



**TECHNOLOGY MODEL FOR PARKING LOT
MANAGEMENT INFORMATION SYSTEM**

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ABSTRACT

The increasing number of vehicles in the present has brought many problems, in this case the availability of parking lots. It can be said that the comparison of the number of vehicles that go down the road with the number of available parking lots is not directly proportional, consequently many riders either cars or motorcycles that find obstacles when looking for availability of places in the parking lot. Due to this situation, there is a technology model that could help to face the problem namely Automated Parking Lot Management System or in the other word it called with smart parking system. This system is fully functional and digitally controlled parking lot management system that is implemented with the use and integration, as well as it could manage the parking spaces available in the lot with monitoring and various sensor systems. The smart parking system is considered beneficial for the car park operator. The information gathered via the implementation of the Smart Parking System can be exploited to predict future parking patterns. In terms of environment conservation, the level of pollution can be reduced by decreasing vehicle emission in the air, can be attributed to the fact that vehicle travel is reduced. As fuel consumption is directly related to vehicle miles travelled it will be reduces as well. The system is made more efficient as vehicle travel time and search time are significantly reduced due to the information provided by the smart parking system. With the information provided, drivers are able to avoid car park that are fully occupied and locate vacant parking spaces with ease elsewhere. Most importantly, traffic congestion can be reduced and all this would eventually lead to convenience for the patrons. The purpose of literature review is to analyze about the development of technology smart parking system.

Keywords: Parking lot, Smart Parking system, Technology

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I. INTRODUCTION

Nowadays, the significant increase of the number of vehicle has creates some problems including the place where people could park their car. Moreover, it is also become struggle to find a place to park the car when someone inside the building's parking lot or mall, it is become a problem because of the lack of information that people could afford regarding the available place to park their car so it needs longer time for people or the visitor just to park their car, in the other side since sometimes they have to go back from the beginning until they find the available space.

By some experiences in the parking field, the difficulty in finding this available parking slot is not only experienced personally by the author, but also by family and friends of the author, so it means there should be a way more simple to deal with this kind of situation. The constraints that the author thinks are imposed by most parking spaces, both in office buildings and malls, are still traditional. What is meant by traditional parking itself is the parking which the operating system is still normal as often the riders encounter. Conventional parking has no information delivery system on the availability of slots, in specific parking lot, or has a parking slot booking system. The lack of these two things is the biggest reason why drivers have trouble in looking for parking. The evidence that this issue is a matter that needs to be raised as a topic can be seen in a journal entitled "User Behavioral Intention toward Using Smart Parking System," which shows that the percentage of drivers who have difficulty in finding parking slots in parked parking spaces such as malls and so on is as much as 86% (Kianpishah et al., 2011). Approximately 66% of motorists also take about 10 minutes or more in search of parking, especially on weekends or holidays.

Most car parks today are not run efficiently. This means that on busy days drivers may take a long time driving around a car park in order to find a free parking space. Implementing this system will help to resolve the growing problem of traffic congestion, wasted time, wasting money, and help provide better public service, reduce car emissions and pollution, improve city visitor experience, increase parking utilization, and prevent unnecessary capital investments. The system does this by making the parking enforcement more accessible and reliable. An automatic parking system can be achieved by sensors at the park entrance and exit, a computer system that controls the whole process and various display panels and lights that help the driver park his vehicle.

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Rapid economic and technological growth made private ownership of a vehicle available to citizens all over the globe. While allowing more freedom for people, shorter travel times, and better utilization of their working and leisure time, mass vehicle ownership is also constantly creating challenges for urban, traffic and road planners. Demand for wider and higher quality roads is rising, crossroads need control, traffic rules need to be increased, etc. One of the challenges which still has room for improvement today are places where vehicles can be left unused or parking lots. They have to be placed in areas with high parking space demand and offer appropriate capacity (Maršanić et al. 2010).

Parking lots may be owned by many individuals (every owner of a vehicle has his own parking space in the parking lot) or by one person or corporation only. When any one person or organization owns a large parking lot, economic income from that parking lot is crucial. Hence they are designed in areas with high vehicle and movement of people such as shopping malls, airports, business centers, tourist destinations, intermodal junctions, etc. The owner and user of the parking lot share the same goal that is to provide / find free parking space at the most convenient place. Both require a parking lot management system that tracks and informs about the amount of free parking spaces, ensures safe usage, navigates individual users to reserved parking spaces or parking spaces closest to the final destination, and ensures correct payment by the time the car was spent on the parking spot..

These parking lot management systems have to operate as part of a larger urban parking scheme, individually. They are usually built under the measure -> process -> react control framework to bring the whole system into desired reference state. In this case, the desired reference state is a road traffic area with satisfied traffic users (drivers and pedestrians), traffic without congestion at parking lot entry or exit area and minimal traffic induced by vehicles searching for a free parking space. It is important to note here that in dense urban areas-up to 30 per cent or more in severe circumstances-traffic caused by vehicles looking for free parking space can pose a significant amount. Poor management of large parking lots may also create traffic congestion and critical vehicle queues in the entry or exit area of the parking lots. This can lead to potentially dangerous situations for drivers' health due to exhaust gases from vehicles in closed underground parking lots.

II. LITERATURE STUDY

II.A Parking lot management problem

The parking lot management problem can be viewed from several angles. Parking lot owners want to ensure sufficient economic revenue and safeguard their investment; drivers want a secure secured place to leave their vehicle at a fair price; and authorities want the local road traffic to be free of congestion, moderate density and with limited accident situations caused by parking lot. Drivers are mainly interested in finding a parking lot near their destination with free parking spaces. Owners and authorities are much more interested in the influence of the parking lot on surrounding road area traffic, users' safety, and ensuring optimal usage of the parking lot (enough available parking places in peak traffic hours and profitable parking lot occupancy in off-peak traffic hours).

The increase in demand for parking spaces mainly stems from two big trends in rising car ownership and urbanization. To understand the extent of parking lot problems facing local communities when it comes to parking, take a look at the statistics below:

- According to the World Bank, over four billion people on Earth are city residents, that are more than half of the entire population. By 2030, the value will reach 60% of the overall population. The growing scale of urbanization brings more challenges in terms of infrastructure planning and transportation network including the rising demand for comfortable parking.
- Searching for parking results in considerable losses in productive time and money. 35% of the overall commute time is dedicated to finding a parking spot.
- Autonomous vehicles will likely present new demands to parking that have to be foreseen and analyzed. These may include the rising need for charging stations since most AVs are electric, ensuring that a vehicle can abide by the rules of parking which vary among different spots.

II.B Challenges for parking space operators

- DEMANDING ASSET MANAGEMENT

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Municipalities, companies and colleges face various problems in parking management, such as inconsistent rules, spot parking, parking in permanently prohibited areas, and many others.

- **TRAFFIC CONGESTION**

Many credible studies claim that around 30% of urban traffic is taken up by vehicles cruising to find a vacant parking space. It is one of the major reasons for congested city centers and a cause of road accidents.

- **FRUSTRATION AND STRESS**

Some drivers say that parking in especially busy areas could take them up to an hour. This leads to frustration and disagreements with other drivers at times. And this can contribute to loss of revenue for local businesses.

- **AIR POLLUTION**

Circling around in search of a vacant spot not only causes discomfort to drivers but also contributes to wasted fuel. This in turn leads to lost money and increased traffic emissions in an already polluted urban climate.

II.C Existing Parking Systems

Parking systems can be divided into five major categories: Parking Guidance and Information Systems (PGIS), Transit Based Information Systems (TBIS), Smart payment systems, E-parking and Automatic parking systems (Shaheen et al.2005). Every category uses various sensors regarding vehicle detection for parking lot status monitoring, driver informing and parking usage payment related tasks.

- **Parking Guidance and Information System**

Parking Guidance and Information (PGI) Systems, or car park guidance systems, present drivers with dynamic information on parking within controlled areas. The systems combine traffic monitoring, communication, processing and variable message sign technologies to provide the service. Every PGIS consists of four major components: information gathering module, information disseminating module, control center, and telecommunication network. The implementation of PGIS can include an entire city area or only a particular car park facility. Both implementations provide information which aids the decision making process of drivers in reaching

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their destination location and in locating a vacant parking space within a parking lot. The city wide PGIS is indeed helpful in assisting drivers navigating to a parking lot with vacant parking spaces via the information occupancy status for various parking lots around the city. PGIS implemented within a parking lot provides guidance in locating a vacant parking space within the parking lot (Shaheen et al. 2005).

- **Transit Based Information System**

Transit Based Information System provides parking space information and public transport schedules in Park and Ride facilities. The key aim of the programs is to enable drivers to park their cars and take advantage of other forms of public transportation. It in effect reduces congestion on the roads, noise and fuel consumption. Transit Based Information System is very similar to Parking Guidance and Information Systems regarding used vehicle detectors.

- **Smart payment system**

The Smart payment system is implemented in the effort to overcome the limitation of the conventional payment methods by revamping the payment method via parking meter and introduce new technologies. It is because the traditional approach makes the patrons pause and annoyance because they have to handle cash. It also reduces maintenance and staffing requirement for payment handling purposes as well as traffic control (Chinrungrueng et al, 2007). The smart payment system can be based on contact or contactless methods. Contact methods involve using smart, debit or credit cards. Contactless methods involve using smart cards, RFID technologies, automated vehicle identification technology, and mobile communication devices. Contactless approaches are much easier, but both the parking lot management system and the users need adequate infrastructure.

- **E-parking**

E-parking systems provide information about car parking space availability and allow parking space reservation at a desired parking lot. A driver can ensure the availability of a vacant car park space when he arrives at the desired parking lot. Accessing the system can be done using a smart phone, personal digital assistant, short message service or through Internet. The system must be able to identify the customer that

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made the reservation of its vehicle and allow them access to reserved parking space (Chinrungrueng et al. 2007). The User Recognition method has several different implementations. Such examples are an entry to authentication code obtained on the customer's mobile phone, printed receipts, smart cards, magnetic cards, and Bluetooth ID. E-parking has additional benefits like simpler payment mechanism of aforementioned smart payment system whereby payments by the parking lot users are made hassle free using e-payment technologies discussed previously (Idris et al. 2010).

- **Automatic parking system**

Automatic parking systems use computer-controlled mechanisms that require users to drive up to the entrance bay, position their car in a specially built cradle, lock their car, and allow the system to position the vehicle automatically in the designated parking area. Users only have to insert a code and a password to retrieve their vehicle. The mechanical system retrieves their vehicle automatically. The aim of an automated parking system is to use expensive and small parking lots efficiently in densely populated urban areas. Since vehicles are driven by manipulators and placed in a designated container-like parking position, a relatively small building area is needed for the entire parking lot. Needed area used in conventional parking lots for car driving can be mostly used for additional parking places. Automatic parking systems are very popular in developed countries such as Japan, United States and Canada (Shaheen et al. 2005).

III. CONCLUSION AND RECOMMENDATION

III.A Conclusion

The increasing number of vehicles in the present has brought many problems, in this case the availability of parking lots. It can be said that the comparison of the number of vehicles that go down the road with the number of available parking lots is not directly proportional, with a consequent which is many riders either cars or motorcycles that find obstacles when looking for availability of places in the parking lot. the existence of the new technology model parking lot management information system, it help to make the driver easier in the process of looking for parking lot and it more efficient also, such as in some condition it just need shorter time than manual process of course then with the shorter time that needed in the looking process, it also help to save more in using the fuel of the vehicle, in the other side also effect in stress reducing for the driver in the process.

III.B Recommendation

Parking management information system technology model is more widely applied in developed countries such as Europe and other developed countries. For Indonesia itself, the technology model of parking management information system is still underdeveloped or cannot be implemented yet. So that I hope that in the future there is an appropriate technology innovation model, more effective and efficient which can be implemented in Indonesia.

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