Study Of Reliability Of Smart Parking Systems Based On Microcontroller Esp 8266 NodeMcu

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Abstract

Article Info	
Received : 29 November 2021 Revised : 21 December 2021 Accepted : 28 December 2021	Automatic system is a process to control the operation of an a tool that can automatically replace the role of humans. One of the industries that is also experiencing rapid progress is in the field of parking (Smart Parking) for vehicles, both two-wheeled and four-wheeled vehicles. The current parking system still uses a lot of conventional parking systems that only utilize parking lots and parking attendants who control each incoming vehicle and also often do not pay attention to the capacity of the parking lot owned by a building. The research describes a design to build a parking prototype to make it easier for drivers to find empty parking slots. The tool that will be built will start when the car enters the parking area and is detected by the TCRT-5000 sensor, then the servo opens the gate at the command of the Arduino and the driver looks for an empty parking lot. The driver can see the empty parking slots through the parking application that is connected to the database through the Esp 8266 NodeMcu. The LCD will issue an output in the form of letters and numbers.

Keywords : Esp 8266 NodeMcu, Arduino Nano, Sensor TCRT-5000, Servo motor, Parking Application.

1.   Introduction

An automated system is a process to control the operation of a device automatically that can replace the role of humans to observe and make decisions. The current control system has begun to shift to automation of control systems, so that human intervention in controlling is very small. The equipment system that is controlled automatically is very easy when compared to the manual system, because it is more efficient, safe, and thorough.

A person can control the devices installed in his home or office from anywhere in the world just by using a Smartphone, PC or other device connected to the internet. The smart parking industry has seen a number of innovations such as Intelligent Parking Management System, Intelligent Gate Control, Smart Camera that can detect vehicle type, ANPR (Automatic Number Plate Recognition), Smart Payment System, Smart Entry System and many more.

This study describes a Smart Parking solution that will be built using IR sensors to detect the presence of vehicles and trigger the gate to open or close automatically. ESP8266 NodeMCU is a microcontroller which is used as the main controller to control all the peripherals connected to it. ESP8266 is the most popular controller for building IoT microcontroller-based applications developed by Espressif Systems, a shanghai-based company. Because it has built-in support for Wi-Fi, to connect to the

internet. In this Smart Parking IoT System, the device will send data to the application to find the availability of space for vehicle parking. Here the author uses firebase as the IoT database to get parking availability data. For that, I need to find the address of the Firebase host. Firebase is Google's database platform used to create, manage and modify data generated from android apps, web services, sensors, etc.

The components needed are ESP8266 NodeMCU, Arduino nano, TCRT-5000 Sensor, DC Servo Motor, 16x2 i2c LCD Screen, Jumper. Circuit for IoT based vehicle parking system It involves Seven TCRT-5000 sensors, two servo motors, one 16x2 LCD. The ESP8266 will control the complete process and also send parking availability information to the app, so it can be monitored from anywhere in the world via the internet. Seven TCRT-5000 sensors are used at the entrance and exit gates and at each slot to detect the presence of a car and automatically open or close the gate.

The TCRT-5000 sensor is used to detect any object by sending and receiving infrared rays, Two servos will act as gate in and out and they rotate to open or close the gate. Finally the TCRT-5000 sensor is used to detect whether the parking slot is available or occupied and sends data to Arduino nano and Arduino sends data to ESP 8266 NodeMCU via serial communication.

2. Methods
2.1 Hardware
Design The overall hardware design of the Smart Parking system design with the Esp 8266 NodeMcu microcontroller starts from the system design as shown in Figure 3.1.
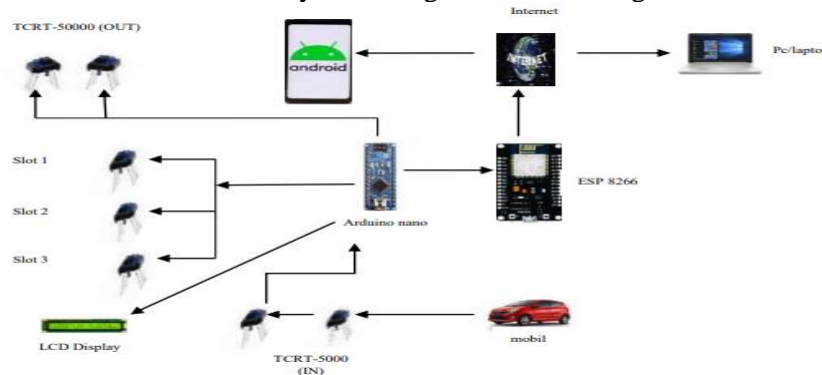

Figure 1. Smart Parking System Design

2.2 Software Design (Software) Software
design is one step to provide a general description of the proposed system software design or design in general defines the components to be designed. In designing this system the author tries to provide a new picture of the system. In this case, the steps taken are to design the system components in the form of input and output models. As for this design using a flowchart.

2.3 Parking Application Design The
application used in this smart parking system was created using the app inventor, from application design to program blocks designed using the app inventor, App inventor is an open source web application that was originally developed by Google, and is currently managed by the Massachusetts Institute of Technology (MIT) is a private research university located in Cambridge.

App Inventor allows new users to program computers to create software applications for the Android operating system, App Inventor uses a graphical interface that allows users to drag-and-drop visual objects to create applications that can run on Android devices. In creating App Inventor, Google

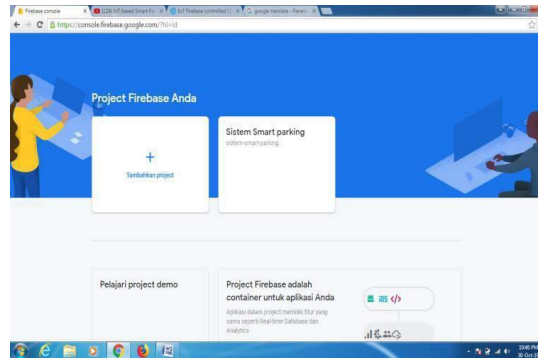has conducted research related to educational computing and completed Google's online development environment.

Figure 2. Overview of Designing in Firebase

3.   Result And Discussion
3.1   Minimum Hardware and Software Specification Requirements

Based on several circuit designs that have been described in the design of the smart parking system. it takes several supporting devices both hardware and software in building and designing a smart parking system.

In supporting the implementation of the smart parking system design, there are several hardware supports, namely a set of computers consisting of:

Table 1. Hardware

No	Hardware	Specifications
1	1 Processor Unit	AMD A4-3330MX APU with
2	Laptop/	Radeon Computer, memory 2Gb
3	Mouse	Standard
4	Keyboard	Standard
5	Smartphone	5.1 Quad core

3.2   Smart Parking System

Testing The first test is done by checking the function of each sensor and the LCD display used. and continued with the circuit wiring test. In this process, errors often occur that make the tool not work so a troubleshooting process must be carried out to find out where the errors and errors occur.

The test is the result of the system design that has been made on the smart parking prototype. The next process is to test each tool that functions as a function, such as an Lcd display which functions as an output in the form of numbers and letters, and a servo that functions as a gate driver, and TCRT-5000 which functions as a car detector on the prototype, parking applications and the database used. to check the parking slot is empty or not. The following is a test result of the smart parking system starting from entering (in) to exiting (out).

3.3   IR Sensor Tcrt-5000

Testing The TCRT-5000 test was carried out to find out whether the TCRT-5000 sensor was functioning or not as desired by the author. Seven sensors were used to detect cars. The following is a test of the TCRT-5000 sensor in their respective places:
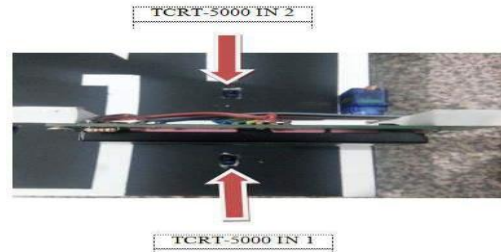
1. Testing on the Tcrt-5000 (in)

Figure 3. Testing the Tcrt-5000 Sensor

From Figure 3 it can be explained some of the functions of the Tcrt-5000in 1 and 2 sensors are :
a. Tcrt-5000 in 1 will detect a car that will enter the parking area so that the sensor will send data to Arduino for processing and instruct the servo to open the gate.
b. Tcrt-5000 in 2 will detect a car that will enter the parking area so that the sensor will send data to Arduino for processing and instruct the servo to open the gate.

3.4   Testing on Parking Slot Sensors
In this test to determine the number of parking slots that are filled or not filled. It can be seen as in Figure 4.
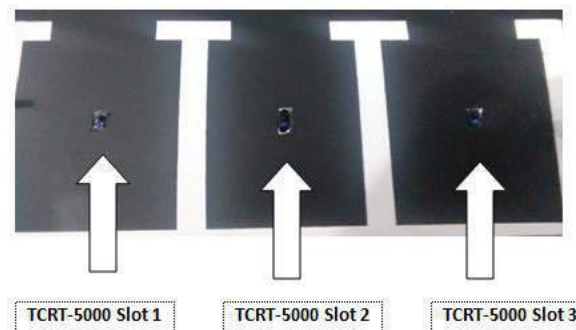

Figure 4. Testing the TCRT-5000 Sensor

In Figure 4 the sensor is made to detect cars in each slot. These three sensors have the same function, namely to detect cars in their respective slots. The TCRT-5000 sensor in slot 1, slot 2 and slot 3 works to detect cars parked in their respective areas by sending data to the arduino and continued on Esp 8266 via new serial communication sent to firebase and the android application.

3.5   Parking
Application Testing Android application testing is carried out to find out the function of an application that has been made by the author whether it is suitable for its function, namely to display parking slots that are still empty or those that have been filled on the driver's smartphone.
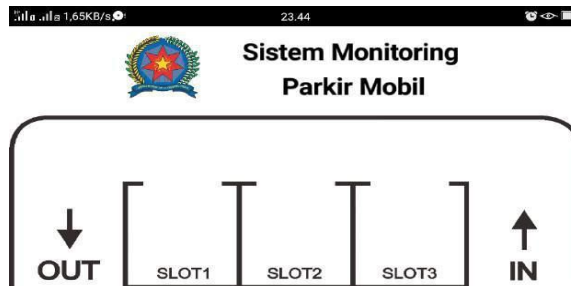a. If the Parking Slot is Empty.

Figure 5. Display of Android Applications

In the picture above is the display of android applications on Smartphones, where none of the slots are filled because the parking area is still empty.

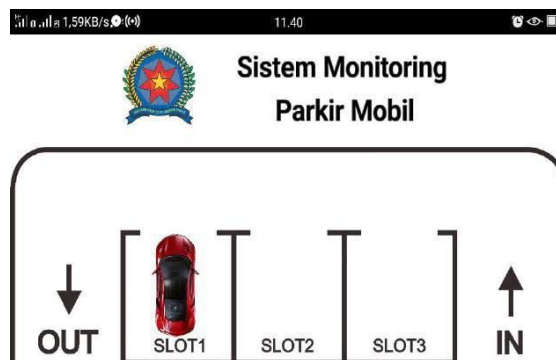b. If the Parking Slot is filled with 1 car.

Figure 6. Display of Andorid Applications

In Figure 6 is the display of android applications on smartphones, if slot 1 in the parking area is filled, then slot 1 on the android application will be filled with cars.

c.　　Parking Slot Filled with 2 cars.

Figure 7. Parking Slot Filled with 2 cars

In Figure is the display of the android application on a smartphone, if slot 1 and slot 2 in the parking area are filled, then slot 1 and slot 2 on the android application will be filled with cars.

4.　　Conclusion

Based on the results and discussion, it can be concluded that; Prototype Smart parking design with Esp 8266 Nodemcu microcontroller, will be connected to firebase and Android. The design uses hardware such as Esp 8266, Arduino nano TCRT-5000, Servo motor, Lcd, Wire jumper. The design uses software such as Arduino IDE and App Inventor. With this smart parking design, finding parking slots is easier and neatly arranged. The design is only up to the prototype.

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