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Design And Construction Of Parking Lot Security System Using Internet Of Things And RFID Technology In Megaland Housing Complex

Riza Salma[1], Al-Khowarizmi[1*]

[1]Department of Information Technology, Universitas Muhammadiyah Sumatera Utara, Indonesia

*Corresponding Email: alkhowarizmi@umsu.ac.id

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ABSTRACT

The parking lot security system is a very important aspect in maintaining the security and comfort of residents in a housing complex. This thesis aims to design and build a parking lot security system using Internet of Things (IoT) and Radio Frequency Identification (RFID) technology at the MegaLand housing complex. This system integrates IoT devices to monitor and control vehicle entry and exit access, and uses RFID technology to identify each vehicle that has a parking access permit. The use of this technology is expected to increase the efficiency and effectiveness of parking lot management, reduce the risk of theft, and make it easier for residents to access the parking area. The results of implementing this system show a significant improvement in the security and parking management aspects of the MegaLand Housing Complex.

1. INTRODUCTION

The growth of urbanization and the increasing number of motorized vehicles in the modern era pose serious challenges in parking management. Population density and the need for efficient parking spaces create an urgent need to develop innovative solutions [1]. Many parking users have difficulty finding parking slots due to the large number of parking users [2]. Therefore, this study aims to design and build an Internet of Things (IoT)-based [3] parking lot security system to optimize parking lot management [4]. The IoT-based parking lot security system is the focus of research because of its ability to provide intelligent and connected solutions to overcome parking problems. By using IoT technology, this system can provide real-time information about parking lot availability [5], allowing drivers to quickly find and access empty parking areas. Thus, this study increases the efficiency and convenience of parking management in the environment. In addition, through the implementation of an IoT-based parking lot security system [6], it is expected to reduce drivers who do not have a need or who live in the area to enter the parking area. Thus, this study not only contributes to more effective parking management, but also has the potential to have a positive impact on the environment of the owners living in the area.

This case study was conducted because many drivers who do not live in the location easily access the environment even though they have no interest in the environment [7], many people in the environment do not know the real-time data on the parking lot, which will cause queues of other car drivers, then a lot of time is wasted by drivers looking for empty parking lots [8]. This parking direction system can make it easier for drivers to find real-time data when heading to an empty parking lot, when they know the real-time data, drivers can see the remaining parking lots [9]. With the presence of a barrier at the entrance, drivers who have a card in the area can access to enter the parking area by scanning the card, then if the card owner wants to see the remaining parking space, but is still far from the area, the driver can open the web from blynk, then if there are visitors who try to access the parking area using a card that is not from the area, a beep will sound indicating that the card is not detected and the barrier will not open. With the security of the parking area, it will make it easier for drivers to find an empty parking space [10], with time efficiency and also there will be no drivers.

2. RESEARCH METHOD

2.1 Hardware System Flowchart

The hardware system flowchart illustrates the workflow of the hardware and monitoring system to find out empty parking spaces and then direct drivers to the remaining empty parking spaces according to the data on the monitor at the entrance gate.

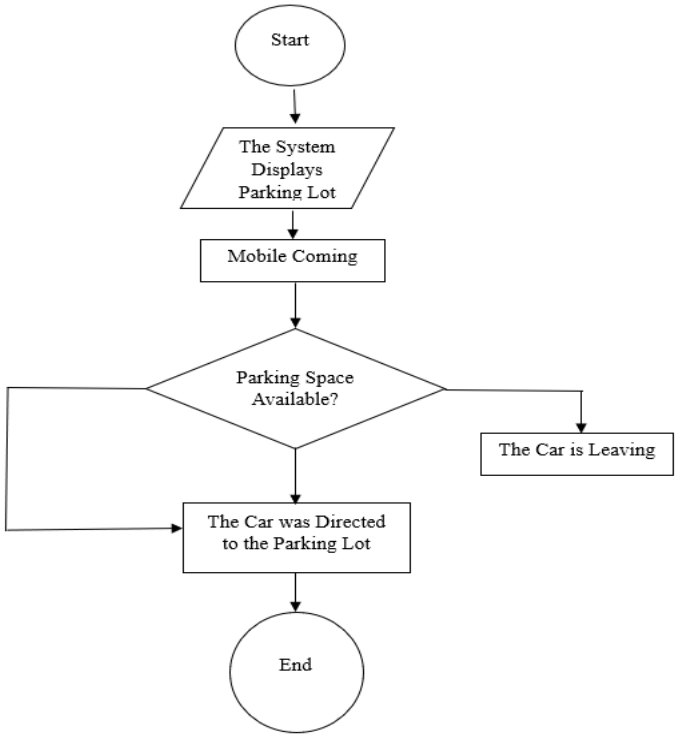

Figure 1. Hardware System Flowchart

The systematic flowchart above is the driver's route from the beginning, namely starting with the driver coming to the parking location, then the driver sees real-time data displayed by the monitor explaining the remaining available parking spaces, then the driver will be directed to the available parking space with the direction lights that will be on, and vice versa if there is no remaining parking space, the driver will exit the parking area.

2.2 Circuit Schematic

The circuit diagram of the tool is a picture of the tool model that will be used. The circuit diagram of the parking control and monitoring tool consists of, ESP8266 as a microcontroller, then an IR sensor (there are 6 pieces) to detect an object moving around it, then an RFID RC522 Reader as a scanner, Servo SG90 as a barrier driver, then Buzzer in and out to provide a beep sound when the barrier is accessed [11],[12].

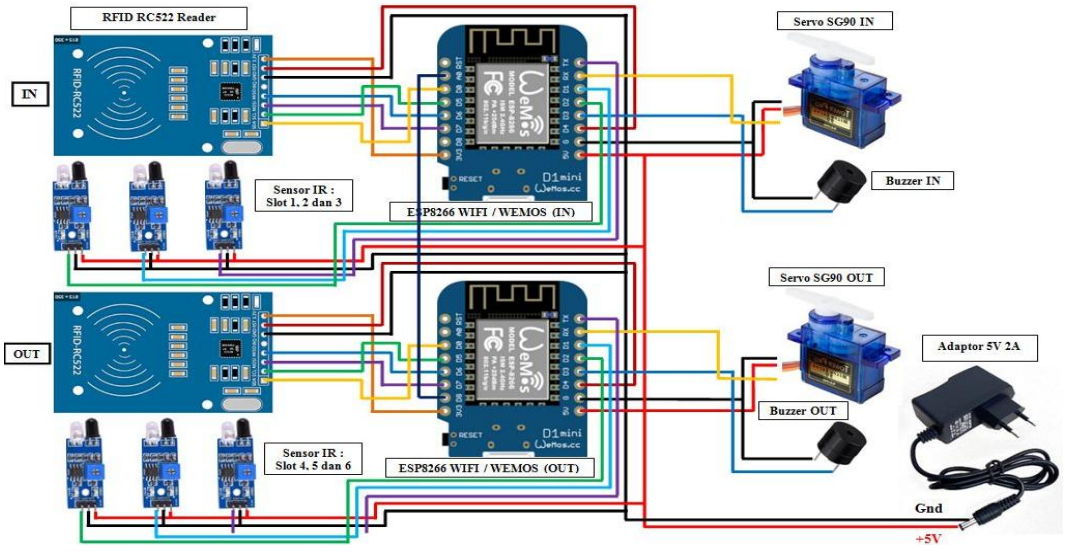

Figure 2. Equipment Circuit Schematic

The circuit above contains several tools to assemble the parking lot direction system, the presence of ESP8266 as a microcontroller for other tools, then the presence of an IR sensor to detect whether a car is parked or not as a detector of empty parking lots, then [13] RC522 as a scanner, and Servo SG90 as a barrier driver, then Buzzer in and out to provide a beep sound when the barrier is accessed.

3. RESULTS AND DISCUSSION

3.1 Hardware

In this process, the hardware was made for the "Parking Lot Security System Prototype Based on IoT (Internet of Things)". The hardware making for this project consists of several processes, namely:

a. Making a prototype design.
b. The sticker printing process for the project.
c. The results of assembling all the components of the tool.

3.2 Prototype Design Creation

In making the tool design, by making a picture of the parking lot that will be made into a prototype, in this prototype 6 parking lots will be made with straight entrances and exits together.

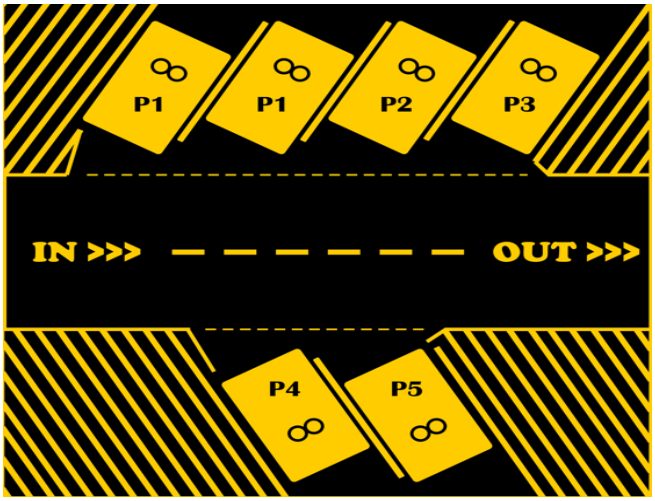

Figure 3. Parking Lot Prototype Design

3.3 Assembling the Entire Series of Tools

This process is carried out to assemble all the components that have been cut and printed according to the previously created design.

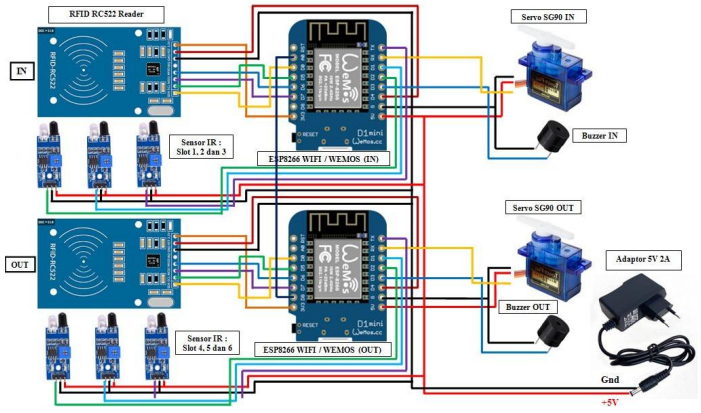

Figure 4. Tool Circuit Assembly

Figure 5. Tool Design Results

3.4 Software

In making the designed tool software, the author uses the Arduino IDE software which is used to program the ESP8266 microcontroller and other devices [14]. Furthermore, connecting the Arduino IDE to the Blynk software to display the system interface in displaying the parking lot conditions, how many vehicles have accessed the parking lot, then the remaining parking lot slots available in real time via the internet.

IOT_SISTEM_PARKIR_IN | Arduino 1.8.9

File Edit Sketch Tools Help

IOT_SISTEM_PARKIR_IN

```
#include <SPI.h>          // Library Komunikasi Serial
#include <Servo.h>        // Library servo
#include <RFID.h>         // Library RFID Reader
#define BLYNK_PRINT Serial    // Library Sever Blynk
#include <ESP8266WiFi.h>      // Library ESP8226 Wifi
#include <BlynkSimpleEsp8266.h>   // Library Seve Blynk
#define BLYNK_AUTH_TOKEN "wwtzbD-UX7iinAxEZgMTs5cPpUnF-r4p" //Token blynk
char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "ROBOT UNO";      // Nama Wifi
char pass[] = "201601201601";   // Password Wifi
#define SDA_PIN D0              // Pin SDA RFID dihubungkan ke pin D0 ESP8266
#define RST_PIN D4              // Pin RST RFID dihubungkan ke pin D4 ESP8266
```

Figure 6. Arduino IDE Code Display

To connect the ESP8266 module to blynk, the code is needed as shown in the image above:

1. To connect the ESP8266 to blynk, the library is needed:
   #define BLYNK_PRINT Serial
   #include <ESP8266WiFi.h>#include <BlynkSimpleEsp8266.h>
   #define BLYNK_AUTH_TOKEN
2. After importing the library, the next step is to define the ssid and password that will be connected to blynk
   char auth[] = BLYNK_AUTH_TOKEN;
   char ssid[] = "zaaa";
   char pass[] = "tanyasalma";

Once finished we can access blynk which has been connected to the Arduino IDE, which we can see in figure 7.

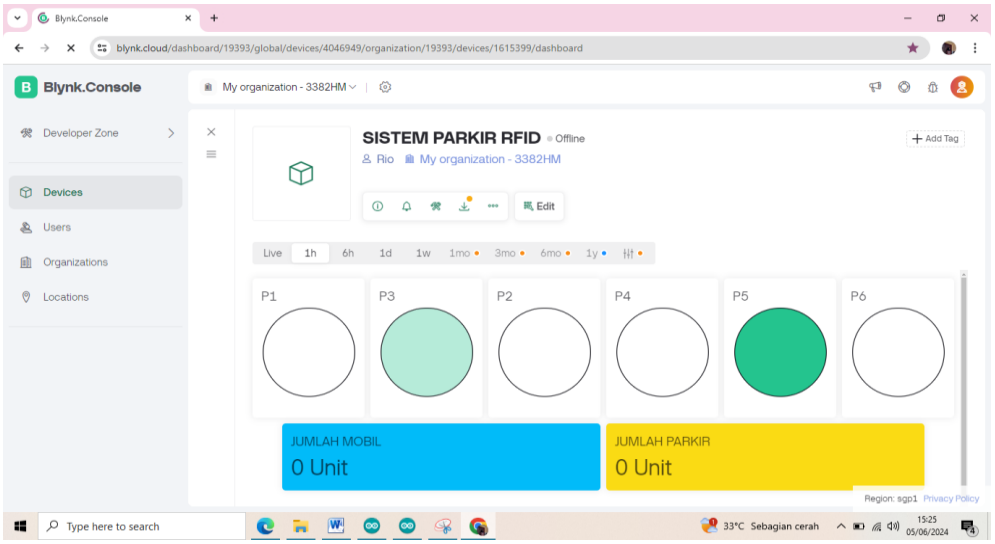

Figure 7. Blynk view

On the blynk display we can see the number of incoming car units and also the number of car units that are parked, complete with the positions that have been made. If there is a color filling the circle, it means that there is a car parked on the land.

4. CONCULUSSION

There are several conclusions drawn, namely:

1. ESP8266 can operate well as a data processing center for RFID modules in displaying how many vehicles have accessed the parking lot environment, then the remaining parking slots on the blynk display, and ESP8266 operates well as internet and blynk network connectivity.
2. The RFID module is able to identify data contained in the ID Card chip and forward the data to the microcontroller to be further processed as a command for other components.
3. Based on the prototype design of the IoT-Based Parking Lot Security System, Servo Motor, RFID, which is processed through ESP8266, as its control center with information on how many vehicles have entered and exited, then the remaining parking lot slots that will be displayed on blynk, RFID as an identity for entering or exiting the car and servo motor as a parking barrier. The design results found to be running well.

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