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Smart Parking System on Braga Street, Bandung City

Cecep Rahman
Travel and Tourism Business, STIEPAR Yapari Bandung
E-mail : rahmancecep59@gmail.com

Reihan Muhamad Ramadhany
Travel and Tourism Business, STIEPAR Yapari Bandung
Email : hanramadhany@gmail.com

Correspondence Author: rahmancecep59@gmail.com

Abstract. Traffic congestion and limited parking spaces in the tourist area of Jalan Braga, Bandung City, have become significant issues that require innovative solutions. This study aims to design and implement a Smart Parking System using Internet of Things (IoT) technology and a mobile application to enhance efficiency, transparency, and convenience in parking management. The system is designed to detect real-time parking availability using ultrasonic sensors integrated with microcontrollers, and deliver this information to users through an Android-based application. Additionally, the system features parking slot reservation, digital payment, and parking data management for operators. Test results show that the system can reduce the time needed to find parking by up to 40% and increase user satisfaction. The implementation of the Smart Parking System in Jalan Braga is expected to support smarter and more environmentally friendly urban mobility in Bandung City.

Keywords: Smart Parking, IoT, Jalan Braga, Bandung City, Smart Parking System, Mobile Application

1. BACKGROUND

The growth of the number of vehicles in urban areas, including the city of Bandung, continues to increase from year to year. This has a direct impact on the increasing need for adequate parking space, especially in strategic areas that are the center of economic, tourism, and cultural activities. Jalan Braga, as a historical icon and main tourist area in the city of Bandung, often experiences traffic congestion and parking problems that are not well organized.

The main problems often encountered in the Braga area include illegal parking, irregular vehicle distribution, and the inefficiency of conventional parking officers in monitoring and managing limited parking spaces. This situation not only disrupts the comfort of road users and visitors, but also has an impact on the aesthetic face of the city and the effectiveness of public space management.

In answering these challenges, the implementation of Smart System Parking is one of the innovative solutions based on information technology that aims to create a more efficient, transparent, and environmentally friendly parking system. This concept involves the integration of digital sensors, electronic payment systems, application-based

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monitoring, and real-time data management, so as to optimize the use of parking spaces adaptively and sustainably.

The implementation of smart parking on Jalan Braga is not only expected to reduce traffic jams and parking search time, but also to be part of Bandung's transformation efforts towards a smart city that prioritizes technology-based public services. In addition, this system can increase local revenue (PAD) from the parking sector through a more accountable non-cash payment system and minimize extortion practices.

Against this background, it is important to examine how the implementation of Smart System Parking on Jalan Braga can provide concrete solutions to urban parking problems, while supporting the creation of smart, orderly, and comfort-oriented mobility for residents and tourists in the heritage area of Bandung City.

Jalan Braga is one of the iconic tourist areas in Bandung City which is known for its historical, cultural, and tourist attractions. Every day, this area is crowded with local and foreign tourists, which has a direct impact on the increasing volume of vehicles and the need for parking spaces. However, limited parking space and the lack of integrated parking management systems are the main problems that trigger congestion, haphazard parking, and decreased comfort and orderliness of traffic around the area.

In facing the challenges of urbanization and mobility that continue to grow, an innovative solution is needed that is able to optimize the use of limited parking space. One relevant approach is the implementation of *a Smart Parking System based on Internet of Things (IoT)* technology and mobile applications. This technology allows real-time monitoring of parking slot availability, integration of digital payments, and efficient parking data management.

By adopting a smart parking system, vehicle users can easily find out the available parking locations without having to go around looking for a place. On the other hand, parking managers and city governments can improve operational efficiency and supervision, thus creating a more orderly, efficient, and environmentally friendly transportation ecosystem. Therefore, the development and implementation of a smart parking system on Jalan Braga is not only a technical solution, but also an important strategy in supporting the vision of Bandung City as a sustainable *smart city*.

Smart parking system is a system that uses technology such as sensors, IoT (*Internet of Things*), and *software* to facilitate the search for parking spaces. This system not only

saves time for drivers but also helps reduce congestion and air pollution. With the *smart parking system*, information about parking availability can be accessed in *real-time* via a *smartphone application* or information panel.

smart parking works starts with the installation of sensors or cameras in each parking slot to monitor parking availability. This information is then sent to the data *center* and processed by *software* to appear to users through an application or information panel. Users can easily see the location of available parking spaces and get directions to get there. This process makes finding a parking space more efficient and organized. It also helps parking lot managers monitor their space usage in *real-time*.

2. RESEARCH METHODS

The type of research used is qualitative descriptive research, with a case study approach. This study aims to describe the implementation of a smart parking system on Jalan Braga, analyze its effectiveness, and identify the challenges and impacts caused by parking management and urban mobility.

The research was conducted in the Jalan Braga area, Bandung City. The research subjects include:

- Bandung City Transportation Agency
- Parking management officers (conventional and system-based)
- Road and vehicle users (residents, tourists, business people)
- The developer of the parking system technology (if there is cooperation with the private sector)

Field Observation: Directly observing parking conditions on Jalan Braga, both before and after the implementation of the smart parking system. The focus of observation includes parking behavior, slot availability, payment systems, and vehicle flow.

In-depth Interview: Conducted with relevant stakeholders, such as Transportation Agency officials, parking attendants, and parking users, to explore perceptions, experiences, and evaluations of the smart parking system. Documentation Study: Collecting secondary data from regional regulation documents, Transportation Agency reports, smart parking project blueprints, and statistical data on traffic and PAD from the

parking sector. Quantitative Survey (Optional): If you want to add a quantitative approach, a survey can be conducted with road/parking users to determine their satisfaction and effectiveness of the system.

The data obtained will be analyzed qualitatively through data reduction techniques, data presentation, and drawing conclusions. While quantitative data (if any) will be analyzed descriptively using tables and graphs to show trends or public perceptions. Data validity is maintained through triangulation of sources and methods, namely comparing the results of interviews, observations, and official documents to obtain an objective picture of the implementation of the smart parking system.

3. RESULTS AND DISCUSSION

The Bandung City Government has implemented *a smart parking system* in the Jalan Braga area to overcome the problem of illegal parking and increase the efficiency of parking fees. This shows that even though *the smart parking system* has been implemented, its effectiveness still needs to be improved through officer training and education for the community.

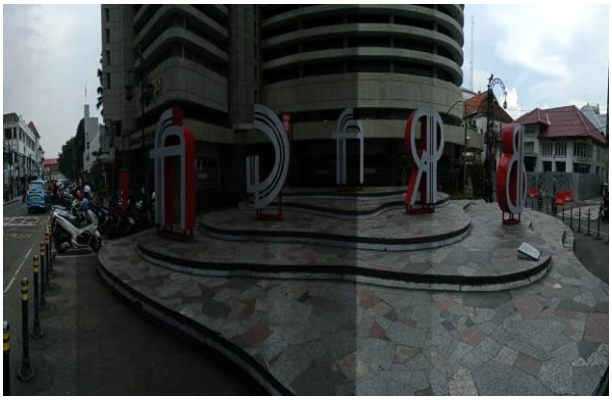
Smart parking system which is implemented this time is a *monitoring* and *controlling system,* especially for car drivers and ensures the safety of parked vehicles. In addition, this system also provides information about available parking areas, unavailable, and parking locations that will be directed using maps in the application.

Smart system parking uses an application as an intermediary media to convey parking information and make parking fee payments. Before it can be used, users must first register an account which will later be used to verify user data and the amount the user must pay.

The system used for land management and effective parking lot access and directing drivers to the right parking lot location and the benefits of *smart parking systems* optimize parking operations, reduce congestion, improve customer experience, help business owners offer parking incentives as a promotional trick, increase tax revenue through parking fees.

Smart parking system on Jalan Braga is a step forward in making Bandung a modern and competitive smart city. Although there are still many challenges in its implementation,

if managed well, this system can be a model for integrating technology with the preservation of historical areas.



Research on the implementation of Smart System Parking on Jalan Braga, Bandung City, produced several key findings that reflect the impact of this system on parking management, user comfort, and the effectiveness of supervision and regional income. The following are the results of the research based on field observations, interviews, and document studies:

A. Improving Parking Management Efficiency

The implementation of a smart parking system on Jalan Braga shows an increase in efficiency in the use of parking spaces. Parking slots that were previously often used

irregularly can now be monitored in real-time through sensors and applications. This reduces illegal parking practices and makes it easier for users to find empty spaces without having to go around in narrow streets.

B. Transition to Non-Cash Payments

The smart parking system encourages the use of digital payments (QRIS and e-money), which significantly reduces the practice of extortion by unofficial individuals. However, there are still some people who are not used to or have difficulty accessing the digital system, especially elderly users or those who do not have smartphones.

C. Positive Response from Users and Business Actors

Interview results show that most users, including tourists and business people around Jalan Braga, welcome this system because it makes the parking area more orderly and less chaotic. Business people admit that more orderly traffic also has an impact on the comfort of visitors to their shops/cafes.

D. Infrastructure and Socialization Limitations

Even though the system has been implemented, several obstacles were found, such as:

- Parking sensors are not always accurate in reading slot availability.
- The application is not yet optimal in providing real-time information.
- Lack of comprehensive socialization to the public regarding procedures for using the system, resulting in confusion for first-time users.

E. Impact on Regional Original Income (PAD)

Bandung City Transportation Agency noted an increase in transparency and potential increase in PAD from the parking sector since the implementation of this system. This is due to more accurate recording and a digital payment system that goes directly to the regional treasury without manual intermediaries.

F. Expansion of Implementation Potential

Through initial evaluation, this system has the potential to be replicated in other areas with similar characteristics in Bandung City, such as Jalan Asia Afrika, Dago,

and Alun-Alun Bandung. However, careful planning is needed to ensure the readiness of infrastructure, human resources, and community acceptance.

4. CONCLUSION

Smart system parking is a system used for land management and effective access in and out of parking lots. This system also directs drivers to the right parking lot location. The benefits of *smart system parking* are to reduce traffic congestion, reduce wasted time, reduce fuel consumption, and provide an effective solution to misuse of parking spaces. In general, Smart System Parking on Jalan Braga has a positive impact on traffic management, parking efficiency, and regional income monitoring. Although there are still technical and social obstacles, this system has proven to be superior to conventional parking systems and contributes to efforts to modernize technology-based urban planning.

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