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Web based smart parking: IOT microcontroller studies

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Web based smart parking: IOT microcontroller studies

Andie, Fathul Hafidh, Faruq Rahmadani

Universitas Islam Kalimantan Muhammad Arsyad Al Banjari Banjarmasin

*andina777@gmail.com

Abstract. Parking is a temporary stop for a car. The need for parking space is important in the center of activities. The rate of increase in the number of cars is not directly proportional to the availability of parking space, so the available parking space is currently not adequate with the number of vehicles using the parking lot. Moreover, parking land users can not know the available parking location information from a distance. This can cause queues, delays, or congestion and will disrupt the smoothness of traffic if the availability of parking space capacity in place is not able to accommodate vehicles to be parked. For this purpose, this research aims to design and build a prototype to inform the parking location available to prospective users of parking area using web and microcontroller based on ESP8266. This research begins by analyzing and doing system design both hardware and software, then proceed with coding programming. The last stage is a test of tools and systems to find out if the tool has been running properly as planned. The system is designed to be able to work automatically in checking the available parking location conditions and is not available as well as calculating the number of cars passing through the parking gate and informing potential users of the parking lot. The working system of this tool is by reading the microcontroller on the sensors that have been installed behind each parking location to find out the parking conditions and sensors found in the parking gate to find the car passing, then update the database so that it can provide location information parking to users through the website.

1. Introduction

Parking is a temporary stop for a vehicle. In public places such as trade centers, offices, airports and entertainment establishments will lead to the need for adequate parking spaces. The need for parking space is important in the center of the activity as it may cause problems such as queues, delays or congestion and will disrupt traffic smoothness if the availability of road capacity and parking location in the place can not accommodate the vehicles to be parked. The increase in the number of motor vehicles is proportional to the increasing demand for parking lots, while the amount of available parking space can not keep pace with the demand. If this is left then it will be less parking space that is available so that the impact of accumulation queues of motor vehicles.

The system contained in car parks located in multi-story parking buildings such as shopping malls, offices, hospitals, hotels and apartments is not very influential to the parking attendant because the officers are only limited to recording the number of vehicles, receiving payment, and providing parking tickets. Meanwhile, in the process of searching for available parking spots, drivers should find their own parking location, motorists have to go through each floor to look for empty parking spaces. So unconsciously riders need enough time to find a parking space that can be used from every floor.

Just like the parking lot provided Duta Mall Shopping Center Banjarmasin which often occurs buildup queue of motor vehicles that want to park, especially four-wheeled vehicles. One factor of the occurrence of the buildup is the management of parking that has not been maximized. The process of motorists looking for parking locations can not be done from outside the parking lot, but by looking for one by one empty parking location by driving. This can cause parking queues that accumulate and cause the process of finding parking locations to be ineffective and efficient.

Based on the problems that have been described above, then required a systematic parking system that is able to overcome these problems. It takes a system that can provide information to prospective users of the parking lot about available parking locations even before the user enters the parking lot. So it can minimize the buildup of parking queue. To support the design of this tool or system, the researcher tries to use microcontroller with base module ESP8266[1].

2. Methodology

Smart Parking Microcontroller prototype integrated with internet application of internet of things can help for users of parking four wheel vehicle in searching information of parking location which available directly through network connected device by way of accessing web.[5] How to use this prototype simply put the exact distance sensor behind each parking location and LDR sensor along with the laser module on the entrance gate with a position opposite the parking path, to turn on the prototype using a 5v USB adapter. To facilitate the design of the prototype then made the block diagram as follows:
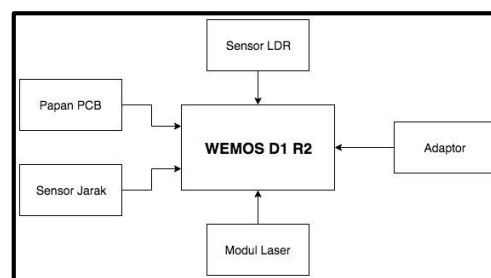

Figure 1. Block Diagram on Prototype

All equipment components such as proximity sensor and LDR sensor are connected to Wemos D1 R2. After all the sensors and modules are installed then connect USB type A to adapter, USB type B to Wemos D1 R2. The functions of the components for this prototype are:

Adapter, as the main power supply input connected to the power supply so that all components connected to Wemos D1 R2 can run in accordance with the programmed ones, and by using the 5v voltage. Wemos D1 R2, as circuit board to connect sensor and some other circuit. Wemos D1 R2 serves as a code storage medium and as the brain to perform the functions that exist in this smart parking prototype tool, including to connect devices with the network through wifi signal. PCB, as a place to connect components one with another.[7] Ultrasonic distance sensor (HC-SR04), to detect the presence or absence of the car being parked in a designated location. Light Dependent Resistor (LDR), functions to read the intensity of light emitted from the laser module to detect the number of cars that cross the road.
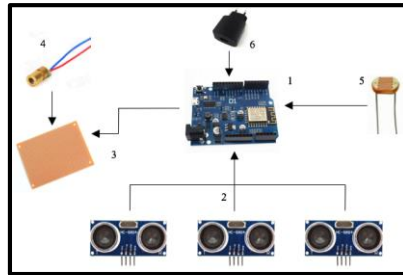
2.1 Tool Model Design

Figure 2. Smart Prototype Model Parking Design

The tool components contained in the Prototype Smart Parking design are : Wemos D1 R2, HC-SR04 Ultrasonic Sensor, PCB board, Laser Module, Sensor Light Dependent Resistor and Adapter.

2.2 Hardware Design

The series to be used in hardware design include:

Control circuit, Wemos D1 R2 is a circuit board based on ESP8266 microcontroller. This integrated circuit (IC) has 11 input / output pins and 1 analog input pin, USB connection, adapter socket, reset button and can also connect with wifi network. Wemos D1 R2 functions as the controller of all module and sensor circuits. ***Mechanical Design***, In the mechanical design consists of planning hardware mechanical design that supports performance. The manufacture of mechanical devices consists of mechanical design planning that supports the performance of the appliance and is appropriate to the actual conditions. This plan consists of setting laying of LDR sensor along with laser module, ultrasonic sensor HC-SR04, PCB, and Wemos D1 R2. **Adapter**, The adapter acts as a primary voltage source in the tool set. The adapter used is 5v in order to enable Wemos D1 R2 along with its modules and sensors. **Ultrasonic Sensor HC-SR04**, The main focus of the tool and system to be built is that it can detect the location of the vacant parking, to be able to detect used Ultrasonic sensor SR-04 is placed in such a way at each parking location.[3] **Laser Module**, The laser module serves to emit a laser beam that is fired towards the LDR sensor to detect a car detector passing the predetermined path.[2] **Sensor Light Dependent Resistor**, The function of the Light Dependent Resistor (LDR) sensor is to detect the intensity of light fired from the laser module.[4] **Software Design**, The design of the software includes writing listring program that will be uploaded on board Wemos D1 R2 using Arduino IDE Software, where the program commands will be executed by hardware.

3. Result and Discussion

3.1. System Initialization

Prototype built with size 49cm x 51cm inside there is entrance gate and parking location, entrance gate is the main entrance for parking access which have sensors to count the number of passing cars and parking location amounting to 3 parking squares with each parking box measuring 6,5cm x 5.5cm. Simulation cars used amounted to 1 piece with size 6.5cm x 4cm x 4.5cm.
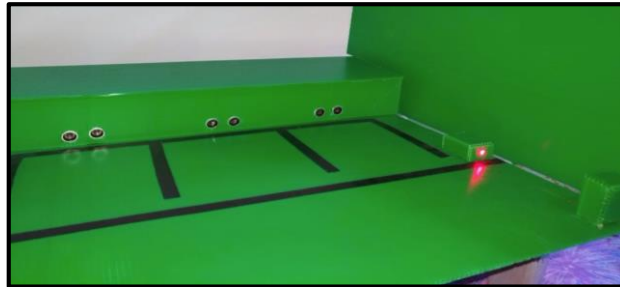
Figure 3. Initialization tool

Testing tool in Figure 3 is the initialization tool when first turned on. On the part of the circuit it looks to function normally marked with a laser module flame

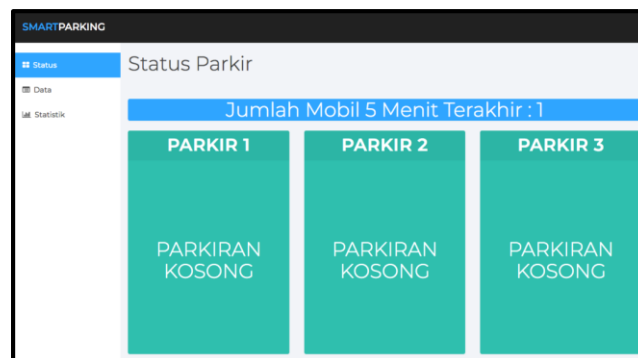### 3.2. Testing Car Count Counters

Figure 4. Car Count Count on Web

The test tool in Figure 5 is a simulation when the car passes through a laser module directed to an unobstructed LDR sensor, so the intensity of light received by the LDR sensor is not as maximal as the light from the laser module is not blocked, so Wemos D1 R2 will trigger to update data on the web.[6] The result of data update process from Wemos D1 R2 can be seen from the Fugure 6, the number of cars last 5 minutes will increase according to the number of passing cars.
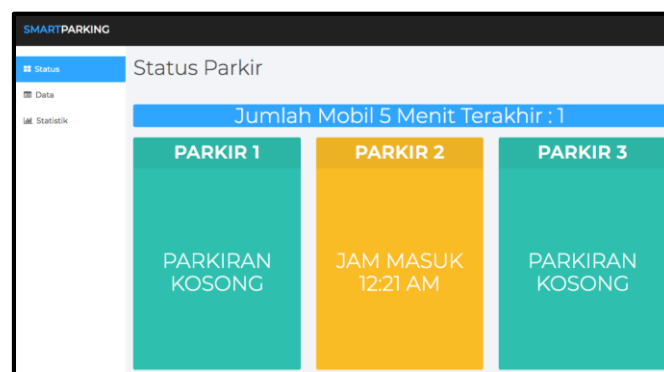
3.3. Car Parking Detection Test

Figure 5. Car Parking Detector on the Web

4

Testing tool in Figure 7 is a simulation at the time of car parking. When the car parked, the sensor will detect by calculating the distance from the sensor to the car, if the distance is less than the predetermined threshold, then Wemos D1 R2 will trigger to update data on the web which results can be seen from the Figure 8, the parking box will change in realtime and displays the time the car entered the parking lot according to the location of the filled parking.
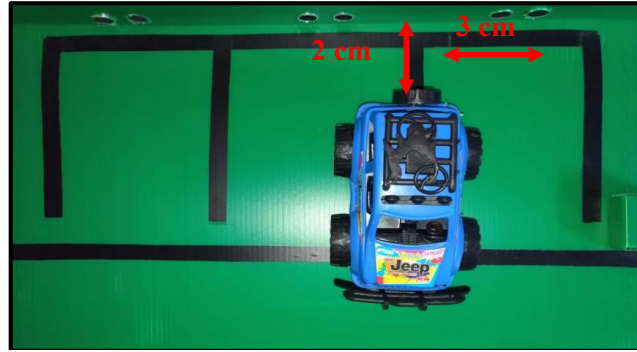

Figure 6. Parked Car Condition is Not Good

Figure 8 is a simulated image where the car is not parked properly. Can be seen in the figure that between the car and the parking line has a distance (cm) to the left of the left parking line and also from the back line has a distance (cm), so it can be said that the car is not terakir well.

4. Conclusion

The test is done by simulating the position of the car park with the distance variation until the test produces unreadable results. Testing is divided into 2 stages. With a threshold of 10 cm and 5 cm.

Table 1. Table Tests With Threshold 10 cm

Sensory Threshold HC-SR04	Distance between Parking and Car Lines		Sensor Reading Results (cm)	Results
	Front (cm)	Side (cm)		
10 cm	0	0	2	Read
	0	1 (Right)	4	Read
	0	2 (Right)	2	Read
	0	3 (Right)	14	Can not be read
	0	1 (Left)	2	Read
	0	2 (Left)	3	Read
	0	3 (Left)	6	Read
	0	4 (Left)	9	Read
	0	5 (Left)	12	Can not be read
	1	0	3	Read
	1	1 (Right)	6	Read
10 cm	1	2 (Right)	12	Can not be read
	1	1 (Left)	4	Read
	1	2 (Left)	6	Read
	1	3 (Left)	11	Can not be read
	2	0	3	Read
	2	1 (Left)	0	Can not be read
	2	1 (Right)	9	Read

	2	2 (Right)	11	Can not be read
	3	0	0	Can not be read

In table 1, a system test with the threshold of HC-SR04 10 cm sensor with varying parking position. It was found that a 10 cm threshold could not be used because many parking positions were not properly readable parking.

Table 2. Table Tests With Threshold 5 cm

Sensory Threshold HC-SR04	Distance between Parking and Car Lines		Sensor Reading Results (cm)	Results
	Front (cm)	Side (cm)		
5 cm	0	0	2	Read
	0	1 (Right)	4	Read
	0	2 (Right)	2	Read
5 cm	0	3 (Right)	14	Can not be read
	0	1 (Left)	2	Read
	0	2 (Left)	3	Read
	0	3 (Left)	6	Can not be read
	1	0	3	Read
	1	1 (Right)	6	Can not be read
	1	1 (Left)	4	Read
	1	2 (Left)	6	Can not be read
	2	0	3	Read
	2	1 (Left)	0	Can not be read
	2	1 (Right)	9	Can not be read
	3	0	0	Can not be read

From the test table 2 with the threshold of HC-SR04 5 cm sensor with some variation of parked car condition. From several conditions in the table obtained different results. But with a 5cm sensor threshold, with bad parking conditions the sensor reads can be minimized. So a 5 cm sensor threshold can be used on this system.

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