

Smart Parking Application for Parking System

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Abstract

Now a days, people are increasingly demanding parking lots, and their security awareness is most important for parking. Smart Parking Mobile Application for Parking System has become a development trend. The development of new technologies such as information and communication has led to the increasing automation of parking lots, and unmanned services have become the norm. Smart Parking Mobile Application for Parking System has realized networked data sharing through network platforms. In this paper, we discussed the multiple subsystems and adopts technologies of the Smart Parking Application for Parking System with help of information technology. This system is to solve the problem of car driver or owner difficulties in finding parking spaces, avoid blind parking, parking reservation services for parking slots ,improving parking efficiency, improve the utilization of the traffic road and alleviate the traffic congestion.

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I. INTRODUCTION

Smart Parking Application for Parking System is generally composed of multiple subsystems such as entrance and exit management, parking guidance, parking space guidance, reverse vehicle search, automatic license plate recognition, parking space reservation, self-service payment and adopts technologies such as central charging mode and long-distance identification to realize intelligence. The Smart Parking Mobile Application for Parking System can help the owner to quickly find the parking space, avoid blind driving, and eliminate the troubles of the owner to find the car, effectively improve the utilization of the traffic road and alleviate the traffic congestion. Looking at the popularity of Internet technology, most organizations prefer to process their systems online. By doing so, their users can easily access the system no matter where they are. Obviously, the Internet has become a key issue. Therefore, it is used in various fields such as education, health, tourism and business; each of them is trying to profit from it. As a result, the Internet has become easier to use and has grown into a larger virtual community than

many countries.

II. LITERATURE REVIEW

Drivers in Kuala Lumpur spend an average of 25 minutes per day in search of parking spots, according to a recent study by the Boston Consulting Group (BCG) called 'Unlocking Cities.' This amounts to 6.3 days a year [12].

According Long-term search parking spaces cause driver's anxiety, irritability and loss of patience, so they will ignore their laws and ethics and park their cars in places that should not be parked, making the roads smaller and the roads unable to reach the originally designed traffic. It directly led to road congestion. Parking in Johor Bahru indiscriminately has become the norm for Johor Bahru drivers. City Councilor Neo Khai Beng said that the "ignorance" attitude of many drivers in the city caused their vehicles to stop in disorder, narrowing the streets and causing frequent vehicle blockages. Neo exclaimed that the city seems to have no law enforcement to train these unforgiving drivers . The results show that people living in Kuala Lumpur spend about 53 minutes trapped in traffic jams every day, according to a study conducted by Boston Consulting Group

(BCG) known as "Unlocking

Cities." It is estimated that about 30 per cent of cars that travel around the city at any given time do so when the driver is looking for a parking space. In addition to frustration factors, these cars are causing traffic congestion, which survey respondents consider the most important social change affecting the parking industry. From an environmental perspective, this means that wasted fuel and carbon emissions are immeasurable. "" this is a newly emerging parking research trend from the international parking association (IPI) in 2012 ([14]. Congestion and parking are also interlinked, as the search for a parking spot causes additional delays and damages local circulation. In the heart of a big city, cruising may account for more than 10 percent of local traffic because drivers can spend 20 minutes looking for a parking spot. The reasons for traffic jams are often complex, but they all come down to having too many cars on the same street at the same time. The most common cause of repeated traffic congestion is the lack of vehicle capacity on the road Too much traffic or too few roads. Or accidents, failures, construction and other random traffic limiting events are typical causes of traffic congestion. Lack of parking is not the only cause of traffic congestion however, it is a major factor. Drivers looking for free or cheap roadside parking can bypass the street just to save money and traffic congestion. Off-road parking too far from shopping or retail may also cause drivers to circle for more convenient parking. The difference in our carbon footprint makes sense if we can reduce the time it takes for drivers to find a parking space in a fraction of the time. [3].

III. PROBLEM STATEMENT

Chaotic parking was triggered by the full amount of parking spaces, leading directly to a traffic jam. The government has therefore also hoped to combine the remaining resources of different parking lots in the area, but this is often not accomplished by the complicated and varied parking network. The systems of different parking lots cannot be compatible, the system cannot display the real parking space, and cannot respond to the parking in time. The vacancy is

given to the driver. Only the LED road signs can be used to identify the vacancy status of several parking lots in the main intersections. It cannot meet the parking requirements of the

whole city, nor can it guarantee the effective time of the vacancies. The driver was told that it was full when he arrived at the parking. This caused the driver to distrust the LED area guide. This makes it difficult for drivers to plan their own trips, and often a lot of time is wasted in finding parking spaces [5]. The system is complex in construction, many types of equipment, high engineering cost, high operating cost and difficult maintenance. Eventually, decision-makers will be able to vote in the decision-making process, and only in the local area, the expected effect is not obvious. The system's vehicle traffic data collection is extremely inaccurate, wrong data, wrong guidance, and ultimately make drivers complain.

IV. SIGNIFICANCE OF RESEARCH

To Base on the above issues, the Smart Parking Application for Parking System in Malaysia allows owners to reserve parking spaces through an online portal. The owner will definitely reduce the time to find a parking space on the road. And therefore, the time for people to find parking spaces on the road is reduced, the traffic on the road is reduced, and congestion is reduced. In addition, city managers can manage roads more effectively because people are no longer on the road and reduce road congestion. At the same time, the parking lot administrator can effectively manage the parking spaces in the parking lot and can also reduce the workload of the management personnel.

The concept of Smart parking has become more and more popular and popular among people due to the difficulty of parking. Especially in urban areas, land resources are more limited, and parking problems are everywhere. The voice of smart parking is also growing. The program should provide users with parking space alerts that are nearly accessible. With the successful implementation of smart parking, the cost of traffic congestion, the costs associated with waste gas fuel and the time spent on parking due to low parking capacity will be significantly reduced [7].



Figure 1: Smart Parking Application

Overcome Smart Parking Application can not only implement intelligent road parking, but also bring considerable economic benefits to the roadside parking operation management department. Through various means of charging, it can reduce the manpower and material resources of parking management, as well as the parking guidance function, and can arrange parking reasonably. Improve parking space utilization and turnover rate, reducing the time spent by drivers looking for parking spaces. It can also improve traffic conditions.

V. METHODOLOGY

A. Smart Parking Application Architecture

Smart parking system proposed PGI system should be used as the basic structure. Meanwhile, this system includes a driver request processing center (DRPC) and Smart Parking Allocation Center (SPAC). In Figure 1, parking resource management centers to collect and update in real time all parking information that spread through the Internet or VMS. The DRPC collects driver parking requests, and the system intelligently allocates and reserves parking spaces for drivers based on driver requirements and parking resource status.

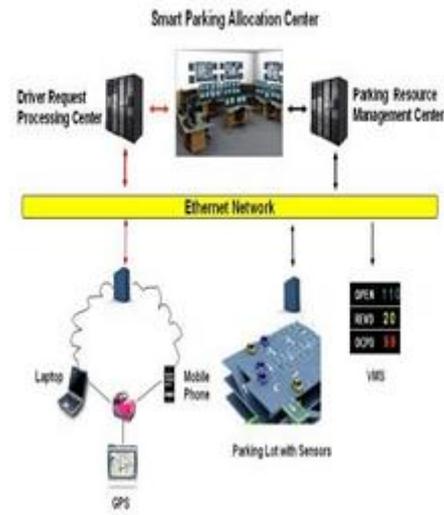


Figure 2: Smart Parking Application Architecture

In addition to this, [6] claim the system is modular and service-oriented, including web applications for parking operators, web applications for end users, and two types of mobile applications, one for end users and one for Parking controller. In Figure 2, the proposed system allows the operator to customize the parking space and to define the details, and then the end user has predetermined parking spaces and can be directed to the most suitable parking space, there may also be places of interest in the cloud, the controller to monitor all vehicles parked in their area. Another important feature is that the end user can share their awareness of the occupancy of the parking lot, which is not very helpful when the exact amount is accessible in the parking area. [6].



Figure 3: Smart Parking Application User Architecture

In addition, [1] claim Smart parking systems should be based on a sensor-based approach and a multi-layered architecture for achieving modularity and scalability, as well as providing different services for different parking system users. The framework shown in Figure 4 consists of four layers: sensing, networking, middleware, and application layers.

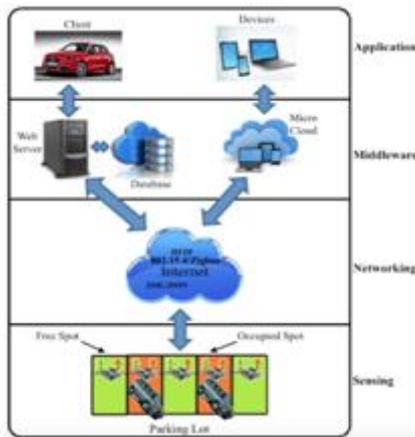


Figure 4: Layer of Smart Parking Application
Sensing layer, which defines a platform in which RFID devices embedded in the parking lot to detect the presence of the car and strategic points in the parking lot and parking lot are used to identify the car based on a unique mapping between the RFID tag and the car. The network layer proposes different communication modes in this layer to support communication from the primary sensor and anchor sensor to the sensor gateway and from the gateway to the parking user (parking driver, remote user and parking owner). The middleware layer, which is a layer that performs context recognition using intelligent algorithms and efficient visualization techniques to present intelligent services and user-friendly interfaces to users. The application layer, which is a layer that defines different services and provides them to different users. The client device has connected to the parking database via TCP/IP.

B. Smart Parking Application Detection Technology

In order to develop smart parking system, it requires several pieces of equipment: ultrasonic sensors, LED indicators, indoor display boards, outdoor display board (s), zone control unit (ZCU), central control unit (CCU), network switch, telephone cable and management

software .The ultrasonic detector over a telephone cable sends its state information to the zone control unit, the zone control unit receives the information collected and transmitted to the central control unit, which processes the collected data and sends instructions ZCU and LED panel [11].

In addition, [10] claim Smart Parking System Detection Technology presented by cloud-based smart parking, the method of achieving this goal is that each parking lot equipped sensor capable of sensing the presence of the car. Info Station operating in the parking area and periodically collect aggregate presence information from all the cars in the area sensor is disposed of, for example, by Wi-Fi, ZigBee, or other short-range wireless technologies. For paid parking, parking optional timer runs between Info Station and sensors. When the parking lot occupancy status changes, information Info Station will be pushed to the Internet cloud Parking Information Center (Info Centre).



Figure 5: Smart Parking Application Detection Technology

On the other hand, Project "smart parking system based on Internet of Things" is mainly used by the server status (Wi-Fi) monitoring equipment. The control unit of the entire system is a microcontroller. Wi-Fi module, IR sensor connected to the microcontroller. IR sensor fed as input into the microcontroller. The microcontroller processes the data and transmitted by Wi-Fi, which received from the mobile phone. The user wants to park the vehicle connected to the parking lot by a specific Wi-Fi network password. IR sensor will send a complete status to the microcontroller data

processing. The microcontroller sends status information to the web page [15].

To add on to the idea, [4] highlighted that the infrared sensor is a combination of an infrared LED and a photodiode. Once the car is located above the sensor, an infrared photodiode is reflected and captured, the receiver will act as a photodiode sensor. Received from the sensor readings will be treated as input, processes it according to the way vacant or occupied.

Parking lots are widely used in our days, and for the automation of parking lots, there are two types of sensors that can be used to help detect vehicles entering or leaving the parking lot. There are invasive and non-invasive sensors. Using intrusive sensors, a car was detected at the time and placed under the vehicle. Although non-intrusive sensors can detect multiple vehicles at the time.

C. Microwave radar

A sensor that is known to be better than other sensors. It can easily detect cars passing through multiple lines and then calculate their speed. This object is then detected by an electromagnetic signal emitted by the reflected signal to complete. The disadvantage of this system is that no additional sensors would not detect the stationary car [8].



Figure 6: Microwave radar



Figure7: Active infrared sensor

D. Active infrared sensor

A sensor commonly used to help detect vehicles. They are less frequent than microwave radar sensors. They are very sensitive to environmental conditions such as fog, snow and wind. This type of sensor is good, because it can emit a plurality of light beams, in order to detect the position and speed of the passing vehicle [2].

Parking Guidance and Information (PGI)

The system or parking guidance system of the Park Guidance and Information (PGI) provides the driver with complex parking information in the controlled area. Such systems incorporate the software for service delivery of traffic monitoring, messaging, and variable message signs storage. Advanced parking lot which uses a range of technology to help drivers find parking spaces empty, car location and improve their experience when returning the vehicle. This includes an illumination sensor and adaptive parking indicators (occupied red, green can be represented, in blue for the disabled; above each parking space), and an indoor positioning system (IPS) [16].

PGI can be divided into two different aspects. This can be used to monitor an entire city or to monitor only specific parking. The above categories are mainly implemented in major cities around the world, such as Japan, the United Kingdom and the United States. PGI offers essentially the same benefits as the aforementioned smart parking system. The main similarity is in decision making. The information provided by the system helps the driver decide how to reach the intended destination and to determine the parking spaces available in the parking facility [17]. PGI can be divided into four different aspects: information dissemination mechanisms, information collection mechanisms, control centers, and telecommunications networks. In PGI, a variable message flag is used to provide the driver with a method to take when looking for a vacancy.

Various sensors are placed at the entrance, exit and in each parking space to detect the presence of the car. The LED lights are connected to the sensor and the sensor is placed in each parking space in the parking lot. This is used to give a parked state. Depending on the sensor, then the occupancy of each point is calculated before giving the output of

the available points. Based on the information obtained, the implemented process will analyze the information to display accurate information for the driver to view. Thus, the telecommunications network can transfer the processed data to other modules [18].

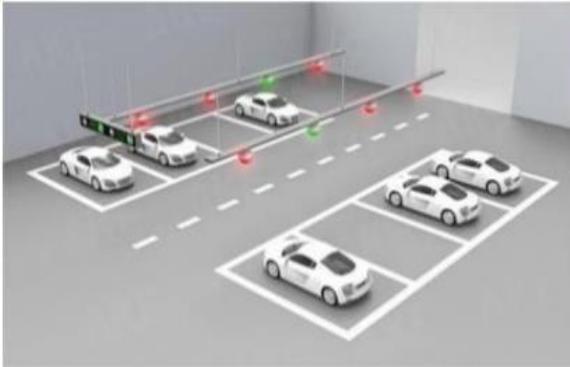


Figure 8: Telecommunications Network

It is also possible to use mobile phones for guidance and the analysis uses the Global Positioning System (GPS) to track vehicles. The map of the driver's current location is sent to their mobile phone based on the current position of the customer based on GPS data and the status of the three nearby parking lots. In addition, parking guidance systems [13] based on network and GIS technology can disseminate information to users via the Internet, mobile phones and/or PDAs. The guidance system can also be used with traditional parking management systems. The parking lot map is printed on a parking ticket with a radio frequency identification (RFID) tag for guidance in order to effectively guide customers so that the designated parking space can be easily located by the customer. And don't worry about forgetting where to specify a parking space when user quit [9].

CONCLUSION

Looking at our time's globe, Internet technology has played a major role in marketing, trade, banking, and so on. Internet technology is helping people to create web applications. A good example is the smart parking application. The project's first move was to build a prototype that was connected to the Internet to make the system easier for users to use. The second step in the project was to create a website that allowed the

prototype of the parking to interact with the website of the process. The aim of this research is to highlight some of the ways in which smart parking applications will help improve the lifestyle of many car owners and save time when parking in an area around the mall, school or any other way around. Despite having met all the goals and requirements, there are still some goals to be implemented in the future to make the project more effective.

REFERENCES

- [1] Bagula, A., Castelli, L. and Zennaro, M. *On the Design of Smart Parking Networks in the Smart Cities: An Optimal Sensor Placement Model. Sensors*, 15(7), pp.15443-15467, 2015.
- [2] Burnett, R, *Ultrasonic vs. Infrared (IR) Sensors - Which is better - MaxBotix Inc.*2019. <https://www.maxbotix.com/articles/ultrasonic-or-infrared-sensors.html>.
- [3] Caluori, L. *Car Parking and Traffic Congestion. Parking Network.*2018. <http://www.parking-net.com/parking-news/skyline-parking-ag/traffic-congestion>. 11 May 2019.
- [4] Chaudhari, P., Kumar, R., Mistra, R. and Jorvekar, P, *Smart Parking System.* PP.2395-0072, 2018.
- [5] Chen, M. and Chang, T., June. A parking guidance and information system based on wireless sensor network. In *Information and Automation 2011. (ICIA), 2011 IEEE International Conference on* (pp. 601-605). IEEE.
- [6] Grazioli, A., Picone, M., Zanichelli, F. and Amoretti, M. Collaborative Mobile Application and Advanced Services for Smart Parking. 2013. *IEEE 14th International Conference on Mobile Data Management*.
- [7] Grodi, R., Rawat, D.B. and Rios-Gutierrez, F. March. Smart parking: Parking occupancy monitoring and visualization system for smart cities. In *SoutheastCon, IEEE* (pp. 1-5), 2016.
- [8] Guerrero-Ibáñez, J., Zeadally, S. and Contreras-Castillo, J. Sensor Technologies for Intelligent Transportation Systems. *Sensors*, 18(4), p.1212, 2018.
- [9] Idris, M., Leng, Y., Tamil, E., Noor, N. and Razak, Z. Car Park System: A Review of Smart Parking System and its Technology. *Information Technology Journal*, 8(2), pp.101-113, 2009.
- [10] Ji, Z., Ganchev, I., O'Droma, M., Zhao, L. and Zhang, X. A Cloud-Based Car Parking Middleware for IoT-Based Smart Cities: Design and Implementation. *Sensors*, 14(12), pp.22372-22393,

2014.

- [11] Kianpisheh, A., Mustafa, N., Limtrairut, P. and Keikhosrokiani, P. Smart parking system (SPS) architecture using ultrasonic detector. *International Journal of Software Engineering and Its Applications*, 6(3), pp.55-58, 2012.
- [12] Lim, J. *People in Kuala Lumpur Waste 25 Minutes of Their Lives Everyday Looking for Parking*. [online] SAYS.com. 2018. <https://says.com/my/news/people-in-kl-waste-this-much-time-everyday-looking-for-parking>. 2019.
- [13] Liu, Q., Lu, H., Zou, B. and Li, Q. (). Design and Development of Parking Guidance Information System Based on Web and
- [14] GIS Technology. *6th International Conference on ITS Telecommunications*. 2006.
- [15] Smart Application for parking, S. *SmartApp*, 2019. <https://www.smartparking.com/smartpark-system/smart-app>.
- [16] Rao, Y.R., Automatic smart parking system using Internet of Things (IOT). *Int. J. Eng. Tech. Sci. Res*, 4, pp.2394-3386, 2017.
- [17] Shin, J., Kim, N., Jun, H. and Kim, D. . A Dynamic Information-Based Parking Guidance for Megacities considering Both Public and Private Parking. *Journal of Advanced Transportation*, pp.1-19, 2017.
- [18] UKEssays. *A Parking Guidance and Information System Information Technology* 2013. <https://www.uniassignment.com/essay-samples/information-technology/a-parking-guidance-and-information-system-information-technology-essay.php#reference>. 2019.
- [19] Vera-Gómez, J., Quesada-Arencibia, A., Garcia, C., Suárez Moreno, R. and Guerra Hernández, F. An Intelligent Parking Management System for Urban Areas. *Sensors*, 16(6), p.931, 2016.

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