in various locations working with Park. Optimizing a real-time system that can update data on the number of available parking spots and parking volumes in diverse places is the business development problem in building the ParkHere application. As a result, working with various shopping center managers can help the ParkHere application's parking service business process. Based on the results of black box testing on several ParkHere features can be seen in the following table.

Table 1. Testing Result of ParkHere Application

No	Scenarios	Expected	Results	Test Results
1	Go to the start page	The Start page is displayed, along with	The system successfully displays the start page,	Succeed

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No	Scenarios	Expected	Results	Test Results
		navigation for other pages.	and navigation for other pages is available.	
2	Go to about page	The About page is displayed in the system, along with other page contents and navigation	The system successfully displayed the contents as well as navigation and other pages	Succeed
3	Enter the services page	The services page appears, along with the embed of google maps	On the system appears the services view, and embed from google maps	Succeed
4	Enter the contact page	The contact page appears, along with a form for filling out messages	The system display displays the contact page and message filling form	Succeed
5	Sending messages on the contact page	Messages sent by users can be sent and received by Park Here managers	This part of the system is still in maintenance due to technical policy.	Maintained
6	Implement ation of ParkHere function using google maps API	The services page allows you to use maps for parking recommendations, finding information about parking spots, etc.	This part of the system is still in maintenance due to technical policy.	Maintained

Table 1 shows two features being developed and updated: the integration of ParkHere website functions with the Google Map API and sending messages from users' smartphone devices to service providers through the ParkHere website. Additionally, the website page's functionalities can all operate properly. This demonstrates the potential for the ParkHere website to grow into a successful digital enterprise in the age of digital transformation. When assessed from each level in the Design Thinking framework, it is clear from the outcomes of application trials utilizing the black box testing method that the ParkHere website has been successful and meets user expectations. The ParkHere website can use cutting-edge technology to address issues and provide solutions to user demands. However, for it to spread, regular maintenance is required.

4. CONCLUSION

The results of this study show that the design of the ParkHere application using the Design Thinking framework can reconstruct the idea of innovation through information technology that solves the problem of motorists regarding parking location. Through the ParkHere application as a website-based parking information management system, system users can access services in the form of safe and comfortable parking spot recommendations and qualified parking facilities in various shopping centers. The ParkHere application is still in the development stage. Hence, it must be optimized for business processes to manage digital data and protect system users' private and riders' vehicle data. Thus, the ParkHere application can generate financial benefits and the prospect of increased demand or the need for parking services in Indonesia.

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