

# Android-Based Information Technology Design for Easy Parking

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## Abstract

The development of transportation information technology has been going on for a long time. The development of information technology has forced every individual to master it. Including the development of parking information technology. Limited parking spaces at public service locations have become a problem for the community. Integrated parking information technology using mobile communication devices, laptops and personal computers is needed. The problem faced now is to be able to ensure a parking space is available. This study aims to answer these problems. The methodology used is to create an Android-based parking information technology application. With the hope that the convenience of this parking application will make certainty about the place and time of parking users.

## Keywords

Transportation, Parking, Android

## 1. INTRODUCTION

The definition of parking according to the Technical Guidelines for the Implementation of Parking Facilities, Directorate General of Land Transportation (1996) is a state of immovability of a vehicle that is not temporary. Parking is one of the needs of the community for transportation in placing vehicles at a certain time or for a certain period of time. Various parking management policy efforts have been made by most of the City Governments or other regions to organize parking. However, parking can create various potential advantages and losses. The expected potential advantages are parking regularity, economic benefits and vehicle safety. On the other hand, a poor parking management seems to cause bigger problems, such as vehicle security vulnerabilities, inexpedient and hardship of obtaining parking locations, and more importantly it can cause traffic jams.

The parking management patterns have been carried out in various ways. It could be manually(conventional), modern (IT-based) or combination of both. However, in term of parking location, it can be categorized as on-street and off-street parking (Figure 1). Each of those variables will bring difficulties that need to be challenged by a good parking management system. Surono and Wasono (2019) noted that the proportion ration between space availability and volume of vehicles must be well considered, otherwise it could disrupt the orderliness and comfort for the parking users. These are figures which picture current parking management.



Figure 1. off-street Parking  
(Source: Mudjanarko, 2020)

The space availability for off-street and on-street parking must be properly arranged so as to reduce parking problems. Especially for the off-street parking which will reduce the road capacity and potentially cause traffic jams. On the other hand, the use of IT for parking management is relatively new. There are various ideas and concepts has been implemented within this subject. One of the commonly used is the usage of electronic parking ticket to minimize human interaction (Figure 2). However, the fast development in IT will consequently drag continuous improvements in its implementations. New ideas are demanded to explore options in which can bring innovation within transportation management in general.

Researches in monitoring vehicles activity with Intelligent Transportation Systems (Sulistio and Mudjarko, 2011) and community behavior in parking activities (mudjanarko, et al. 2013) have stressed that extreme jams lead to delays in reaching destination would waste fuel and spoil the vehicles. Furthermore, Roy, et al, (2016) added that improper traffic management particularly parking activities would cause stressed and frustrated vehicle drivers.



Figure2 Parking Ticket Machine  
(Source: Mudjanarko, 2020)



Figure 3 Installation Number Plate (TNKB)& System Block Diagram  
(Source: Slamet, et. al., 2017)

The research in technology used for parking management has been developed in numerous ways. As Limantara, et.al. (2017), the ultrasonic sensors and internet of things was used to convey information on the position

of an empty parking lot to the parking users in order to detect the presence or absence of vehicles. It was combined with a device (object) that can transmit signals through network system (wired or wireless) which known as Internet of Things (IoT). The model used was an ultrasonic sensor (proximity sensor) and internet of things (IoT). In this case, a chip that was programmed and placed in each parking lot so that it can transmit digital information signals both to the server and to the parking user's gadget (with a special software installed). Moreover, a research was also conducted by Slamet, et.al. (2017) which made IoT sensor devices that can identify the vehicles through model of information system connected with the detection system of motor vehicle license plate. As illustrated in Figure 3, the identification was by means of sensors and data that stored in a digital chip which is mounted on any motor vehicle. The chip was able to identify license plates with the code specified by the police of the Republic of Indonesia. The chip detection can be developed in other countries based on their vehicle license and transportation system standards. The chip can detect the presence of vehicles not more than 100 meters in distance by using Wi-Fi signal emitted by those vehicles. This digital identification system was also believed could help identifying vehicles in case of crucial problems.

James and Abraham (2018) noted that parking has become problem in most big cities in the world. The limited parking space has been detected as one of major cause for urban traffic congestion and air pollution. The drivers used to find the parking space manually by finding a space on the street through luck and experiences. In case of cities with high vehicles density, it would take time and effort and might lead to failing to find any parking space. Therefore, they proposed a system which automated the vehicles as well as the parking space with a Smart Parking System (SPS). The system integrated an Android application and QR Code reader.

In the heading of smart cities technologies, where billions of smart devices are connected through internet, our urban landscape is gradually changing. The intelligent transportation systems especially smart parking technology is believed improves on citizen's life quality. A lab experiment was done by Niculescu, et al. (2016) which proposed a system that implemented as a mobile application with an integrated GUI adapted for Android tablets. The application would assist drivers by providing information and suggestion based on parking charged fee. The innovative features within this system were the use of local language and the ability to redirect drivers based on current parking occupancy. In order to do so, the system utilized online mapping with the GPS menu on mobile devices.

On the other hands, the success of smart parking systems are related to the provision of appropriate data. Kilic and Tuncer (2017) provided a framework which could provide instant information given by the parking park in each part of the city. The system used online storages or known as cloud architecture as database. The parking information were collected by sensors placed in parking gate. The system optimized wireless sensor network technology to collect data, control and observing of large physical areas. This system was part of a big concept of implementing smart city environments. Moreover, Bonde, et al. (2014) proposed a model of parking system which conceptually reducing human interaction to its operations. It was a miniature model system that could manage parked vehicles' population in any given space and certain period of time. Entering and leaving activities within the parking lot was automatically monitored and regulated by an Android based application. They believed that the system would improve effectiveness in parking activities.

Furthermore, a more sophisticated idea was proposed by Renuka and Dhanalakshmi (2015) which offered reservation option to their parking management system. The idea was inspired by the continuous increasing in vehicle numbers that would make parking spots were harder to get, especially during the pick hours. It has been a common situation where the drivers have to walk relatively far from their destination or even, in worst cases, have to cancel their schedule because of failing to get a parking spot. By advance reservation, drivers abled to design their transportation activities and consequently would cause efficiency. The proposed scheme was a prototype model driven by an Android system and combined with Internet of Thing (IoT) using slot allocation method and performing automatic billing process.

This research was constructed with ideas that parking has to be easy and effective. Furthermore, the research spotted that the difficulties were increase in public facility parking space. The research designed to solve the parking management system from the perspective of users, in this case the research focused to the train station parking space's users. Mudjanarko and Rasidi (2020) noted that more than 70% of incoming vehicles to the train station would park their vehicles. The proposed system adopted the reservation option as well as electronic billing scheme. The limited space within the facilities and repeatedly high occupation during departure and arrival of scheduled trains have made this model would use different methods other than previous models.

## 2. METHODOLOGY

This mobile e-parking application is an online-based parking system application where users of this application can book a parking space and make payments using electronic money. In an instant, this system uses an Android studio device to create Android applications and uses MySQL for basic storage data. The model was designed based on preliminary study conducted by questioners to the selected respondents. As stated, to be focused in this research, the respondents were train station parking facilities user. The field study was majority done during pick occupancy period, which the time of arrival and departure of scheduled train.

The system architecture was built based on gathered data and model from the preliminary studies. The literature review was used to give a frame work of thinking whilst field study which was done by questioners provided the characteristics needed for novelty of the parking system. The field study chose randomly 150 respondents. It was done at three major train station in Surabaya, which are, Gubeng, PasarTuri and Surabaya Kota train stations. The respondents' age and gender were documented as research variables. Moreover, the approximate duration of parking and an open question regarding respondents' opinion for the best parking system were also recorded.

The Figure 4. shows the proposed system architecture. The chart illustrates processes from the reservation activity until paying the parking billing.

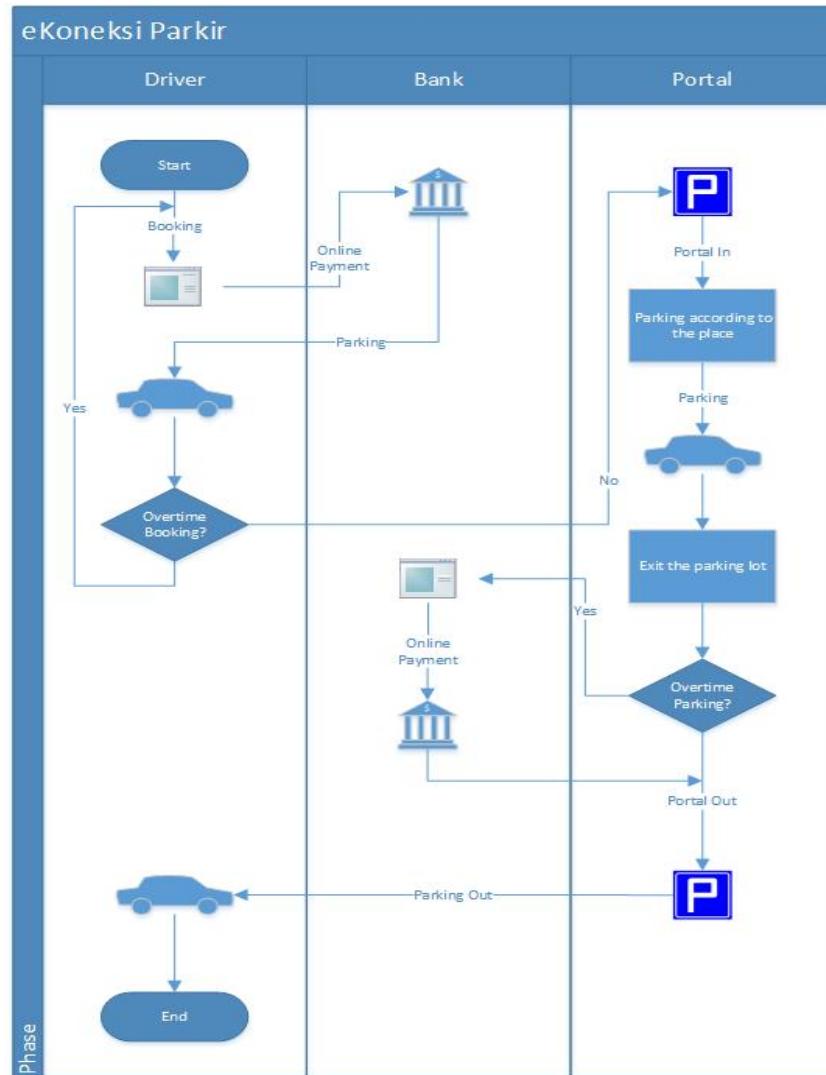


Figure 4. The schematic diagram for e-Parking system

### 3. RESULT AND DISCUSSION

#### 3.1. Result Based on Respondents' Data

In perspective of gender, the research noted that majority of parking users were male by more than 70% of respondents. Table 1 shows the detail of the data.

Table 1. Respondents' characteristic based on gender

Number	Gender	Quantity	Percentage
1	Male	110	73,3 %
2	Female	40	26,7%

Furthermore, in the heading of age, as described in Table 2, the distribution of the respondents was relatively event. Yet, it was noted that the highest percentage was in range of 40 until 60-year-old by 38% and followed by range of 25 until 39-year-old (36,6%). The rest of the respondents were categorized as under 25-year-old and above 60-year-old with percentages of 10% and 15,4% respectively.

Table 2. Respondents' characteristic based on age

Number	Range of age	Quantity	Percentage
1	Under 25	15	10%
2	25 - 40	57	38%
3	41 – 60	55	36,6%
4	Above 60	23	15,4%

On the heading of parking duration, as described in Table 3, the majority of the respondents parked their vehicles under 1 hours with percentage of 48% and followed by under 2 hours duration with 24%. Moreover, 16,6% of the respondent needed less than 15 minutes in using parking area and followed by more than 2 hours with 11,4%.

Table 3. Respondents' characteristic based on duration of parking

Number	Parking duration	Quantity	Percentage
1	Under 15 minutes	25	16,6%
2	Under 1 hours	72	48%
3	Under 2 hours	36	24%
4	More than 2 hours	17	11,4%

The last inquiry was an open question which highlighted respondents' opinions regarding online booking parking system. In general, top 3 respondents' hope regarding this system were;

1. The parking bill has to be reasonable
2. The menu has to be as simple as possible
3. The certainty to have parking spot after completed the reservation process

#### 3.2. Operational Procedure

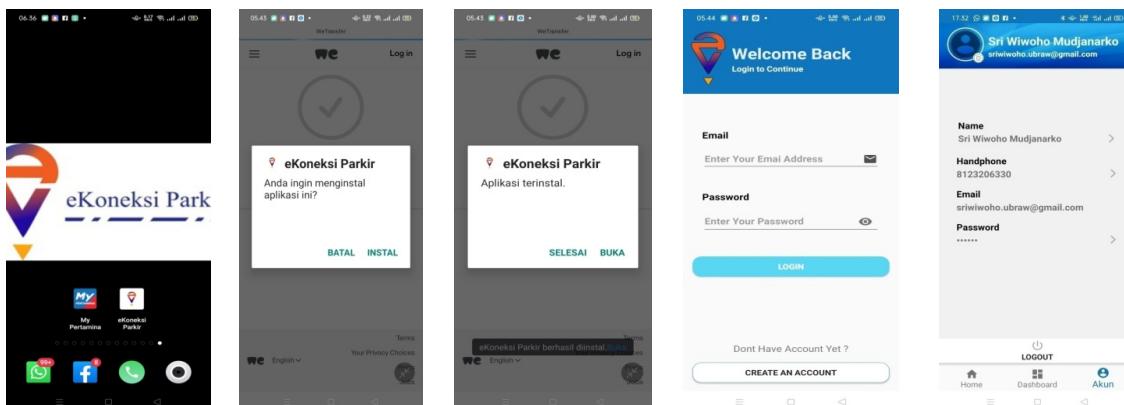


Figure 5. eKoneksi Parkir

In general, the procedure of using the system starts with users make parking bookings through the e-Parking Connection android application. After placing an order, the user makes an online parking reservation payment using a Virtual Account. Then users can park at the intended location and the reservation is only valid for 2 hours. When the user enters the parking location, the system will check whether the reservation is overtime or not. If the order exceeds the 2 hours' time limit, the user is required to re-order. The Figure 5. pictures these early steps in using the system.

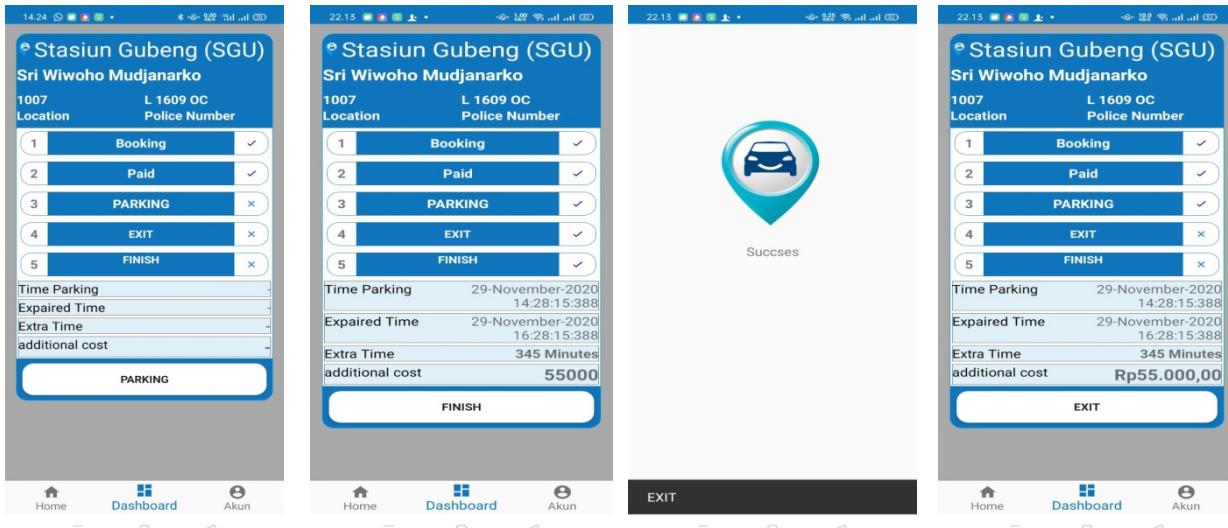


Figure 6. eKoneksi Parking Payment Booking Process

Figure 6 shows the process of ordering a parking location. Parking reservations are made per hour. Parking fee of Rp. 10,000 per hour. If parking exceeds one hour, the fee will be added automatically. It can be seen that the parking fee is Rp. 55,000 or 345 minutes. 1 hour equals 60 minutes. This means that parking costs more than 304 minutes.

As long as users enter the parking area, the parking system will record how long the user has parked the vehicle. When the user exits the parking location the system will show the limit and length of parking time. Payment for excess parking time is made online.

### 3.3. Program Trial and Respondents' Response

The system has been trialed for some period of time. It shows no signs of failure. Yet, during the trial period, improvements were made and the latest revision is version 11.0.

To validate the system model, the program has been shown to 150 chosen respondents. The research explored respondents' views regarding the trialed program. As seen in Figure 7, it was noted that majority of the respondents accept or willing to employ the program (62%). However, there was 14.7% respondents said "no" to the program and the rest of the respondents (23.3%) had no definitive answer. For the last group of respondents, they had doubt whether such a program could be implemented in society.

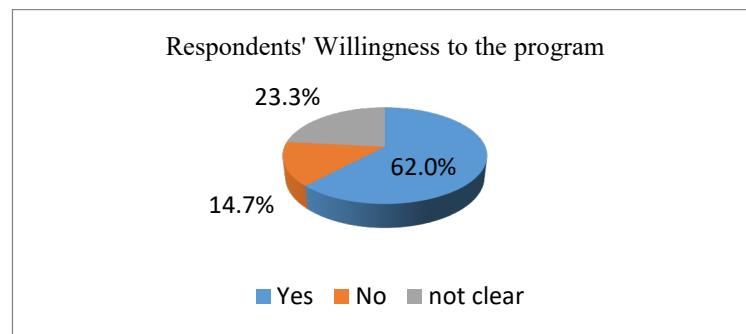


Figure 7. Respondents' willingness to the program

#### 4. Conclusion

As has been discussed in early chapter, the availability of parking space has become one of major issue within transportation management systems. Many researches have been conducted in regard of solving the problems. However, a unique model was required for specific problem solver within transportation issue. This parking management system was constructed to challenge the problem faced within train station parking facilities. The use of IoT bring the development of such systems to the next level and it was proved which could facilitate the uniqueness of the required program.

The program is open for the further explorations and ready to be implemented for permanent basis. Furthermore, its employment hopefully will bring advantages for the future regulator and for sure, will make the parking user satisfied.

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## Biography / Biographies

**Sri Wiwoho Mudjanarko**, Starting his career in construction services since 1991, since 2000 he has worked as a Lecturer in Civil Engineering at Narotama University, Surabaya and as an Extraordinary Lecturer in the Master of Civil Engineering at the 17 August 1945 University of Surabaya. Diploma III Civil Engineering at Petra Christian University, Surabaya, Undergraduate Civil Engineering Narotama University, Surabaya, Magister Civil Engineering at SepuluhNopember Institute of Technology, Surabaya, Doctoral Civil Engineering at Brawijaya University, Malang, Engineering Professional Program (Ir) UniversitasGadjahMada (UGM) and in the professional field of Railways. The author is currently serving as the Chancellor of Narotama University, the Head of the Narotama University LPPM, a member / professional committee of the Inter-College Transportation Study Forum (FSTPT), the Indonesian Railroad Society (MASKA) and the Chair of the LPPM Association in Surabaya and its surroundings. He has been awarded Research Grants from the Government of Indonesia on various schemes since 2009 until now.

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**Achmad Muchayan**, is a lecturer at the computer science faculty at Narotama University. Having an interest in the field of computer science, especially in developing web-based applications and developing information systems related to management science. Completed the undergraduate program in 2011 at the Adhi Tama Institute of Technology in Surabaya and completed the Master of Management program in 2017 at Narotama University.

**Slamet Winardi** is a senior lecturer at the UniversitasNarotama. He is born in the city of Semarang on August 3, 1971, received his advanced education in ITS Control System, graduating in 2003. Now he is pursuing the Internet of Things, especially IoT transportation. The latest achievement resulted in a patent, 2 brands, more than 21 copyrights, and 9 books from a research funded by RistekDikti. Concentration in their field by forming an IoT community which is named the Indonesian Internet of Things which is abbreviated as Id-iot.

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