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# PARKING INFORMATION SYSTEM BASED ON INTENET OF THINGS (IOT)

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## ABSTRACT

*Parking area is a necessity for vehicle users who must be supported by its effectiveness and efficiency. Many companies or malls have mortgaged parking lots but the problems that occur, one of the causes is the guards who are not careful to be maintained, do not see the number of parking slots available, therefore it is necessary to add a clear parking information system. Smartphones are used to monitor the availability of parking lots. This research was conducted to design and create a parking information system that can be identified by parking users who wish to park their vehicles and monitor the parking area before entering the parking area. To see the availability of the amount of parking before the parking area can be monitored via a Smartphone using a web-based application. System design in my final project where the sensor reads input from the obstacle in front of the sensor, then the sensor sends data to the NodeMcu ESP8266 wifi module to appear, after that the NodeMcu ESP8266 wifi module will send data to applications that have been made on the smartphone, after From this application, it will be connected via an existing internet network, after connecting to the internet, the data can be requested by the application on the smartphone and the user can open the application that has been installed on the smartphone to see the amount of parking that is still empty.*

***Keywords :*** *Parking Information System, wifimodul*NodeMcu *ESP8266, Smartphone.*



## INTRODUCTION

Parking area is a necessity for vehicle users who must be supported by its effectiveness and efficiency. Many companies or malls have mortgaged parking lots but the problems that occur, one of the causes is the guards who are not careful to guard the vehicle, do not know the number of parking slots available, therefore it is necessary to add a clear parking information system [1] and also officers The parking lot still allows motorists to enter the parking lot which is full, even though the parking capacity is full [2].

Several studies on parking information systems have been carried out, including smart parking based on Arduino Uno which in this study uses Visual Basic 6.0. However, this tool still has its drawbacks that it cannot monitor empty or filled parking slots in real time [3]. The same tool has also been made, namely the design of a PLC-based smart parking system (logic control program), but there are still drawbacks that only users who have a card can enter the parking lot. To complement the shortcomings of these tools, the authors developed the previous tools and added more complete data in real time with the help of the Internet of Things (IoT) [4].

Internet of Things (IoT, which is a means of connecting communications such as smartphones, internet, TV, sensors and actuators to the internet where smart devices are connected together, enabling new forms of communication. The use of IoT technology can be one of the supports to meet these needs. dynamics of life that are increasingly increasing, including the availability of parking lots and an effective parking system [1].

At this time, the development of parking system technology has made it easier for users, one of which is the Parking Information System. Parking Information System is an automatic stand-alone system that provides information on parking availability for drivers / users. This system was developed to meet the needs of increasing parking services in organizations by providing parking monitoring activities using smartphones [5].

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This tool uses the Mcu ESP8266 Node as the control center for the tool's work system, the servo motor as an automatic aperture limiter, the HCSR-04 ultrasonic sensor as a detector for incoming and outgoing cars. This tool is also equipped with a smartphone to monitor the number of vehicles in the parking area.

## METHOD

This tool is a planning process before making a tool for Smart Parking. The application design made in this final project uses a smartphone as monitoring, where the existing application can monitor the number of vehicles in the parking lot.

The system design in this tool is where the sensor reads input from the obstacles in front of the sensor, then the sensor sends data to the NodeMcu ESP8266 wifi module to be processed, after that the NodeMcu ESP8266 wifi module will send data to applications that have been made on the smartphone, after being received from the application then will be connected via the existing internet network, once connected to the internet, the data can be processed by the application on the smartphone and the user can open the application that has been installed. on the smartphone to see the number of empty parking spaces.

The components in this research are:

1. Node MCU ESP8266

   ESP8266 MCU nodes have 4MB flash, 11 GPIO pins 10 of which can be used for PWM, 1 pin ADC, 2 pairs of UART, 2.4GHz Wifi and supports WPA [6].

2. Ultrasonic Sensor

   The ultrasonic sensor is a sensor that aims to convert sound frequencies into electrical frequencies. The working principle of the sensor is based on the emission of a sound wave so that it can determine the distance of an object with a certain frequency [7].

3. Internet Of Things

   The internet of things is an activity that can interact with the perpetrators and can be done with the internet network. Internet of Things is also found in many daily activities and can also help in certain areas by using tools such as GPS tracking [8].

4. Motor servo

   The servo motor is a component designed through a closed loop feedback control system, so that it can be adjusted to test the angular position of the motor output [9]

5. Website

   Website is an application that contains multimedia documents (text, images, animation, video) containing the HTTP protocol (Hypertex Transfer Protocol) and to access it using a software, namely a browser [10].

A tool or a system can be categorized as working well according to its plan if it has been tested according to the work function of the equipment. The test results show the final results of planning in accordance with the fact that the hardware that has been made can work properly and can be done by the user interface.

Instrument testing tools, Digital Multimeter: this multimeter functions to test the voltage from the power supply d, ultrasonic sensor and NodeMcu ESP 8266. The multimeter used is the Dekko Dm 136A digital multimeter. Osciloscop: This measuring tool serves to project the form of an electrical signal so that it can be seen and studied. This measuring tool is used to measure the current in the servo motor. Meter Cloth: This tool has a function as an ultrasonic sensor distance measure where it can be seen at what distance the sensor has an error.

Hardware Testing and Analysis, Ultrasonic Sensor: The sensor reading value will be compared with the actual sensor distance reading. The results of measurement and ultrasonic sensor testing are shown in the table below.

**Tabel 1. Ultrasonik sensor testing**

| No | Jarak sebenarnya | Jarak pengukuran pada sensor ultrasonik (Cm) | | | | | Tegangan |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | |
| **1** | 4 cm | 4 | 3 | 4 | 3 | 4 | 5.18 V DC |
| **2** | 8 cm | 8 | 8 | 8 | 8 | 8 | |
| **3** | 15 cm | 15 | 15 | 15 | 15 | 15 | |
| **4** | 25 cm | 24 | 25 | 24 | 25 | 25 | |
| **5** | 35 cm | 35 | 35 | 35 | 35 | 35 | |
| **6** | 50 cm | 50 | 50 | 51 | 50 | 50 | |


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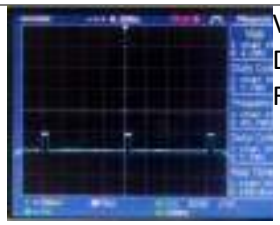
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 60 cm | | 60 | 61 | 61 | 60 | 60 |

In table 1 it can be seen that there are differences in ultrasonic sensor readings, the purpose of this test is to determine the accuracy of the sensor in reading the distance, then the results obtained based on this experiment are that there are many errors that occur, the amount of error obtained from the measurement is 1 cm but In measurements within a distance of 4 cm an error occurs while at a distance of 4 cm to 60 cm there is no error so that the sensor accuracy is very good but at a distance of 70 cm more there is an error of 1 cm on some sensors.

Tabel 2. Testing Motor Servo

| Servo | Sudut Pengaturan | Gelombang Pada CRO | Keterangan pada CRO |
|---|---|---|---|
| 1 | 90° |  | Vpp = 4.94 V<br>DC = 7.70%<br>Freg = 49.70 HZ |
| | 0° |  | Vpp = 4.20 V<br>DC = 3.0%<br>Freg = 50.05 HZ |
| 2 | 90° |  | Vpp = 4.94 V<br>DC = 7.70%<br>Freg = 49.70 HZ |
| | 0° |  | Vpp = 4.20 V<br>DC = 3.0%<br>Freg = 50.05 HZ |

In table 2 above it can be seen that the servo position or servo angle determines the resulting pulse width, the greater the angle given, the wider the pulse. Node Mcu ESP8266, This measurement is measured using a multimeter by connecting the circuit to the source. Data as shown in the table.

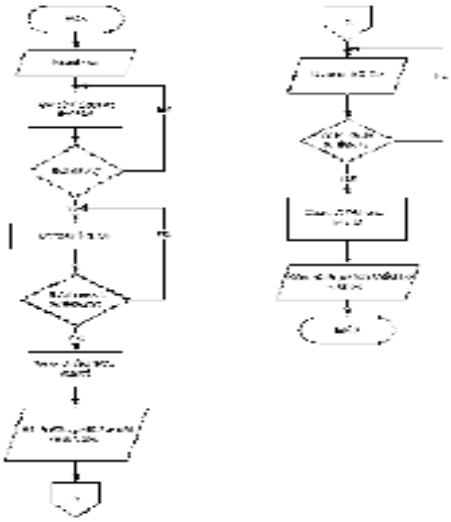


Figure 1. Flowchart diagram

In Figure 1, it explains the work diagram of the tool as a whole. This tool will work with a 220VAC voltage source where the voltage will be reduced to 12V DC and 5V DC using the power supply. The ultrasonic sensor 1 will detect the car entering the parking lot then send the information to the ESP8266 Mcu Node then the servo motor will open the automatic bar. Then the Mcu ESP8266 node will send the incoming car data which will be displayed on the MIIT APP INVENTOR application that has been installed on the user's smartphone. When the car is about to leave the parking lot, the ultrasonic sensor 2 will send information to the Mcu ESP8266 Node which then orders the servo motor to open the exit portal. Then the Mcu ESP8266 node will send the outgoing car data which will also be displayed on the MIIT APP INVENTOR application that has been installed on the user's smartphone.


Figure. 2. Blok diagram sistem

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From Figure 2 above the part function of each block is as follows:

1. The ultrasonic sensor functions to detect an object that enters or leaves the parking area.
2. The power supply serves as a source.
3. The servo motor functions to open or close the door latch.
4. Wifi Module Node MCU ESP 8266 functions as a system control center that receives input from sensors and communicates or transfers data to Android.
5. Smartphones function as monitoring the number of vehicles.

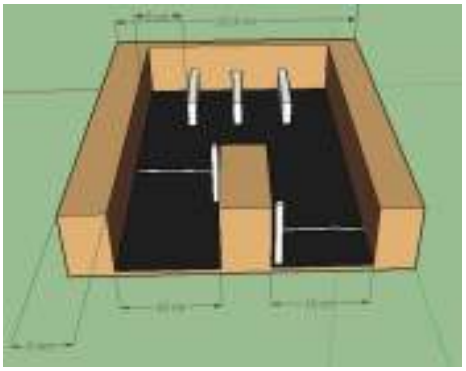

Figure.3 Mechanical form seen from the front.

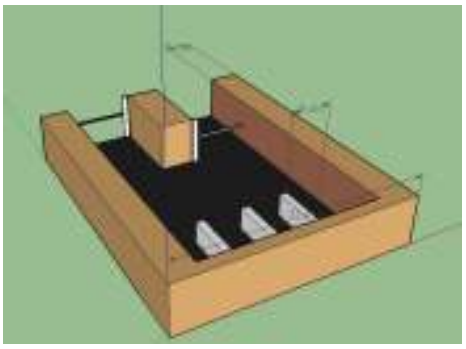

Figure 4. Mechanical form seen from behind.

In Figures 3 and 4 it can be explained that there are 2 automatic door signs, which are 10 cm wide and have 3 parking slots measuring 22.4 cm.

Figure 5. PIS's original mechanical form

## RESULTS AND DISCUSSION

A tool or system can be categorized as working well according to plan if it has been tested in accordance with the work functions of the equipment. The test results show the final results of planning in accordance with the fact that the hardware that has been made can work properly and can be done by the user interface.

On this occasion, the authors made a parking information system (PIS) application which aims to monitor the availability of a parking lot.

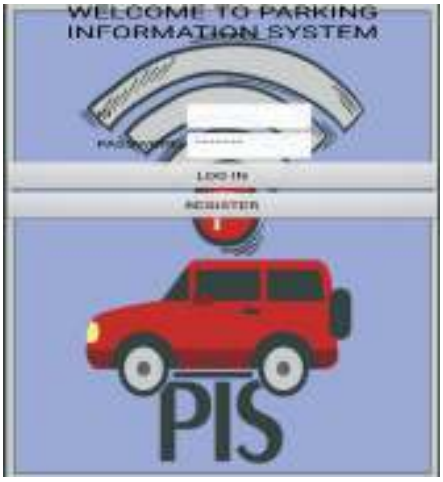


Figure 6. The first slide of the PIS application on a smartphone.

In Figure 6 it can be seen that there are 2 buttons, namely the login and register buttons. On this slide we have to register first, when it's finished, then this application can login.


Figure 7. The second slide of the pis application on the smartphone.



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In Figure 7 it can be seen that there are sign up and login buttons, on this slide the user must create an account id and password to enter the PIS application, when it is finished, the user can press the sign up button which can be seen from the picture above, the account will automatically be generated. made by the user earlier, it can be active in the PIS application, the last step a user can take is to press the back button to login in the image above.


Figure 8. The third slide of the PIS application on a smartphone.

In Figure 8, there are several objects or places to simulate parking locations and on top of these objects there are also tools that show the number of vehicles in the parking lot provided by the objects or places in the PIS application above.

In this discussion, the author will try the procedure for testing cars entering or leaving the tools and applications.

Figure 9. The condition of the car when the condition enters the parking lot.

Figure 10. When the car enters through the automatic signpost

Figure 11. The condition of the car in the parking lot.

In Figure 9,10,11, it can be explained that the condition of the car when entering the parking lot. When the car enters the parking lot the driver first presses the blue button which aims to open the door sign, after which the signpost will automatically open which can be seen in Figure 10 and the flagship can select the desired slot to fill the parking lot. Furthermore, the application will automatically detect the amount of parking in the parking area, which can be seen in Figure 12 below.

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Figure 12. Monitoring the PIS application at the Nanda Mart location.

In Figure 12 it can be explained that if the car has entered the parking lot, it will automatically be detected in the PIS application. And the number 1 in the picture shows the number of vehicles in the parking lot.

Figure 13. The condition of the car out of the parking lot.

Figure 14. The condition when the car exits through the automatic signpost.

Figure 15. The condition of the car in the parking lot.

In Figure 13,14,15 it can be explained that the condition of the car when it exits the parking lot. The working principle is almost the same as above when the car exits the parking lot the driver first presses the blue button which aims to open the door signpost, after that the signpost will automatically open and the car can come out. Furthermore, the application will automatically reduce the number of vehicles.

## CONCLUSION

Previously, the Internet of Things (IOT) based parking information system design has been designed. So in this chapter the following conclusions can be drawn. The design of a parking information system based on the Internet of Things (IOT) is running as expected and in accordance with the design, The electronic and mechanical design works based on the Wifi Node MCU ESP8266 program, The ultrasonic sensor works quite well and has very few errors, The application on the smartphone works quite well, and can monitor the amount of parking availability.



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## SUGGESTION

Based on the design and manufacture of a parking information system based on the Internet of Things (IOT), there are still many shortcomings in this tool. For this reason, the authors provide some suggestions and input so that in the future this tool can be even better. The following suggestions and additions from the author can be developed:

1. In hardware and software, the authors also suggest adding a GPS as directions to the parking lot.
2. The internet connection process can be developed using a wifi proxy network or like a wifi id.

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