Development of an IoT-Smart Parking Mall Sensor Using Blynk and ThingSpeak

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Abstract In almost all of Malaysia's malls, maintaining the parking system has become a major problem. Most malls in Malaysia have trouble designing a strategy that allows their parking slots to be optimized. Through the paid parking scheme, some malls earn more profit, sadly the system disappointed the clients. The conventional parking system often faces similar issues as it causes problems for customers, such as finding vacant space to park their car and wasting a lot of time. The aim of this analysis is to propose a parking mall sensor, through the use of the Internet of things (IoT). The paper applies the parking mall's sensor system that helps visitors to access a parking space without wasting their time, and the existence of this sensor also allows the mall's management to collect data on how many cars are parked and how long each slot is parked. The purpose of this research is to improve the current system for parking management designed by the IoT, with the intention of being used as a reference for parking management in a shopping complex.

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1 Introduction

In large cities, such as Kuala Lumpur, shopping complexes and malls have been the favorite place for urban society to go. It has already become part of their lifestyle to visit shopping malls. Not unexpectedly, in shopping malls, they can find almost anything. Mall management has equipped its clients with different services to make customers feel better on their visit to the shopping centers, one of which is parking spaces.

The parking management dilemma can be viewed from many angles in recent studies in urban cities. This leads in an irritating challenge for drivers to park their because it is very difficult to locate a parking slot. To find parking space, they usually waste their time and effort and end up parking their vehicles to find a space on the streets. Worst of all, people, especially during festive seasons and peak hours, fail to find any parking space. Therefore, with the introduced smart management system, parking by using sensors to identify available slots and direct users to the location in some malls in Malaysia can be one of the solutions to this issue (Olanrewaju and Arman 2019).

The Internet of things (IoT) is a well-known communication protocol suitable for any applications (Hafidz et al. 2020). Smart parking is a very simple example for an everyday citizen on how the IoT can be used quickly and efficiently to provide various services to different people. The proposed application is user-friendly and can be used by even non-technical individuals via mobile devices. Users can check for a free parking spot from anywhere in the world using this application. The proposed framework offers well-organized control of car parking by independent localization of parking spaces. The traditional reservation-based system of car parking has a room and time limit. The proposed smart parking solution offers accessible free parking space that saves time and fuel and decreases urban air emissions and congestion. The new IoT-based parking platform allows data collected from sensors to be linked, processed, automated, and implemented effectively, making smart parking possible (Vakula and Kolli 2018).

To give user updates to users about the availability of online parking, the PaaS Blynk Android app is used. A resource management approach is proposed based on real-time sensor data. A complex parking tariff and load-handling plan for parking spaces in parking malls would benefit from this optimization process (Mishra et al. 2019).

In the cloud model, ThingSpeak is used as a medium for transmitting sensor data and visualizing data. Data such as how many vehicles have been stored and how long the car has been parked in each slot could be preserved (Bharadwaj et al. 2020).

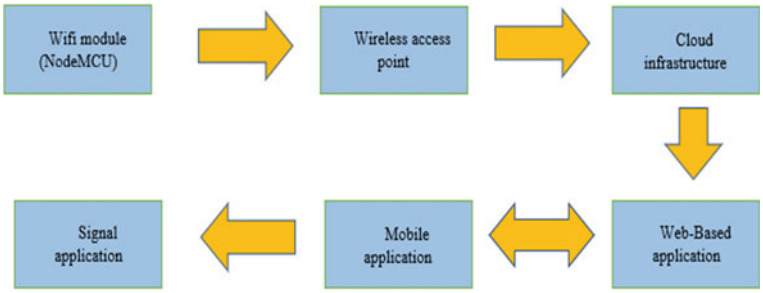

Fig. 1 Flow of application

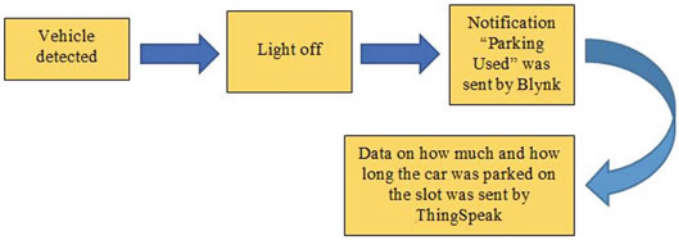

Fig. 2 Flow of parking mall sensor

2 Methodology

For this smart parking sensor, the two important tools needed are Wi-Fi Module named NodeMCU and a wireless access point. These tools will activate the cloud infrastructure, web application, and mobile application. The end user will receive a signal regarding the vacancy of the parking spot. Figure 1 shows the flow application.

More details on the operation are shown in Fig. 2. A sensor will detect the vehicle; hence, a light at the parking spot will turn on if there is a vacant place. If there is no vacancy at the parking spot, then the light is turned off. The user mobile receives notification on vacant and parking in use. For cloud application, the information on the frequency of parking spot used and duration for each parking was stored.

3 Result and Discussion

For this project, we used four components and two applications. NodeMCU is an open-source firmware and development kit that permits one to prototype or build IoT computers. NodeMCU is used to connect the program and computer to the Blynk app. Blynk is a framework that helps us to easily create iOS and Android software interfaces for managing and tracking our hardware projects. Blynk is used when the

sensor is sensed to receive notification from the NodeMCU. ThingSpeak is an open-source Internet of things platform and API for storing and retrieving data from things over the Internet or over a local area network using the HTTP and MQTT protocols. The creation of sensor monitoring applications, location control applications, and a social network of status update items is supported by ThingSpeak. Resistors are used to reduce the current flow. LDR is used as an input to detect the vehicle. LEDs are used as an output when the sensor is active. Figure 3 shows the initial prototype of parking space with circuit assembly at the back.

Figure 4 shows the before and after a vehicle park in a parking space. Observe parking space D2 where the LED light turns on when the parking space is vacant. Once the vehicle moves into the parking space, the green LED turns off. When the parking is empty, the LED will turn on to notice other drivers. This is because the sensor is not detecting any vehicle. It means the sensor is not active.

The next phase of result is to observe the output from the ThingSpeak and Blynk application. For ThingSpeak, there are two conditions. When the parking is available, the line graph increases according to the LED ignition. The next condition for ThingSpeak is when the parking space is used. The line graph decreases to signify

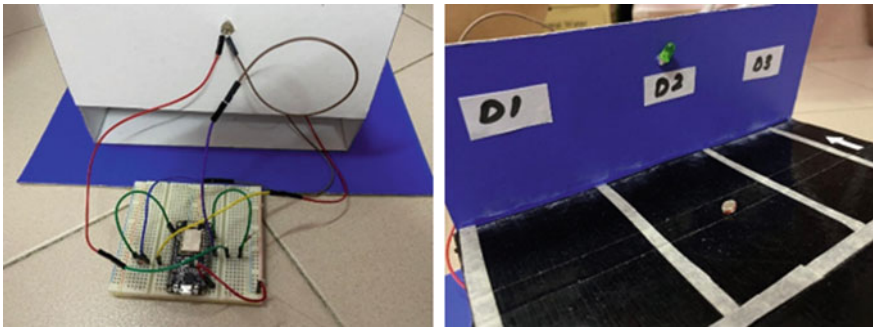

Fig. 3 Prototype of parking space and circuit assembly

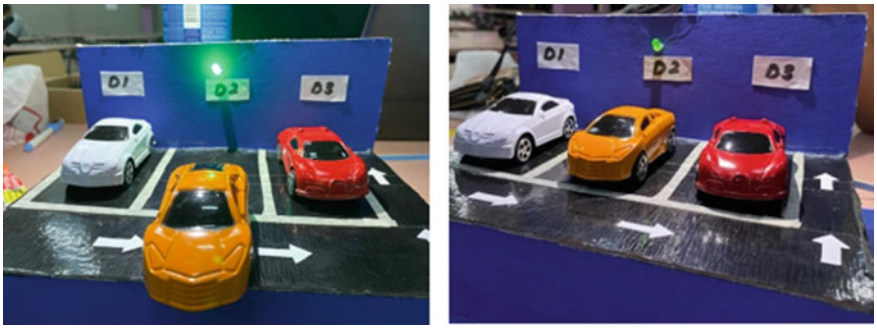

Fig. 4 Before and after vehicle park

Fig. 5 ThingSpeak and Blynk result

that the LED is off. The Blynk application gives notification to smartphones that the parking spot is used.

When the parking was used, the LED will turn off. This is because the sensor is active and detecting a vehicle. Then, the NodeMCU will send data to the Blynk app to pop up the notification "Parking Occupied." ThingSpeak will receive data when the program is running. When the parking is available, the graph will reach to 1025. This is because the sensor is not detecting any vehicle.

After that, when the parking is used, the graph will drop to 980. This is because the sensor detects a vehicle. Figure 5 shows the results of both ThingSpeak and Blynk.

From Fig. 3, it can be seen that this system used an analog input and a digital output. LDR is connected via a wire to the NodeMCU ESP8266. The 3-V supply comes through a resistor with 220 Ω and goes to the first leg of the LDR. Then it goes to the analog pin A0. The second leg goes to ground. We connect to analog pin because LDR is an analog input. LED is connected via a wire to the NodeMCU ESP8266. The connected digital pin D1 reads the LED's state from the first leg of the resistor with 220 Ω. The second leg resistor goes to anode (+) LED to receive supply. Lastly, the other LED leg which is cathode (−) goes to ground. A graph chart from the ThingSpeak is generated to record the data of how many and how long the cars used the parking. The Blynk application sends a pop-up notification to the parking owner/screen monitor for giving alert that the parking is in use.

4 Conclusions

The paper suggests a smart parking solution integrated with the IoT to address the typical challenges faced by the construction management. The concept of the article was applied in many malls in Malaysia, albeit still at an early stage. It is expected that the introduction of the parking mall sensor would assist tenants, parking personnel, and the management of shopping malls. Through this sensor, shoppers can find it easier to park a vehicle in a shopping center.

In the parking mall, this sensor makes it easy to limit the traffic in and out of the shopping center and to maximize the parking area. In the context of simple parking control and allocation, parking workers also benefit from this. We understand that parking slots have not only been a problem for Malaysia in shopping centers, but in other areas also such as parks, tourist destinations, conventional markets, restaurants. As a result, the author hopes that this paper will be helpful in other locations or potential studies for parking issues.

The smart parking sensor promotes sustainable living, travel accessibility, and environmental sustainability issues. The smart parking technology is used to boost levels of efficiency and levels of service in operations. It also benefits from reducing running expenses and raising sales and the valuation of the facility. From conventional support platforms including tollbooth and parking attendants, the proposed system has changed. This includes the use of the Arduino Uno, ESP8266-01 Wi-Fi board, ThingSpeak, and Blynk ultrasonic sensors. Hardware, applications, and network networking are built into the Internet of things, allowing objects to be detected and managed directly through existing networks. This integration enables users to track accessible and inaccessible parking spaces, resulting in increased performance, precision, and economic benefits.

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