

Development of an Automatic Allocation Parking System

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Abstract

Today's people drive cars when they go out. As the number of cars increases, the demand for parking spaces in the parking lot also increases. Due to the lack of parking spaces in the parking lot, people spend more time looking for parking spaces after entering the parking lot, and also consume a lot of car oil. There is no any other parking system that has the ability to automatic allocation parking space for user. This is the reason for making this system. Learning from other similar systems, it is decided that this project is to develop a new parking system that will encompass some functions from the existing systems, but the system will automatic allocation parking spaces for user. To gather the required information, the project uses literature review to determine how this type of system functions and how it is made. Then to make a questionnaire cantered on the users' previous experience on existing systems. Lastly, to make a comparison of existing systems and to analyze the systems strengths and weaknesses to determine what functions to add to this new system. A total of 54 respondents answered the survey of the project. The development process will begin and be completed. Then extensive testing will begin to test all the functions to see if the system has any bugs and errors.

Keywords: automatic, parking lot, system, functions

1. Introduction

A parking lot is a designated area where cars are parked for a certain amount of time. Since cars are the main form of transportation in the world today, in fact, there are even different types of parking lots, ranging from public, private, multi-storey, and even automatic parking lots [1] being developed in urban areas. Some may also ask to pay for parking services. Technology and infrastructure developments have also led to different types of parking systems. This includes a parking guidance system, automatic parking system, vehicle built-in parking assistance system, etc. The purpose of this kind of parking is to reduce searching and parking time and petrol [2].

In the 21st century finding a free car parking slot has become a mind-numbing process, especially for people who travel in the morning to work, attend classes or are following their daily routine, they find it highly difficult

and challenging to get a parking space to them [3]. Even paying parking lots have problems finding parking spaces. Nowadays, the demand for parking spaces is gradually increasing [4], resulting in a shortage of parking spaces in some parking lots. Many drivers have to spend time looking for an empty parking space after entering the parking lot [4], which also makes the parking lot crowded. In addition to wasting the driver's time looking for it, it also makes the driver feel irritable. One example is a shopping mall. The shopping mall which is the heart and soul of the city is one of the focal points of attraction for the public. The parking bay of the shopping mall is congested with vehicles causing a big traffic jam as a usual scenario during the weekends. The shopping mall personnel find it difficult to manage the deadlock situation. Due to the inefficiency of the parking system, vehicles are parked even at the roadside nearby the shopping mall. This hectic problem is addressed in a few of the national newspaper yearly [5]. But the situation

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remains the same even after applying different strategies to alleviate the problem. The root cause of the problem analyzed is the poor parking system employed in the shopping mall. When the problem is closely inspected, the reason for the traffic congestion is not because of lack of parking space but due to the lack of efficient scheduling of vehicles to the parking space. To alleviate the problem, the parking system should implement proper scheduling measures to schedule the vehicle effectively to the appropriate parking region without compromising the precious waiting time of the customer. This paper proposes a prototype Web-based automatic parking allocation system to solve this problem and save users more time when looking for parking spaces. Let the user feel that the parking system is not only convenient but also easy to operate. It also allows parking lot owners to use my system to reduce unnecessary costs such as maintenance costs, machine costs, machine operator costs, etc. For example, when the driver arrives at the entrance of the parking lot, he only needs to scan the QR code at the entrance and fill in the license plate number and some other information. Then the system will automatically arrange a parking space for the driver. The driver only needs to park according to the parking space provided by the system and does not need to drive around in the parking lot in order to find an empty parking space.

2. Literature Review

In public or private structures, an automobile parking system is a solution that consists of barrier gates, an access control system, and an automated parking system. With the use of the vehicle detecting sensors system, automobile owners may quickly find and reserve a parking place at any lot they feel is practical. The introduction of a simple payment method also improves the convenience of vehicle entry and exit. To allow a vehicle to enter and exit, the system uses access control, tickets, and tokens. The barrier gate will lift after the visitor car has a ticket or token from the entrance ticket or token dispenser, allowing it to enter the parking area. When a visitor wants to leave the premises, they can pay the parking fees at the parking payment machine or directly to a staff member in the business's reception or till area. The barrier gate will raise when the bought ticket or token is inserted into the ticket or token collecting device, allowing the tourist vehicle to leave the structure. Most of the parking lot systems are applied to shopping plazas, commercial buildings, high-rise residential buildings, etc [6].

Car parking is one of the primary challenges for transportation and traffic management around the world due to the rising rate of private car usage in metropolitan areas as a result of the quickly expanding economy, negligent regulations, and subsidies. Parking is becoming a barrier to through-traffic operation, as shown by the synchronisation between parking policies and traffic management.

Even if judgments are made on an ad hoc basis while developing policy, it is still accountable for the inefficient use of resources. Therefore, it is important to comprehend parking choice behaviour and actual parking space demand. Numerous studies have been conducted over the past three decades to assess parking characteristics, gauge parking demand, and examine driver behaviour when selecting a parking place.

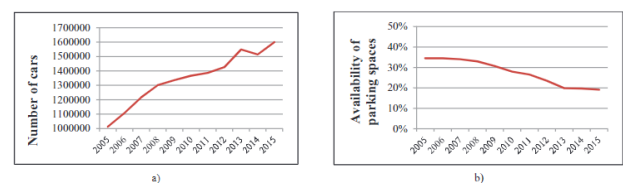


Fig.1. Dynamics of a) the number of private vehicles and b) the availability of parking spaces in St. Petersburg

Due to the rapid global rise of automobile auto mobilization, the issue of organizing permanent storage of cars is currently important. In St. Petersburg, the number of private vehicles has nearly tripled during the last ten years [7]. In the meantime, the number of parking lots and garages gradually declines as they are viewed as transient structures and are slated for demolition, freeing up significant areas for future construction of other structures such as roads, factories, corporate centers, etc. In addition, there are infill developments, primarily residential structures, and public institutions, all around St. Petersburg, and the majority of them lack parking spaces or have fewer spaces than the actual number of automobile owners.

This article [4] incorporates all of these factors and offers a cutting-edge analysis of models and studies on the parking system. Parking-related issues, parking features and their applications, driver choice behaviour, demand model development taking into account various elements, and policy evaluation as an essential component of the urban transportation system are all covered in detail. Despite being underdeveloped, the authors discovered that the research suggests that during all phases of planning and policy formulation, more focus should be placed on metrics such as ease of access, walk time,

parking costs, parking guidance and information systems, management, etc. When seen collectively, the studies presented present insightful data about the overall parking infrastructure. It also gives planners and policymakers vital data for building, planning, and assessing parking systems.

According to [8][9][10] will talk about the challenges of locating parking spaces in privately owned parking lots (such as those at malls, offices, or apartment complexes) and the cutting-edge solutions used in the market. Most persons who have ever operated or ridden in a vehicle have unavoidably run into these problems.

First, the unnecessary time spent merely searching for parking spaces, particularly during busy times like weekends or holidays [9]. Without finding that one available parking space, one could waste a lot of time burning expensive fuel. Occupancy sensors detect the number of parking spaces that are currently available in most mall parking lots and display it at the entrance to each floor of the parking lot, making it easier for people to find a vacant place. Is this, however, truly enough? Even though we are aware that there is parking space available, we do not yet know where it is or how to get there. These issues can be summed up as a consumer's lack of knowledge regarding parking availability, detection, and wayfinding.

Second, there are not many ways to pay for parking [8]. Today, the majority of parking lots still only accept cash payments made manually at payment counters or automatically at machines. In this area, where more convenient payment methods are being deployed, progress is being made. You can avoid searching your wallets for spare change by using cashless purchases like TouchNGo cards and Visa Debit cards, which are instances of this. However, if you still need to physically reload your payment cards, there would be a problem with running out of funds.

Third, parking systems that rely on tickets are unreliable and ineffective [8]. When cars line up outside parking lot entrances while drivers manually take admission tickets or scan their credit cards, traffic congestion can result. This all goes against the concept of a "smart city," because time is lost by adding together these minor inefficiencies.

3. Results

Automated parking systems help to speed up the process of paying for parking tickets. This is very prominent among many shopping malls and universities across the world. People in the survey heavily rely on the system to be efficient and fast to make the process of parking much quicker than before the automated parking system. In the

system that the project is developing, it has some features that will attract many users including automated allocation of parking spaces, a rewards system for user's continuous use of the system and an easy-to-use payment system.

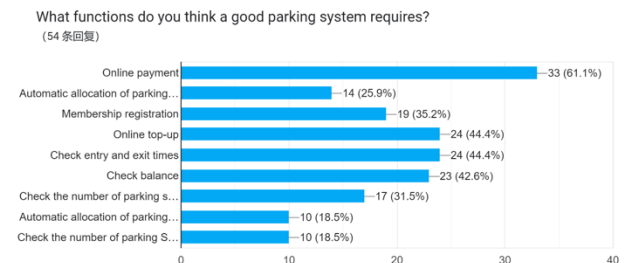


Fig.2. Bar chart of the possible functions to include

Table 1. Functions Respondent

Response	Frequency	Percentage
Online payment	33	61.1%
Automatic allocation of parking spaces	24	44.4%
Membership registration	19	35.2%
Online top-up	24	44.4%
Check entry and exit times	24	44.4%
Check balance	23	42.6%
Check the number of parking spaces available	27	50%

Fig.2 and Table 1 shows what functions all 54 respondents think a good parking system requires. Most of the respondents think that online payment is needed, there are 33 respondents choose online payment, which covers 61.1% of the total respondents. There 24 over 54 respondents think the automatic allocation of parking spaces, online top-up, and check entry and exit times is required in a good parking system. There are only 19 respondents who think membership registration is a good function. 23 respondents choose to check their balance, and 27 respondents choose to check the number of parking spaces available, which covers 50% of all respondents.

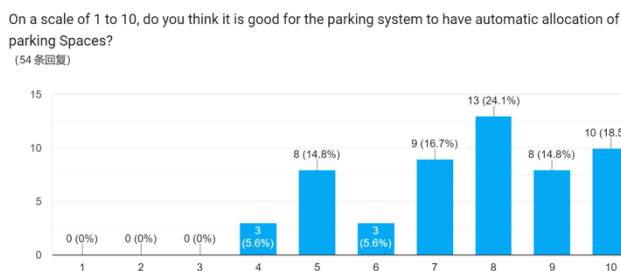


Fig.3. Likert Scale of Respondent

Table 2. Likert Scale Respondent in Percentage (%)

Response	Frequency	Percentage
1	0	0%
2	0	0%
3	0	0%
4	3	5.6%
5	8	14.8%
6	3	5.6%
7	9	16.7%
8	13	24.1%
9	8	14.8%
10	10	18.5%

Fig.3 and Table 2 shows that all 54 respondents agree or disagree that a good parking system requires automatic allocation of parking spaces. The response is from 1 (Strongly disagree) to 10 (Strongly agree). There is no respondent choose 1 – 3 points on the scale. 3 respondents have chosen 4 points and 6 points on the scale. 5 points and 9 points on the scale are chosen by 8 respondents, which covers 14.8% of all respondents. Total of 9 respondents choose 7 points on the scale. Most of the respondents choose 8 points on the scale, which covers 13 respondents, a total of 24.1% of the total respondents. 10 over 54 respondents which cover 18.5% of all respondents strongly agree that a good parking system required automatic allocation of parking spaces.

4. Conclusion

Today's people drive cars when they go out. As the number of cars increases, the demand for parking spaces in the parking lot also increases. Due to the lack of parking spaces in the parking lot, people spend more time looking for parking spaces after entering the parking lot, and also consume a lot of car oil. My system can help drivers solve the time-consuming problem of finding a parking space, so that the driver knows that the parking lot is full, and does not need to enter the parking lot and circle in order to find a parking space. Furthermore, my system also helps owners reduce unnecessary expenses, such as system maintenance and other expenses. Because my system only needs to arrange one or two staff members and able to manage the entire parking lot.

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Authors Introduction

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Currently, Dr. Shayla Islam is an Associate Professor in UCSI University, Malaysia. She has completed PhD degree in Engineering from Electrical and Computer Engineering (ECE) department at International Islamic University Malaysia (IIUM) in 2016 under Malaysian International Scholarship (MIS). She completed her MSc. at the department of Electrical and Computer Engineering in International Islamic University Malaysia in 2012. She completed her BSc. in Computer Science and Engineering from International Islamic University Chittagong, Bangladesh. Dr. Shayla has awarded a Silver medal for her research work at International Islamic University Malaysia. In consequences, she has also awarded a Young Scientist Award for the contribution of research paper at 2nd International Conference on Green Computing and Engineering Technologies, 2016 (ICGCET'16), Organized by the Department of Energy Technology, Aalborg University, Esbjerg, Denmark. Her current research interests include data communications and networking, computer networks and wireless communication, network mobility in heterogeneous network, computer architecture & cloud computing. She published more than 70 papers in international journals and conferences (WoS/ISI/ESCI and Scopus indexed). She works as a reviewer for many international conferences as well as journals.