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Development of Automated IoT-Based Monitoring Multilevel Parking System

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Abstract: The Smart Multilevel-parking system is the parking system that proposed to implement in Malaysia to prevent the problem limited parking lot. The smart multi-level parking system is the parking system that in Malaysia can be advanced in transport services technology. The problem cause of the urban city with limited parking space and hard to pay at the counter. The purpose of the project is to study the needs and constraints of multi-parking system and to proposed the fully automated of multi-parking system to suit the system in Malaysia. To enhance this project, the application of IoT-based monitoring system with Blynks apps is used in this project. As the prototype and mechanical portion, the proposed Smart Multilevel-parking system is used to help and finance the cost of materials. This project will work with IoT and verify with the prototype.

Keywords: IoT-Based, Multilevel-parking, Blynk Aapps

1. Introduction

The multi parking system idea is originally from Germany in 2011, the company call KLAUS invented the fully automated Multi-parking system and came to the idea that uses a card system and more [1]. This project is used to prevent the limited parking space and making parking lot available in urban cities. The Smart Multilevel-parking system is can be implemented in Malaysia to constraint the community and to used fully automated IoT multilevel-parking system that suit to Malaysia parking system.

1.1 Problem statement

From a previous researcher, the automated parking system is just used tickets to enter the parking lot and established the RFID system to improving parking system technologies. In this project, a device like this has been proposed and planned. Additions to existing systems are made to ensure maximum use of the space. Parking slots are designated inside the multi-storied structure according to the size of the car to serve this purpose. Automatic multi-level parking spaces have lower construction costs per

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parking space, as they usually need less construction volume and less ground space than traditional parking spaces of equal capacity.

1.2 Objective

- To study the need and constraints of multilevel parking system in Malaysia.
- To develop the fully automated IoT multilevel parking system that suits to Malaysia parking system.
- To test and validate the proposed multi-parking system.

1.3 Project scope

This project is focused mainly on an automated IoT-based multilevel parking system to prevent the limited parking lots. Basically, there are some parts in completing this project, to study the Internet of Thing (IoT) that can be implement in parking system. This project will be function by using IoT-based monitoring system into the mobile-phone that can detect the parking space and the sensor detects the car and display to Mobile phone that using application Blynk Apps.

2. Literature review

2.1 Traditional parking

The endless search for free spaces in a car park is nowadays a burden on any driver, as vehicles are a predominant mode of transport. With a growing number of vehicles and parking spaces diminishing, vehicles parked along the road and even on sidewalks have become relatively common phenomena. Traffic congestion and injuries are likely with these parked vehicles encroaching upon road space and pedestrian space. A well-organized parking system that maximizes the space available provides a solution to this situation. Two types have been identified for parking systems. There are conventional parking schemes, as well as multi-story parking.

2.2 Using RFID

RFID is a well-known technology that transmits wireless data through wireless sensors [10]. Although RFID utility has long been known, it has not been utilized to its full potential. Smart parking applications that use RFID technology do not require human intervention and are used to detect vehicles. It may also be used to develop an automatic collection system for parking fees. This technology helps drivers to check-in and check-out from the parking lot quickly and also makes the car park safe. The RFID sensor at the entry point helps avoid multiple check-ins and thus prevents traffic congestion in the parking lot.

2.3 Internet of Thing (IoT).

The sensors used in IoT-based smart parking network stores and access data from remote locations using the internet, these factors create a web of things (COT). The nodes could be monitored and controlled from any location the system that propose to provides information about the availability of the parking slots with the help of the mobile application that users can book the parking slots from a remote location.

3. Methodology

This project used three major steps to implement projects starting from planning, implementing and testing. All the methods used for finding and analyzing data regarding the project related. Figure 1 shown the step of methodology for this project.

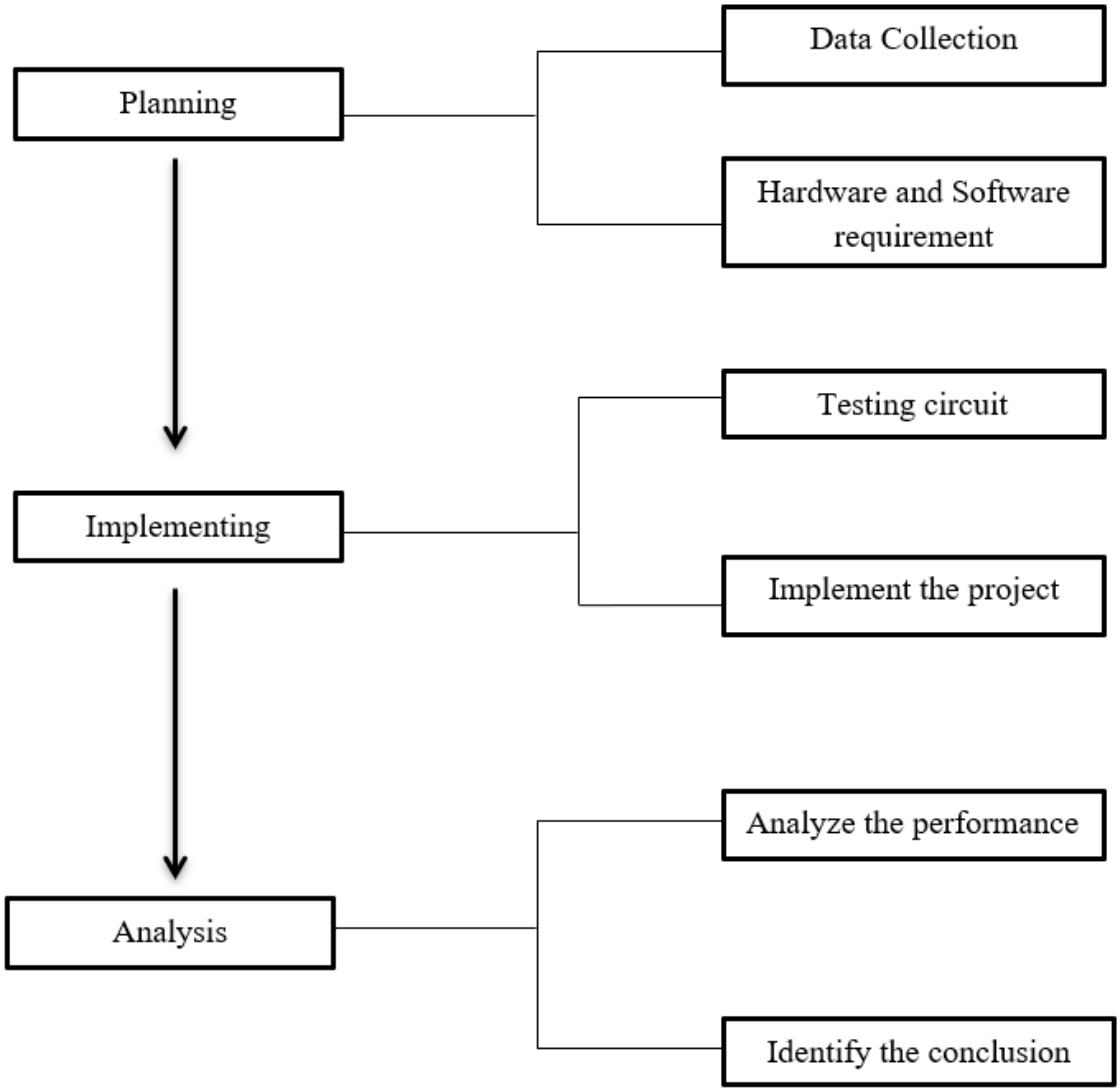

Figure 1: Step of Project Flow

3.1 Development of smart multilevel parking system

Figure 2 shows the block diagram of the planned smart multilevel parking scheme. This DC motor is intended to establish the gate opening and closing gate feature. The role of the rectifier and regulator is to regulate the power supply voltage and stabilize the current. Blynk is to show the time and price in the parking lot and the IR sensor senses that the parking price is sent to Apps Blynk by the vehicle.

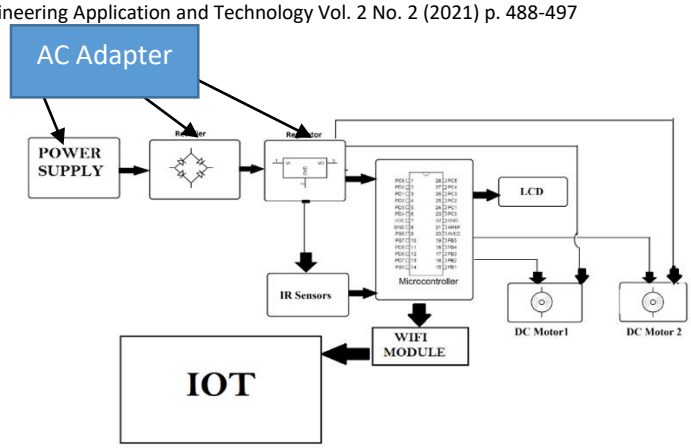

Figure 2: Block diagram of the proposed smart multilevel-parking system

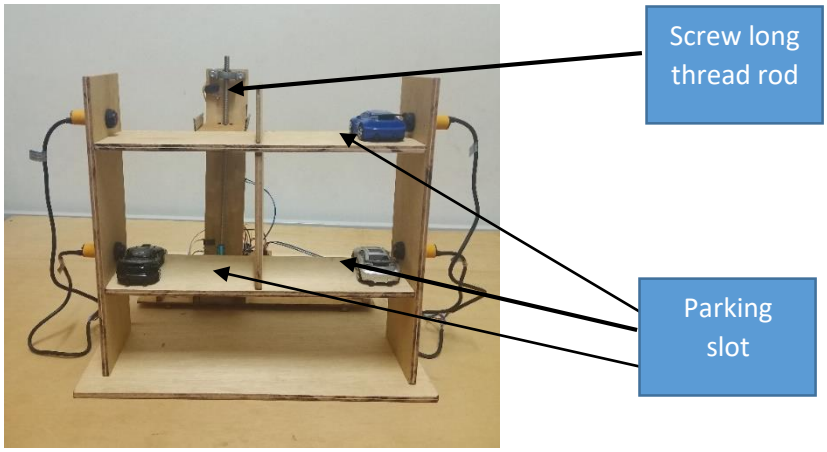

Figure 3: Parking slot

Equation 1 show the time travelled of the lift to travel from slot to another slot. The L is stand for length of screw long thread, t stand for time travelled and s stand for speed of DC motor and parking slot shown in figure 3. Equation 1 should be numbered based on the section number as the following to determine time to travelled with different motor speed.

Length screw long thread rod = 250 mm

Speed of DC motor = 100 rpm

$$s = \frac{L}{t} \qquad Eq\ 1$$

The time taken to travel for every slot

$t = \frac{250}{100}$ = 2.5 second

If speed of DC motor = 50 rpm

The time taken to travel for every slot

$t = \frac{250}{50}$ = 5 second for every slot

3.1 Development of the prototype for the proposed smart multilevel parking system

Specifications and properties of materials, equipment, and other resources used in the current study should be described in this section:

- Sensors E18
- 3 V – 6 V Dual Axis TT Gear Motor
- Arduino Mega Microcontroller
- AC adapter DC 12 V 2 A switching power supply
- ESP8266 Wifi Module
- L298N Motor Driver Module
- Mechanical Parts
- Wire jumper

The AC to DC adapter transforms the alternate current (AC) input to direct current (DC) output. For this device, it will convert the main electricity (100 V-240 V AC) to 12 volts (DC) that you need. You can use this adapter to power up most of the application that needs 12V input, such as Arduino Uno, Arduino Mega, SK40C and etc. Table 1 is represents the AC adapter that uses in the project as the power supply. The power supply can control the input and output power. This adapter is power supply of Arduino Mega Microcontroller in this project.

Table 1: Description of AC Adapter

Property	Rating
Input Power	100 – 240V AC
Output Power	12V 2A DC

4. Results and Discussion

4.1 Design

Figure 3 shows the concept design of the parking system in SketchUp application. It shows the view that can see the movement of parking lot and it will the car go down and slot to the parking lot. And when the car want to leave, the parking lot will rotate and sensor will detect the car to lift up to the exit.

In Figure 4, it shows the car enter the parking lot and LCD will display the number of slots before leaving the car at parking lot. After that, when car want to leave the parking lot, LCD will display the number that save before and verify the information and the car leave safely

Figure 3: Concept design of parking system (front view)

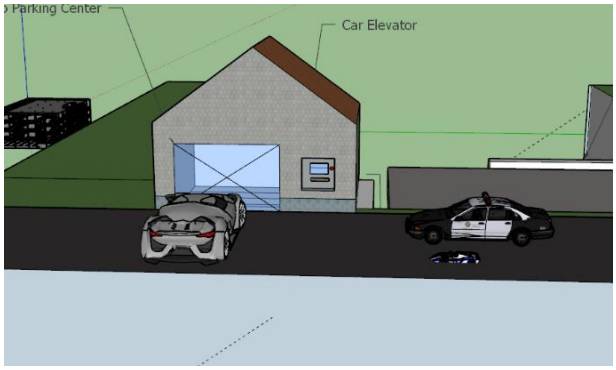

Figure 4: Concept design of main gate parking system

4.2 Simulation Modelling

After the Proteus 8 did the process of designing the circuit, the simulation of the circuit process is followed. By using the same software, Proteus 8 was performed the result of the simulation. Several simulation characteristics that can be observed by using this software are such as the rotation of the motor and also the characteristics of the project. Since this project using IoT, it shows in the application on mobile-phone.

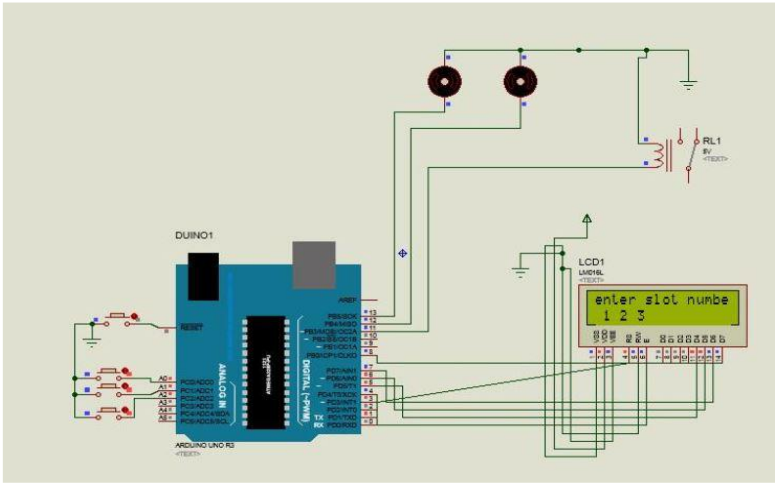

Figure 5: Simulation in Proteus 8 Professional

4.3 Actual and Schematic circuit

This circuit is made by using Fritzing application. Fritzing is an open source project to create amateur or hobby CAD software to help designers and artists ready to switch from playing with a prototype to constructing a more permanent circuit to designing electronic hardware. Figure 6 and 7 is shown the project actual and schematic circuit. This circuit is made by using Fritzing application. Fritzing is an open source project to create amateur or hobby CAD software to help designers and artists ready to switch from playing with a prototype to constructing a more permanent circuit to designing electronic hardware.

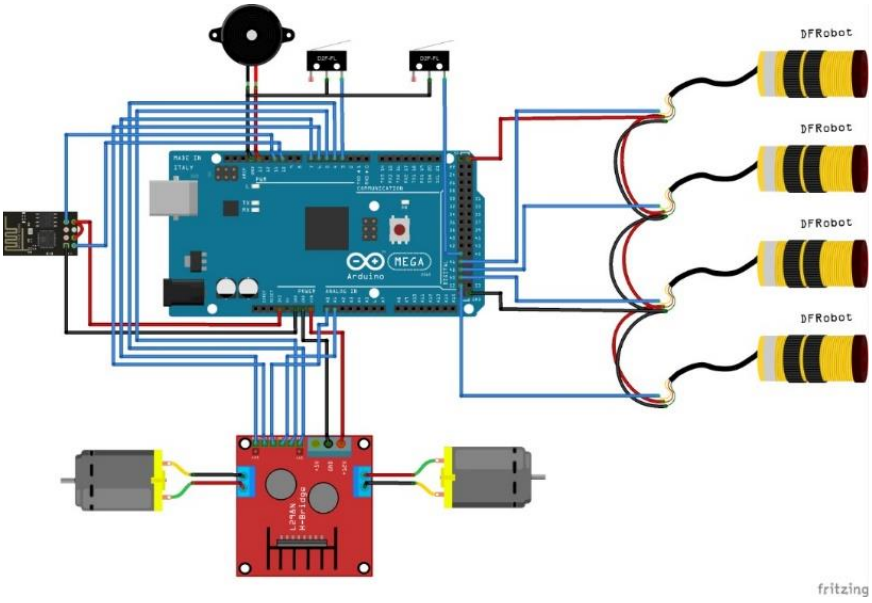

Figure 6:Actual circuit

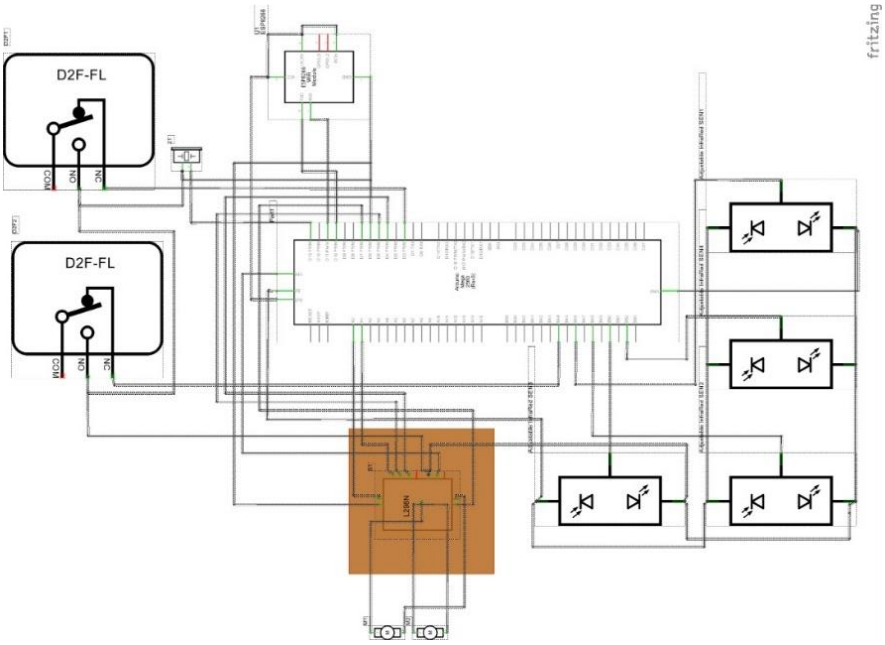

Figure 7: Schematic circuit

4.4 Coding in the Arduino IDE

The coding is based on what the component used and hardware that involved in this project that shown in Figure 7.

xy_park_iot

```
#define BLYNK_PRINT Serial
#include <ESP8266_Lib.h>
#include <BlynkSimpleShieldEsp8266.h>

char auth[] = "sLNJ9tbZmpxSEZGBlBL5ln4gRL4JX2P_";


char ssid[] = "vivo 1806";
char pass[] = "saiful010894";

#include <SoftwareSerial.h>
SoftwareSerial EspSerial(10, 11); // RX, TX

#define ESP8266_BAUD 9600

ESP8266 wifi(&EspSerial);

#include <TimeLib.h>
#include <WidgetRTC.h>

BlynkTimer timer;

WidgetRTC rtc;

int masatanda = 0;

int tanda1 = 0;
int tanda2 = 0;
int tanda3 = 0;

float duit1 = 0;
float duit2 = 0;
float duit3 = 0;
```

Figure 8: Example of coding in Arduino

4.5 Prototype of proposed smart multilevel parking system

Figure 9 and 10 is shown the project prototype that consist of electrical circuit and mechanical parts. And this figure represent the Smart Multilevel-parking IoT-Based monitoring system. The mechanical part is represent screw long thread rod and limit switch with roller lever and the actuator of this project is dc motor attach with coupling and screw long thread rod.

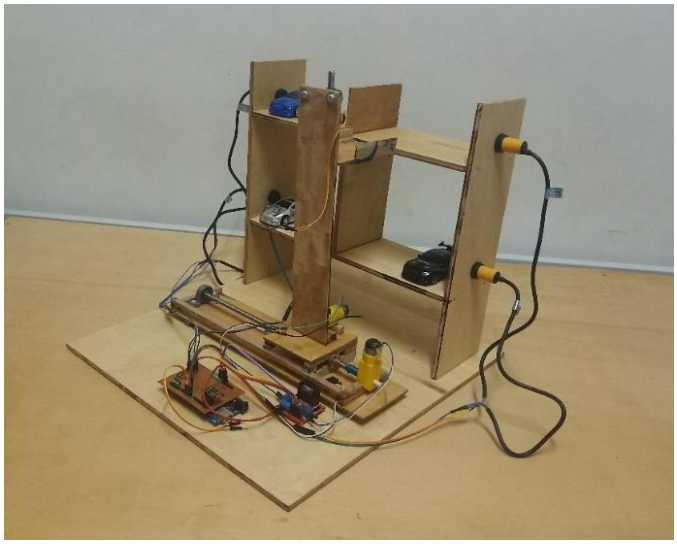

Figure 9: 3D view of the project prototype

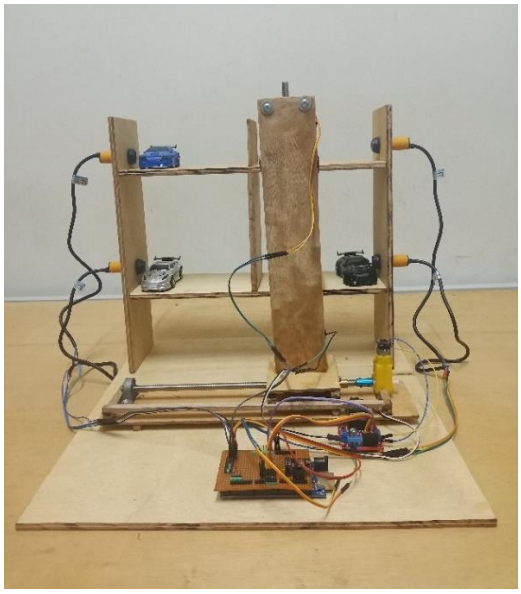

Figure 10: Front view of the project prototype

4.6 Discussions

Discussion and Suggestion for this project is to create the actual Application or "Apps" for this parking system take a risk to do refinement fabrication of the project. The Apps Blynks is helpful in this project because it can display the accurate day, time and other application for others to try more experienced about creating "Apps". This system is concept underground parking like Figure 10 which is invented to prevent the car parking space problem. Arduino coding in this project had some difficulties to write the code and need to explore more detail to acquire the knowledge and experience from this project.

5. Conclusion

The conclusion is in terms of smart cities, the progress of the Internet of Things and cloud computing has given rise to new possibilities. The heart of creating intelligent cities has always been smart parking facilities. The system provides the mechanism and information for the parking slots in real time. This project increases the efficacy of saving time for users to find a suitable parking space. It helps to address the rising traffic congestion problem. And lastly, this project can be marketable to community for advancement technology in Malaysia.

Acknowledgement

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