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A Study on Common Problem on Smart Parking System at AEON Seremban 2

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Abstract: A car parking system refers to a solution which compromising barrier gates, access control system, as well as automated parking system which are widely used in public and private buildings. Smart parking system is a sensing technology system which is leading the way in the delivery of proven, fully integrated, end-to-end solutions, which results to a transformation of the complete parking experience to the drivers. AEON Seremban 2 has been facing parking problem such as insufficient of parking spaces, outdated parking system which causes traffic congestion and time consuming to the drivers. The objectives of this study are to identify common problems on parking system from literature review, to develop questionnaire based on objective 1, and to identify the most preferable smart parking system for car parking problems at AEON Seremban 2. The literature review conducted in this study offers an in-depth review of common parking problems faced in shopping mall. On the other hand, it also offers an in-depth review of various types of smart parking system such as Parking Guidance and Information System (PGIS), transit based information system, smart payment system, e-parking, and automated parking system. Furthermore, the literature review shows the implementation of vehicle detection technologies into smart parking system. This paper presents a survey and analysis of an academic, qualitative literature review implementation process. It reviews many different types of smart parking system and analyse which is the best suits for AEON Seremban 2 through questionnaire which is prepared beforehand. Questionnaire are distributed to the respondents for data collection purpose through e-mail. Out of the five smart parking systems, PGIS has the highest frequency as it has more advantages as compared to the other five smart parking systems. In conclusion, PGIS will be proposed to the management of AEON Seremban 2 for future upgrading purpose.

Keywords: AEON, Parking Problems, PGIS, Smart Parking

1. Introduction

According to the Malaysian Ministry of Transportation, there were 1,169,320 newly registered vehicles were reported in the year of 2020 as compared to the year 2019 where there were 1,258,541 newly registered vehicles [8]. The current transportation infrastructure and car park facilities are insufficient to sustain the influx of vehicles on the road based on the precedent statistics provided by the Malaysian Ministry of Transportation. Problems such as traffic congestion, double-park, and insufficient of car parking space unavoidably affecting most of us. In Asia, the situation is made worse by the fact that the roads are significantly narrower compared to the West [4]. There are many solutions were proposed and they have been taken into consideration to overcome the traffic problems. One of the ideas proposed was overcoming the traffic problems by car parking system.

Therefore, car parking system is to be introduced and invented to solve the above problems. A car parking system refers to a solution which compromising barrier gates, access control system, as well as automated parking system which are widely used in public and private buildings such as hospitals, shopping malls, commercial buildings, high-rise residential buildings, and government office buildings. There are many types of car parking systems in the world such as automatic pay stations and barriers, auto pay parking system, active Radio Frequency Identification (RFID) parking system, robotic parking system, and smart parking system. Although the problems can be solved by various types of parking systems but this study will only focus on the smart parking system in overcoming car parking problems in Malaysia.

A car parking system is defined as a mechanical device that multiplies parking capacity inside a parking lot. It may be shown up in either traditional or automated. In Malaysia, there are various types of parking systems to be used and one of it is called the smart parking system. Smart parking systems can be categorised into five major categories which are Parking Guidance and Information System (PGIS), transit based information system, smart payment system, e-parking and automated parking [9].

Smart parking system uses advanced sensing devices such as cameras with high megapixels, vehicles counting equipment, high sensitivity of sensors which is built in the pavement, etc. These advanced sensing devices are mainly used to determine the occupancy of the parking spaces. There are even more powerful sensing systems are being built to help in analysing and transmitting the information to the database in real time.

1.1 Problem Statement

The traditional car parking system has a lot of disadvantages. The traditional parking systems which are in existence currently in Malaysia right now suffer from major drawback. Here are some of the major issues faced by traditional car parking system in Malaysia now. The traditional car parking system is very dependence on the guards because they are fully manual which requires a guard to open and close when there is vehicle entering or existing the car parking lot. Furthermore, visitors are allowed to enter a premise by the guards on duty without knowing whether the visitors are allowed to go in or not. Lastly, long waiting time is also one of the major issues showed by the traditional car parking system. When there is a number of cars approaching the car parking entry at the same time, the visitors are forced to wait for a long time to enter the car parking lot due to the traditional parking system.

All the challenges stated above which are faced by the management of the mall are not as critical as the last challenge. The most critical challenge face by most of the management of the mall is installing new parking solutions at existing malls and shopping centres. What is even more challenging is the integration of new parking solutions into third party solution. This is because not all the companies involved are willing to support integration and this will even cause the operation to be tougher. This will require the management of the mall to discuss with the desired contractors before the integration works begin to minimise the chances of delaying upgrading work.

AEON Seremban 2 has been facing parking problems with the current parking system they have now. One of the main issues is the car parking system does not display the car parking rate which will easily cause misunderstanding to the drivers. Many of the drivers assume that parking in a mall is free of charge so they did not expect they will be charged until they are preparing to exit from the car park. Some of the drivers will never expected that the rate is charged by per entry but not according to duration of car parking.

On the other hand, Aeon Seremban 2 also having another issue which is insufficient of car parking spaces as the number of populations has been increasing in Seremban all these whiles. According to the Department of Statistics Malaysia Official Portal, there is an increase in the number of populations in 2019 by approximately 1.13 % as compared to 2018. The number of vehicles is uncountable during public holiday and weekend which causes the entrance of the shopping mall stuck with cars. Meanwhile, car parking space without car park occupancy detector is also other issues faced by AEON Seremban 2. Since there is no car park occupancy detection system in the current parking system that Aeon has now, the management cannot predict and estimate how many cars have entered and occupied the car park in the shopping mall. This will cause drivers to enter the parking lot without knowing the availability of parking spaces, yet they have to pay for the parking rate if the system is based on per entry. In short, there are still many unforeseen issues on the conventional car parking system of AEON Seremban 2.

1.2 Objectives

The objectives of this study are as below:

1. To identify common problem on parking system from literature review.
2. To develop questionnaire based on objective 1.
3. To identify the most preferable smart parking system for reducing car parking problems in AEON Seremban 2.

1.3 Scope and Delimitation of Study

In this world, there are various types of smart parking systems such as automatic pay stations and barriers, auto pay parking system, active RFID parking system, robotic parking system, Parking Guidance and Information System (PGIS), transit-based information system, smart payment system, e-parking and automated parking [5]. In this study, the retail stores that had been chosen is located at Seremban 2, Seremban, Negeri Sembilan. This study is mainly focus on what are the common car parking system problems in shopping mall and which is the best smart parking system to overcome the problem. The method which the researcher uses to collect data and results for this study is through questionnaire. A randomly picked of 68 respondents who shop at Aeon Seremban 2 will be requested to answer the questionnaire prepared by the researcher. The questionnaire itself consists of a number of questions which include both open ended and scaled questions. The randomly picked of 68 respondents will need to answer the questionnaire honestly.

The limitation of this study includes dishonest of respondents. This is because some of the respondents will not answer the questionnaire with honesty which might affect the results of the study. However, the researcher will brief the respondents before they start to answer the questionnaire so as to maximise the level of cooperation by the respondents. Another limitation is due to unpredictable situation. According to Dato' Sri Ismail Sabri bin Yaakob, the Senior Minister for Security and Minister of Defence, shopping mall which is located at area of Conditional Movement Control Order (CMCO) can only operate from 10am to 10pm and the number of customers entering the premise is controlled. Some of the customers are requested to queue outside of the mall until there are customers who exit the mall then only the guard will allow other customers to go into the mall. This had caused the researcher to be even more difficult to collect data because the number of customers who go the mall reduces. During this pandemic time, some of the respondents refuse to take part in answering the questionnaire

as they want to keep a social distance with strangers. This will cause the researcher to be difficult to approach to the respondents.

2. Literature Review

Literature review will reveal about the types of smart parking systems based on the information thesis, journals, articles, books, online articles, conference proceedings and other resources. It will also include the common problems on car parking system, types of smart parking systems, car park occupancy detection, implementation of vehicle detector technologies into smart parking system, and analysis of smart parking system.

2.1 Common Problems on Car Parking System

One of the most common problems in the car parking system is insufficient information on parking availability and price rate for the drivers. Most of the conventional car parking systems do not display the price rate of parking which will cause the customers to be unsatisfied with the charges after they parked into the parking lot. Some of the drivers are likely to be frustrated if they expected that the parking is free of charge but ended up, they need to pay.

The next problem is the car parking system does not update the drivers regarding the availability of parking spaces. This will cause many of the drivers who enter the parking lot wasting their time to search for parking. The conventional car parking system will just open the barrier when then drivers press the automated machine for tickets to enter without taking into consideration about the availability of parking spaces. This will only cause unnecessary waste of time and fuel but it will also pollute the environment.

Furthermore, inefficient of the car parking system is also a major problem. The current parking system requires driver to roll down their car window to receive the parking ticket upon entering the parking lot. This will cause a long queue on public holiday and weekend. The condition will go even worse during rainy day.

Lastly, insufficient of sign board is also one of the common problems in a car parking system. When drivers reach the T-junction of the car park, they do not know whether to turn right or left because there is no sign board to guide them. Some of the lane in the car park is one way but there was no sign board displayed which will easily cause an accident to happen.

2.2 Smart parking system

There are five major smart parking systems in current market which are Parking Guidance and Information System (PGIS), transit based information system, smart payment system, e-parking, and automated parking.

2.2.1 Parking Guidance and Information System (PGIS)

There are four major components in PGIS which are information disseminating mechanism, information gathering mechanism, control centre, and telecommunication network. Dynamic Variable Message Signs (VMS) are used to provide drivers with direction within the car park. Mobile phones can also be used for guidance if it is connected to Global Positioning System (GPS) for vehicle detection. The current position of the drivers on GPS with the status of nearby car park will be delivered to their mobile phones. PGIS are normally equipped with vehicle detection sensor which will be installed at the entrances and exits to detect vehicle occupancy. There will be an indicator light integrated with sensor installed at every parking space. If the light displayed is red which means the parking space is occupied whereas if the light shows green, it means that the parking space is available.

2.2.2 Transit based information system

The difference between transit based information system and PGIS is transit based information system focuses on guiding drivers to park-and-ride facilities. It also provides drivers with real time information of the car park. A proper planning must be conducted in order for the transit-based information system to achieve success in its implementation. A proper planning means selecting a good location for location for park-and-ride car parks which can maximize the transit. Network flow-based technique helps to improve the conventional spatial model which is used to determine the park-and-ride facility location by considering of traffic flow and works in reducing the vehicles mile travelled. According to Horner and Groves, there are some other factors which should also be included in determining the location and computer shed area for the park-and-ride lots such as geographical, network, travel time from demand points to the location of the park-and-ride facilities, as well as the constraint on computer shed shapes [7].

2.2.3 Smart payment system

Smart payment system can reduce maintenance and staffing requirement as well as traffic control [3]. This system consists of several payment method which includes of contact method, contactless method, and mobile device. The contact methods such as the use of smart cards, debit cards, and credit cards whereas the contactless method are by the Automated Vehicle Identification (AVI) tag whereby Radio Frequency Identification (RFID) technologies are involved. For the contact method, drivers are required to contact the card with automated parking machines or the parking meter itself. The main concern about the implementation of smart payment system is mainly on the privacy of drivers and security issues. This is because drivers who pay with debit or with credit cards contain personal information such as balance in the account and some other personal information are highly confidential. There are several solutions which had been discovered to secure the data and overcome threats ranging from cryptography, detection and evasion, and temporary deactivation [5]. These solutions will help to secure the data of drivers so they will not have to worry their data being stolen from third party.

2.2.4 E-parking

One of the advantages of e-parking is enabling drivers to enquire for the availability or reserve a parking space at their desired destination. This can help drivers to confirm that the availability of vacant car park when they arrive at the parking facility. The e-parking can be accessed through both SMS and internet. Besides enquiring for the availability or reserve a parking space, this system incorporates the payment method of smart payment system so the drivers are made hassle free. A driver can make the reservation of car parking through mobile phone [4]. In the other hand, another option of reserving parking space which were using internet via Wireless Application Protocol (WAP) enabled mobile phone, Personal Digital Assistants (PDAs), or even through conventional computer. Some researchers had further upgraded the system by cooperate with fuzzy logic so that drivers can choose to accept or reject the parking reservation.

2.2.5 Automated parking

Automated parking system allows the patron to drive the car up to the bay then the machines will automatically place the respective vehicle to the allocate space. This system will involve computer-controlled mechanism. This automated parking system is able to cater more car as compared to the conventional car park where most spaces are used to navigate vehicles in the car park. Automated parking system has higher efficiency in car storage as compared to conventional car parking system because it allows car to stack on each other. This system also provides extra safety measures to both patrons and vehicles because the patrons do not need to go into the car park [9]. It is extremely important to assure that the vehicles remain original and undamaged when the computer-controlled mechanism handling back the car to the owner. A three-level software design which includes Logical Layer (LL), Safety Layer (SL), and Hardware Abstraction Layer (HAL) is introduced. This software can help to ensure correct and efficient storage of vehicle in a safe manner. Most of the automated car parking

system has several components such as conveyer belts, rotatable lifts, and shuttles. This system must be coordinated to ensure of successful and safe placement and retrieval of vehicles.

2.3 Analysis of parking system used in shopping mall

Different shopping malls in Malaysia will use different types of smart parking system. The use of smart parking system is very depending on the location, function, advantages and disadvantages, as well as suitability. Therefore, Table 1 below shows the type of smart parking systems used in shopping mall in Kuala Lumpur.

Shopping Mall	Smart Parking System
1. Suria KLCC	Parking Guidance System
2. Mid Valley Megamall	E-Payment System
3. Sogo	E-Payment System
4. Quill City Mall	Qsmart Parking System
5. Plaza Low Yat	Smart Payment System

3. Methodology

Methodology is a method which is mainly used for designing, collecting, and analysing of data so as to produce evidence to support the study. This chapter will describe the methods used to collect, analyse, and present data throughout the entire study. The methods applied in this chapter are depending on the objectives of the study stated in chapter 1, for then to be achieved.

3.1 Development of Flowchart

The main purpose of developing a flowchart is to be a guidance for this study so as to have a clearer direction on what is going to be done next in order not to waste any unnecessary time. Basically, this entire study will be divided into two parts which are the first part (Final Year Project 1) and the second part (Final Year Project 2). Final Year Project 1 consists of determination of title, problem statement and objectives of the study, and literature review whereas Final Year Project 2 will cover the rest of the study which are data collection, compilation and analysis of data, discussion of results, conclusion, and recommendation for future study. Figure 1 below shows methodology flowchart for the study.

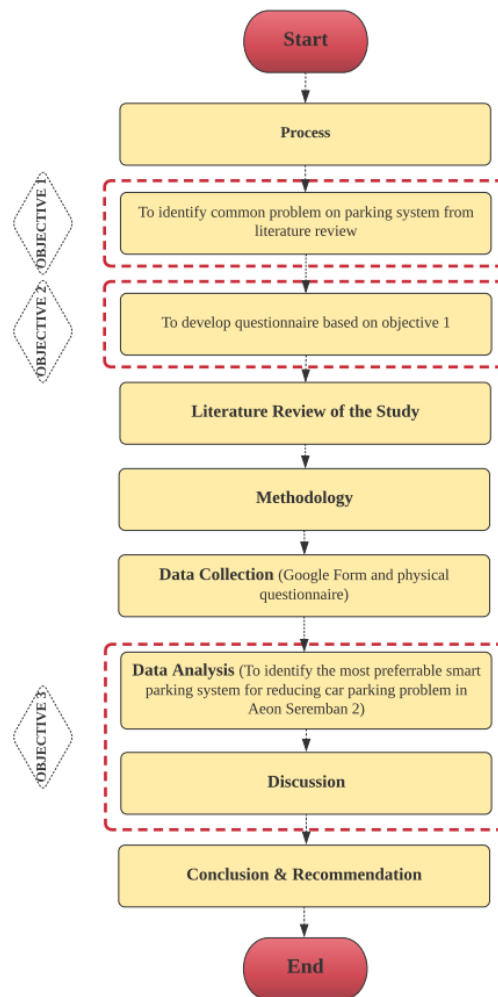


Figure 1: Methodology flowchart for the study

3.2 Simple Random Sampling Method

The sampling method used in the survey is the simple random sampling method. In simple random sample, every member of the population has a chance of being chosen to answer questionnaire. This method can be considered as the simplest method as compared to the other methods. The author will first identify the population of workers who work in AEON Seremban 2 before requesting them to answer the questionnaire. Questionnaire will also be distributed to those workers from other departments who parked their vehicle in AEON Seremban 2.

3.3 Data Collection Technique

The author collected all the data from both Google Form and physical questionnaire so this will require the author to analyse all the data collected in both automatically and manually method. Automatically refers to the data will be keyed into a respective software whereas manually refers to the data need to be analysed by the author itself.

3.4 Questionnaire Data Analysis

Table 1, as are all tables, should be referenced in the text. Items in the table can be aligned to the cell-centre, the right, or the left whenever appropriate. All tables must have a caption that is aligned left. Only horizontal lines should be used within a table, to distinguish the column headings from the body of the table, and immediately above and below the table. Tables must be embedded in the text and not supplied separately. Although all the responses can be accessed within the Google Form itself but

sometimes it is difficult to sort through and analyse every single information. Fortunately, Google Form can store and organise all the information obtained in a spreadsheet with Google Sheets. By clicking the “create spreadsheet” icon on the top right of the Google Form. It will then show up a menu with two options to choose from which are “create a new spreadsheet” and “select existing spreadsheet”. Generally, the option of “create a new spreadsheet” will be chosen. This will automatically generate a new spreadsheet and it will open in a new tab automatically. All the information and questions will be shown in each row and column. Lastly, there are various types of options to choose from to perform the data including line charts, area charts, columns chart, bar charts, as well as pie charts. Data can be classified and put into various types of charts according to suitability and personal preference. Data obtained through manually method will be first analysed by the author before they are keyed into a software called Microsoft Excel. Microsoft Excel is a very useful and thunderous program for data analysis and documentation. It is a spreadsheet containing several columns and rows. It features calculation, graphic tools, pivot tables, as well as a macro programming which is Visual Basic for Application (VBA). Data is then keyed into Excel for further analysis and categorised into various types of charts based on suitability and personal preference.

4. Results and Discussion

Results and discussion will include the results of the data analysis and reveals the findings of this study by interpretation of data. There are 3 sections in the questionnaire which are Section A – Demographic of Respondents, Section B – Common Car Parking Problems Faced in AEON Seremban 2, and Section C – Suggested Smart Parking System.

4.1 Upgrading current parking system to smart parking system

There are 67 of respondents (98.53 %) who agrees to upgrade the current parking system to smart parking system in AEON Seremban 2 whereas there is only 1 respondent (1.47 %) who is unsure about that. The mean value of this question is 1.03 whereas mode and median are having the same value which are 1.00 (Yes) which means majority of the respondents agree to upgrade the current parking system to smart parking system in AEON Seremban 2. Figure 2 is displayed as below.

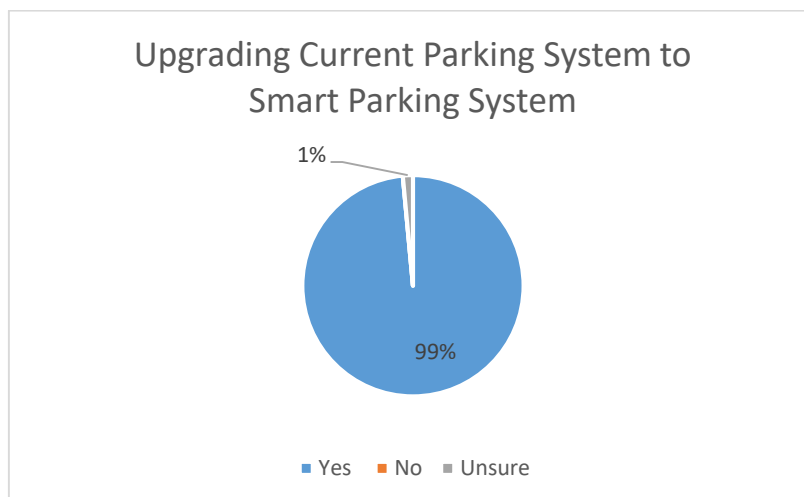


Figure 2: Upgrading current parking system to smart parking system

4.2 Level of Difficulty to Search for Vacant Parking Space in AEON Seremban 2

Based on the data obtained, there is only 1 respondent (1.47 %) stated that it is easy to search for vacant parking space in AEON Seremban 2 whereas there are 9 respondents (13.24 %) and 38 respondents (55.88 %) stated that it is neutral and difficult to search for vacant parking space respectively. Meanwhile, there are 20 respondents (29.41 %) who stated that it is extremely difficult to

search for vacant parking space in AEON Seremban 2. The mean value is 4.13 and mode and median have the same value which is 4.00 (Difficult). In a nutshell, it means that majority of the respondents are difficult to search for vacant parking space in AEON Seremban 2. Figure 3 below shows the chart of level of difficulty to search for vacant parking space in AEON Seremban 2.

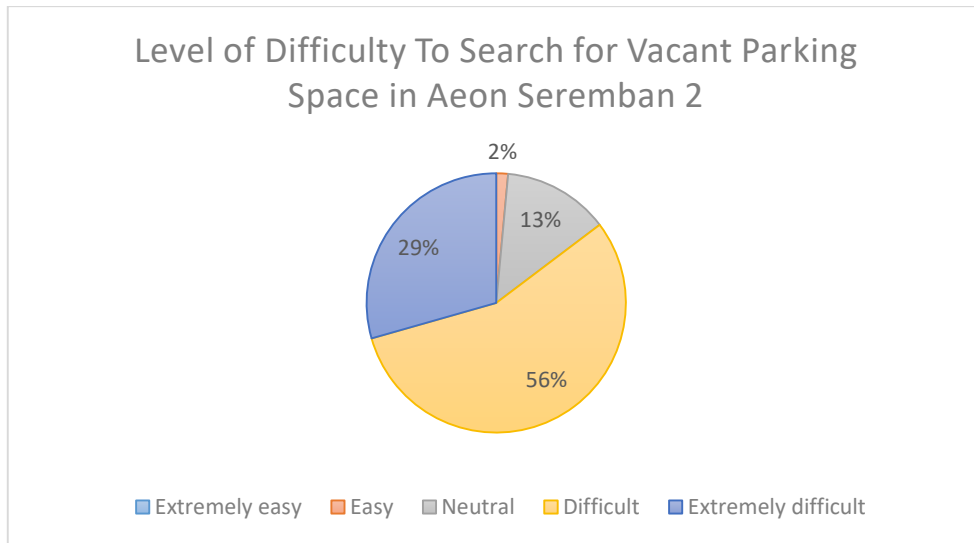


Figure 3: Level of difficulty to search for vacant parking space in AEON Seremban 2

4.3 Types of Smart Parking System

Based on the data obtained, there are 29 respondents (42.65 %) who suggested to implement Parking Guidance and Information System (PGIS) whereas there are 22 respondents (32.35 %) suggested to use transit-based information system. At the same time, there are 12 respondents (17.65 %) suggested to replace the current parking system in AEON Seremban 2 with smart payment system whereas another 4 respondents' (5.88 %) suggestion are e-parking. There is only 1 out of 68 respondents (1.47 %) who suggested to use automated parking system. The mean value of this question is 1.91. The mode in this question is 1.00 (PGIS) and the median is 2.00 (transit-based information system). In conclusion, most of the respondents prefer to replace the current parking system in AEON Seremban 2 with Parking Guidance and Information System (PGIS). Figure 4 is shown as below.

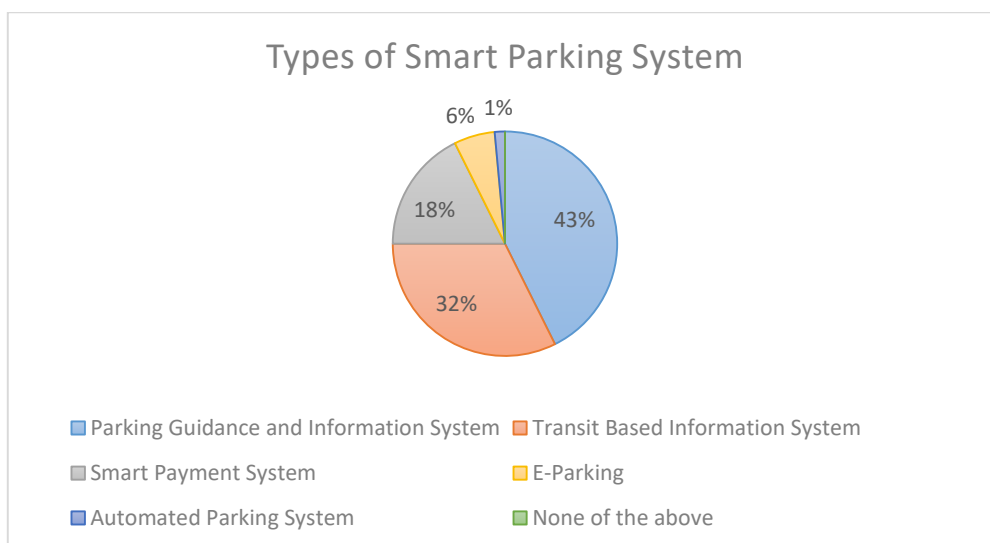


Figure 4: Types of smart parking system

4.4 Discussion

There are more than 50.00 % of the respondents who rated the current parking system in AEON Seremban 2 as poor and average when they are given 5 choices to choose from. Meanwhile, there are also 3 respondents who rated the current parking system as extremely poor. The main reason why they have rated the current system in such way was probably due to unsatisfactory towards the current parking system now. 19 out of 68 respondents are not sure whether to recommend a new smart parking system but there are 49 respondents who strongly recommended AEON to recommend a new smart parking system. 67 of the respondents agree to upgrade the current parking system in Aeon Seremban 2 to a new smart parking system. They were given 6 choices to choose from which are Parking Guidance and Information System (PGIS), transit-based information system, smart payment system, e-parking, automated parking system, and none of the above selection. 29 out of 68 respondents agree to use Parking Guidance and Information System (PGIS) to replace the current parking system in Aeon Seremban 2. Hence, PGIS is to be recommended to the management of AEON Seremban 2 to replace the current parking system as it has the highest frequency.

There are many advantages which Parking Guidance and Information System (PGIS) can bring to the drivers such as improving drivers' parking experience, improving the chances in finding a vacant parking space, as well as locating vehicle in the car park. In the other way, PGIS also indirectly helps drivers to reduce searching time which will lead to decrease of traffic congestion.

5. Conclusion

This research contributes to the management of AEON Seremban 2 in several ways. One of the main contributions from this research is to propose the most suitable smart parking system to overcome the parking problem in AEON Seremban 2. The proposed suitable smart parking is chosen based on the choice from the majority. In short, this research has finally identified that Parking Guidance and Information System (PGIS) to be proposed to AEON Seremban 2. Overall, this study had achieved its objective as stated. However, there are still some unforeseen weaknesses appeared in this study. Thus, these weaknesses should be improved in order to make this study to be more reliable. There are several suggestions to improve the strength of further study which are increasing the size of population so there will be more respondents required to answer questionnaire so the data obtained will be more reliable, expanding the scope of the study to other public building as well such as hospital, commercial buildings, as well as government buildings, and conducting open-ended question regarding common problems faced in parking lot so as to identify more unpredictable problems.

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