

Model of Smart Parking System Based On Internet Of Things

Wibby A.A.P.¹, I. Kholis²

¹Military Electrical Engineering, Faculty Military Engineering, Universitas Pertahanan Republik Indonesia

²Electrical Engineering, Faculty of Engineering, Universitas Indonesia

Email: wibby.praditasari@idu.ac.id

Abstract

Over increased automotive industry is being challenged to produce better quality products with intelligent innovations and lower cost. The huge demand of the market is to get public parking area. The aim of this paper provides the highest quality equipment integrated by Smart Parking System Model. The model Provides simplify to controlling and monitoring of the parking area available which is connected to the Internet network, monitoring can be done remotely. Testing and data collection conducted in Jakarta by taking the data 24 hours during 6 months without stopping. The experiment result shows that the classification of availability of parking is approximately 78%. The results of the car sensor testing can be controlled in accordance with the parking area.

Keywords: car, controlling, Internet of Things, monitoring, Smart Parking System

1. Introduction

Indonesia's capital, DKI Jakarta, is a busy area with a centre of administration, business, and government. Besides that, it is bordered by other residential city areas such as Bogor, Depok, Tangerang, and Bekasi [1]. From the results of the survey (Central Bureau of Statistics) in 2014, there were 3,566,178 people active in Jakarta, as well as passing through Jakarta [2]. Furthermore, most of them live in a capital city, and around of area. The increase in population is proportional to the number of vehicles entering or passing through Jakarta in each year period. This critical condition illustrates that transportation to support infrastructure development in various aspects. Based on the Traffic data of the Republic of Indonesia Police Corps, in 2017, the number of vehicles was recorded above 138 million [3]. The amount of transportation in Jakarta and surrounding areas is very crowded. The worst condition is finding for a parking area. It takes a long time to get around to be able to park a vehicle. In addition, the proliferation of illegal parking which sometimes causes road constraints. Other effects include vehicles that can be towed, damaged or lost.

Previous research from smart car research integrated with the health system was monitored from an android application in ubiquitous systems [4]. Selecting this parking lot too, adapts the previous lesson, choosing

grave plots via digital media via the web and android applications [5]. Data is processed in real-time and provides instructions so that users can more easily understand and use the application [6].

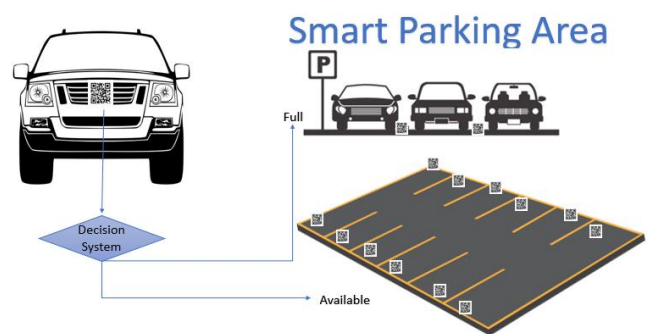


Figure 1. Smart Parking System

Figure 1. describes a smart parking system that was built. The barcode on the sending vehicle (Tx) will be processed through an Artificial Intelligence to be able to determine the available parking position. An embedded system is installed around the parking area, as a receiver (Rx). Data readings in real-time time efficiency and parking selection. This information is read by the user through the android application. There are 3 categories of parking, namely car, motorcycle, and (VIP) Valet service. As far as, the system has been tested on prototypes for private vehicles. The purpose of a project is to make it easier for customers to find a

parking space that is available, such as at certain times, especially on holidays, where the parking lot is full, which makes it difficult for customers to find an empty parking space which can cause queues.

2. Methods

In this section, first, introduce method used in Artificial Intelligence.

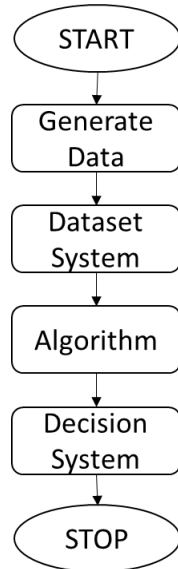


Figure 2. Method of Artificial Intelligence Research

A. Generated data

The internet of things infrastructure bridges data from information sources on parking conditions with vehicles. In this smart parking, AI functions to provide information on parking availability. Data from the parking area is obtained from real-time spatial data with the distance of the vehicle from the parking gate of an area.

B. Data Set System

This study requires data half a year ago taken near-valid average numbers. All data is recorded as training data set information. Data presents information on the number of parking slots and available. By using array modeling, data is processed into a set of data sets.

C. Algorithm

Based on the process of generated data and data sets, next implementation of the algorithm. Matched with the behaviour pattern of the driver to find parking with the data system. The algorithm used by Neural Network Learning, checking values and ensuring the closest distance.

D. Decision System

The decision of the system of the AI from the algorithm considers the best conditions for selecting parking availability. In this case, the data is sorted in

the matrix. The pattern is studied to deduce predictions of parking availability.

E. System Implementation (Prototyping)

Furthermore, the implementation of the AI method is implemented with a car prototype. This car prototype is designed using Arduino microcontroller components, Bluetooth module, motor driver, DC motor, battery, and mechanical body.

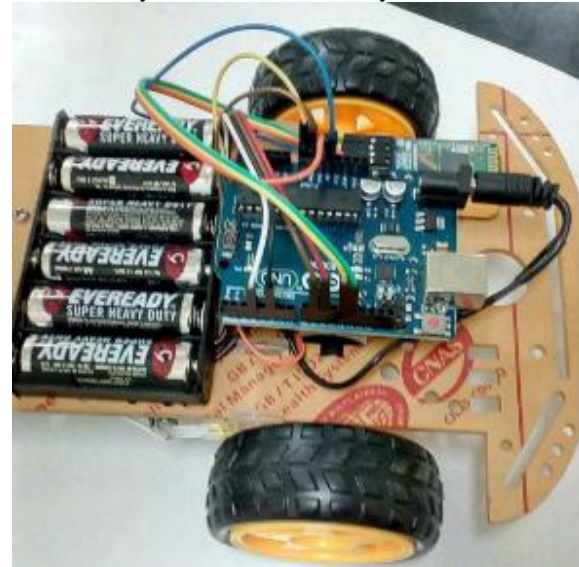


Figure 3. Top View

Figure 3, the top view part of the picture explains that the prototype uses embedded systems with Arduino Uno as a master, battery for power supply. Bluetooth sensor to give data communication in order to provide information to the user's smartphone.

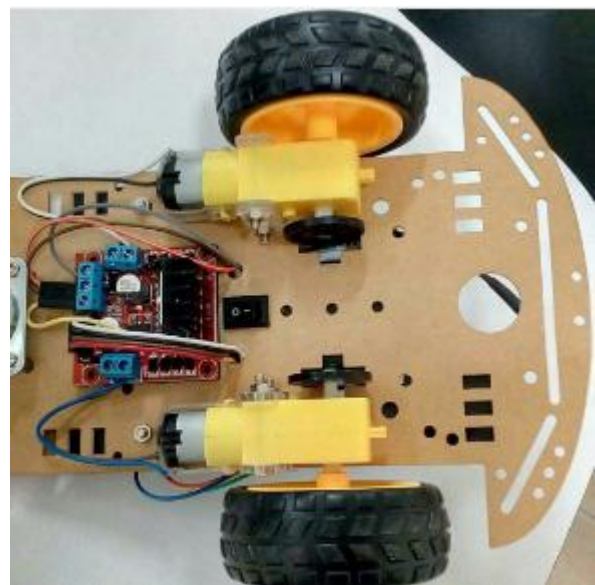


Figure 4. Bottom View

Figure 4. The bottom view describes embedded systems that are connected to vehicle sensors.

Including reading barcodes, data from all sensors is then processed and then sent to a smartphone.

3. Discussions

Figure 5 use case diagram, which illustrates the scenario or interaction can be done by an actor, an actor here in the form admin, user. As for the use case diagram we can see in Figure 5 below:

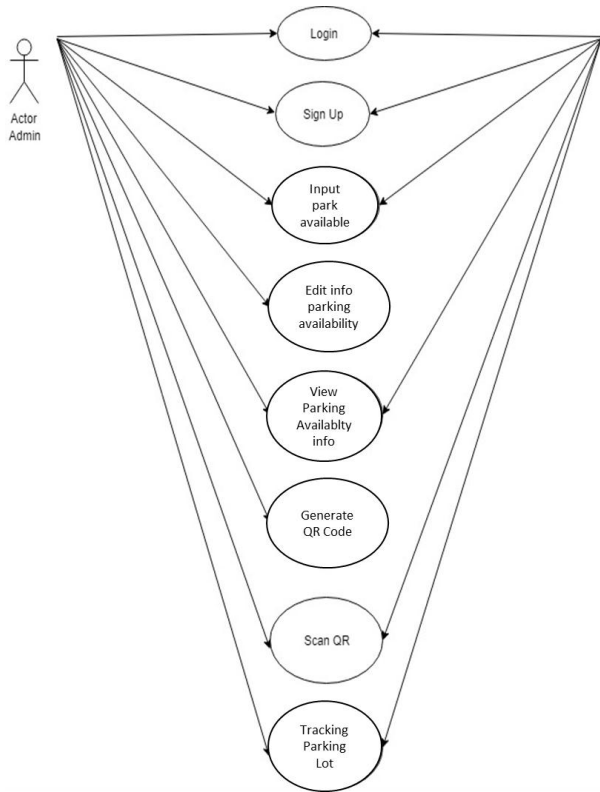


Figure 5. Use Case

After the admin login, admin can manage data- data within the system such as the data. There are of operate, monitoring data, the data rule, the data prediction, user data and after completion admin can exit the menu out.

In the user menu containing data of information experienced by the user driving, history. Driver can view the data of slot, parking area, and best suggestion.

Smart parking system built, include scan barcode from Tx Transceiver and Rx Receiver. It provide vehicle direction navigation, search and select the nearest available parking lot. The procedural system was tested in East Jakarta and the surrounding cities, Depok, West Java. The selection of location is because the number of vehicles in this area is full of vehicles in rush hour. Distance from maps and slot prediction that can be used. It is in Figure 6.

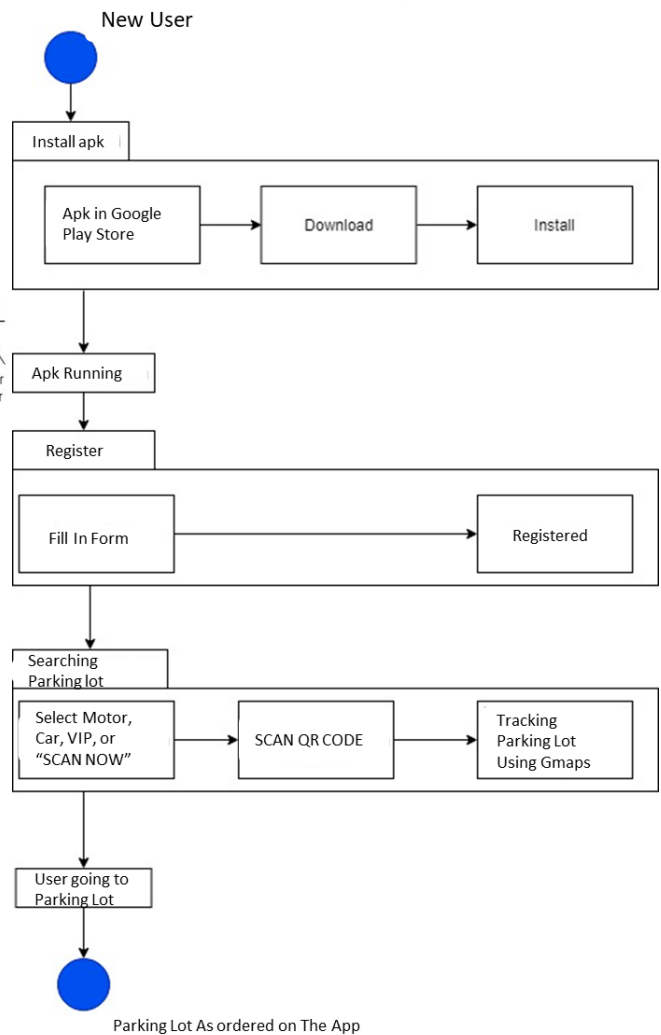


Figure 6. State Diagram

Decision making is based on near-accurate considerations. Scenario: The condition of the car is located between two parking areas, there will be a subsequent decision that adjusts to the behavior of the driver (advanced parking forward or backward). The results given are the best for the driver.

The user has to register on Android Application. Then, the user has to login to Android Application to use it. After logging in, user is directed to Main Activity. Main Activity contained categories. Then, user selects one of the categories which will direct to the next page. The figures below are Android Application screenshots.



Figure 7. Register

The register is input in user data containing information on the type of vehicle, type of smartphone used, and expertise of the driver in parking the vehicle.



Figure 8. Login Page

After the registration process is successful, the user can log in. First, make sure the vehicle is connected to the system. The purpose of reading information can be monitored through the smart parking application.



Figure 9. Main Activity

On clicked of Scan Now Button, user will be directed to Motorcycle, Car or VIP selection. Then, user has to choose one and will go to the next page. Then, user will be directed to options of area that should be checked. The figures below are the parking area is available in two area.

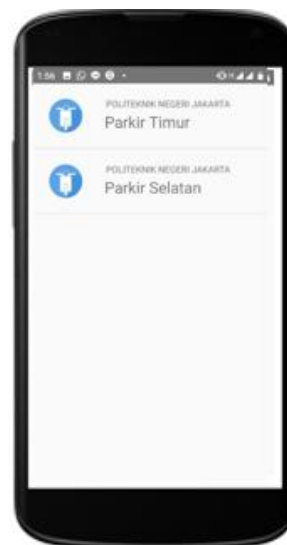


Figure 10. Smart Parking

In this Figure 10. Smart Parking view, providing available parking areas, it is necessary to obtain additional information from the parking lot place, such as an estimate of the amount that is still available. In addition, consider the number of drivers planned for the parking lot. The best system that can be used as the best system driver advice.

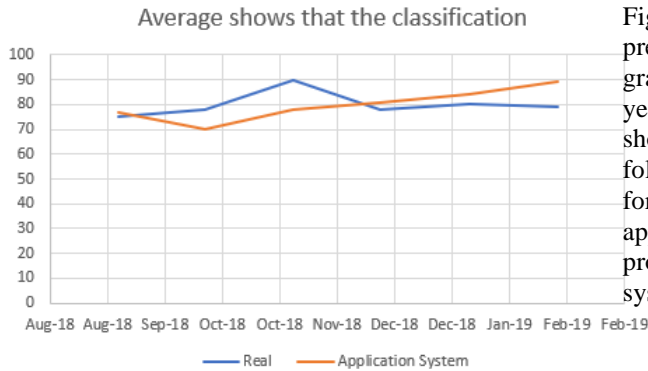


Figure 11. is the graph showing the real data and predictive graph which is done by AI System. The graph explains that data has been processed for half a year (August 2018 - February 2019). The AI system is showed that prediction of parking using the real data is following the real data. The average predicted parking forecast above 78% approaches between real and application. This shows that the system can function properly and achieved the goal of a smart parking system. Explained in Table 1.

Figure 11. Real vs AI System

Table 1. Real vs AI System

No	Testing Name	Input Test	Result of Prediction	Result of Testing
1	Display on Application	Detection object 1-8	Displays the number empty parking slots on Application	Success
		Detection there are 9 object models	Displays the full parking slots on Application	Success
2	Indicator on hardware	The number of objects detected by the sensor < 8	Indicator off	Success
		The number of objects detected by the sensor	Indicator on	Success

Table 1 is The shows compared data on Real (Hardware) vs Application. Maximum of 9 objects that will show full. A will show the number that is still available if it is less than 9. Result on Display Application and Hardware.

4. Conclusion

From the analysis, design, testing, and implementation has been done, it can be concluded:

This research has the potential for IoT success for smart parking. The main goal is to find parking in big cities like Jakarta and surrounding areas can be solved. The application of Artificial Intelligence begins with generated data, training data sets, and decision system processes. Finally, it can be applied to a smart parking system. The experiment result shows that the classification of availability of parking is approximately 78%.

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