“RFID BASED SMART PARKING SYSTEM”

A Mini Project Report Submitted by

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UNDER THE GUIDANCE OF

Mr. Mahesh B L

Asst. Professor

Department of Artificial Intelligence and Machine Learning Engineering

In partial fulfilment of the requirements for the

Internet of Things
20AM506

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B.E. AIML Program Accredited by NBA, New Delhi from 1-7-2020 to 30-6-2024

CERTIFICATE

Certified that the mini project work entitled

"RFID BASED SMART PARKING SYSTEM"

is a bonafide work carried out by

Dhanush Kumar	*Nishanth N*	*Durgaprasad*
(4NM20AI015)	*(4NM20AI029)*	*(4NM20AI016)*

in partial fulfilment of the requirements for the award of

Bachelor of Engineering Degree in Artificial Intelligence and Machine Learning Engineering prescribed by Visvesvaraya Technological University, Belgaum

during the year 2022-2023.

It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library.

The mini project report has been approved as it satisfies the academic requirements in respect of the mini project work prescribed for the Bachelor of Engineering Degree.

14/12/2022

Signature of Guide

Signature of HOD

Evaluation

	Name of the Examiners	Signature with Date
1.	Disha D N	14/12/22
2.	Rakshitha	14/12/22

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Dhanush Kumar

Nishanth N

Durgaprasad

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ABSTRACT

Radio Frequency Identification (RFID) technology is widely used in various applications such as attendance system monitoring system or parking system. Currently, the existing parking system used manual entrance through security guard to access the premise. Therefore, the company need to hire security guard to monitor the premise. In addition, the security guards need to monitor all movement of vehicle or person that enter or leave the premise. As a result, unauthorized vehicle or person can easily access the building. To address this problem, we proposed a parking system using RFID technology that can monitor vehicle's movement that enter or leave the specific area or place by scanning the RFID tag. The potential benefit is it can improve security for both security guards and users. Besides that, this parking system can facilitate access control for users and improve traffic flow during peaks period.

In this paper we have shown the concept of microcontroller based automatic car parking system. As we see in the modern world everything has become automated, we have built a system which will automatically send the entry and exit of cars with the help of microcontroller through a gate and then display the number of cars in the parking lot. We have deployed a microcontroller which is interfaced with the pc to get the information about the parking space availability and then depending on the capacity of cars to enter, the gate either opens or remains closed. There is also RFID module to provide security as users who have authority can swipe the RFID cards and get entry otherwise not. The goal of this paper is to automatically park the car into the parking area .LCD display is provided to display the information about the total number of cars that can be parked and the free slots available. Two IR sensors, transmitter and receiver pairs are used in the project to identify the entry and exit of the cars into or out of the parking lot. These two IR sensors transmitter and receiver pairs are arranged on either side of the gate.

INTRODUCTION :

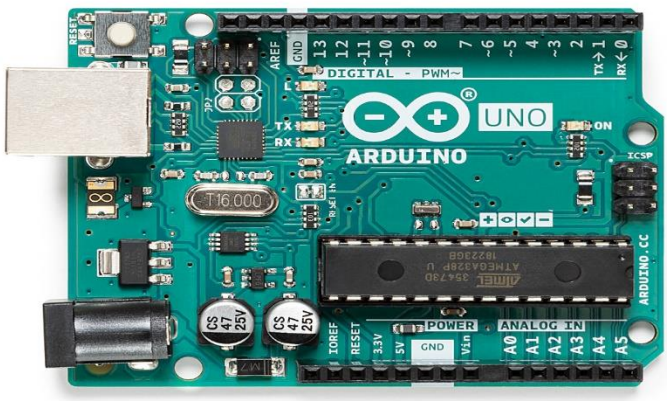
In these modern days finding car parking is a big issue in congested cities. There are too many vehicles on the road but not enough parking spaces. One of the biggest problems is when we enter a parking area then we realize that there are no empty parking slots to park our cars. Important time. Another biggest problem is after entering in a big parking area we confused to find the empty parking slot to park our car. Sometimes maybe we all have been facing these two problems that wasted our important time. That's why we need efficient parking management systems in all parking areas that will provide confusion-free and easy parking.

In this project, we will design a "Smart Parking System " to overcome this problem. This project helps the car's driver to park their car with minimum wastage of time with accurate information of the availability of the space to park.

HARDWARE COMPONENTS :

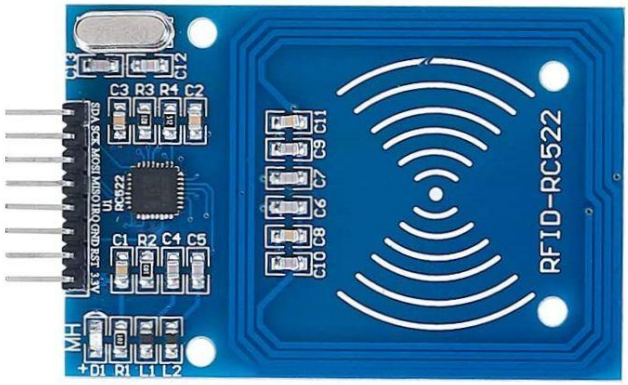
- Arduino UNO R3
- RFID Reader(MFRC 522)
- RFID Tags
- IR Sensor
- MG-90 Servo Motor
- 20x4 LCD & I2C Module
- Jumper cables

Arduino UNO R3 :



Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The processing unit or the micro-controller unit takes reading from the sensor and according calculates the angle and accordingly controls the platform with servo motor. Over here we have used Arduino UNO. Instead, you can even use Arduino Nano or if you want to reduce cost you can use Arduino Pro Mini.

RFID Reader (MFCR 522):



RC522 RFID Card Reader Module 13.56MHz is a low-cost MFRC522 based RFID Reader Module is easy to use and can be used in a wide range of applications.The MFRC522 is a highly integrated reader/writer IC for contactless communication at 13.56 MHz.RC522 is the highly integrated RFID card reader which works on non-contact 13.56mhz communication, is designed by NXP as low power consumption, low cost and compact size read and write chip, is the best choice in the development of smart meters and portable hand-held devices.

MF RC522 use the advanced modulation system, fully integrated at 13.56MHz with all kinds of positive non-contact communication protocols.

This module can fit directly in handheld devices for mass production. The module uses the 3.3V power supply and can communicate directly with any CPU board by connecting through SPI protocol, which ensures reliable work, high reading distance.

RFID TAGS :

A radio-frequency identification system uses tags, or labels attached to the objects to be identified. Two-way radio transmitter-receivers called readers send a signal to the tag and read its response. RFID tags can be either passive, active or battery-assisted passive. An active tag has an onboard battery and periodically transmits its ID signal. A battery-assisted passive (BAP) has a small battery on board and is activated when in the presence of an RFID reader. A passive tag is cheaper and smaller because it has no battery; instead, the tag uses the radio energy transmitted by the reader. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively.An RFID reader transmits an encoded radio signal to interrogate the tag. The RFID tag receives the message and then responds with its identification and other information. This may be only a unique tag serial number, or may be product-related information such as a stock number, lot or batch number, production date, or other specific information. Since tags have individual serial numbers, the RFID system design can discriminate among several tags that might be within the range of the RFID reader and read them simultaneously.

IR Sensor :

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

The emitter is simply an IR LED **(**Light Emitting Diode) and the detector is simply an IR photodiode . Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

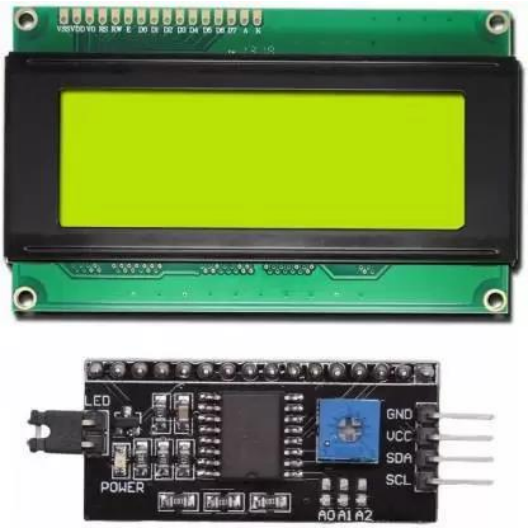
There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LEDs of specific wavelength used as infrared sources.

The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response.

MG-90 Servo Motor :

MG90S Metal Gear Mini Servo is tiny and lightweight with high output power, this tiny servo is perfect for RC Airplane, Helicopter, Quadcopter or Robot. This servo has metal gear for added strength and durability. Servo can rotate approximately 180 degree (90 in each direction), and works just like the standard kinds but smaller. For Motors we have decided to use Servo motor as it is very easy to operate and has internal feedback mechanism so no external feedback is required for the platform. Over here we have used MG90 Metal gear Servo Motor. Depending on the weight of the stabilizing platform you can change the motor that you require. Higher torque servo motors like MG995, MG996 can also be used.

20x4 LCD & I2C Module :



This is a 20x4 Arduino compatible LCD display module with high speed I2C interface. It is able to display 20x4 characters on two lines, white characters on blue background.

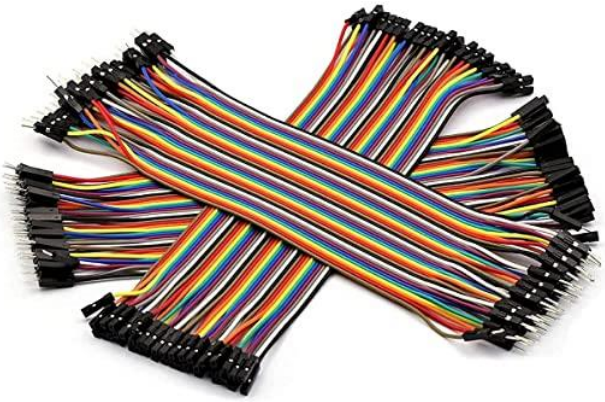
Generally, LCD display will run out of Arduino pin resource. It needs 6 digital pins and 2 power pin for a LCD display. If you want to build a robot project, it will be a problem with Arduino UNO and LCD display.

This I2C 20x4 LCD display module is designed for Arduino microcontroller. It is using I2C communication interface, With this I2C interface, only 2 lines (I2C) are required to display the information on any Arduino based projects. It will save at least 4 digital / analog pins on Arduino. All connector are standard XH2.54 (Breadboard type). You can connect it with jumper wire directly.

This 1602 LCD module has 8 I2C address in all, from 0x20 to 0x27. You can set one according to your requirements, avoiding the confliction of I2C address. And its contrast can be adjusted manually.

This board is able to be powered by 5V or 3.3V which make it compatible with both Arduino 101 or Arduino DUE, intel Edison 3.3V system and standard Arduino UNO/Arduino Mega 5V system

Jumper Cable :



A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. There are different types of jumper wires. Some have the same type of electrical connector at both ends, while others have different connectors. Here we use jumper wires with male and female pins of the solid type.

Software requirements :

- Arduino IDE
- OS (Windows,mac,linux)

Problem Statement :

In these modern days finding car parking is a big issue in congested cities. There are too many vehicles on the road but not enough parking spaces. One of the biggest problems is when we enter a parking area then we realize that there are no empty parking slots to park our cars. Important time. Another biggest problem is after entering in a big parking area we confused to find the empty parking slot to park our car. Sometimes maybe we all have been facing these two problems that wasted our important time

Proposed solution :

Solution to the problem is to create a smart parking lot. If the user is authorised , will need to be given information about where there are open spots in the lot so that they can quickly navigate to those spaces.

Placing sensors in each of the parking spots which can sense if the space is occupied. These sensors will then be networked to a central device, most likely a board, which will compute how many open spots there are and where they are located. Lastly, we need some way to display the information to the driver to make the information useful.

Working :

This smart parking system project consists of Arduino, four IR sensors, one servo motor,RFID, and one LCD display. Where the Arduino is the main microcontroller that controls the whole system. Two IR sensors are used at the entry and exit gates to detect vehicle entry and exit in the parking area .RFID is used at the entrance to verify the car And other two IR sensors are used to detect the parking slot availability. The servo motor is placed at the entry and exit gate that is used to open and close the gates. Also, an LCD display is placed at the entrance, which is used to show the availability of parking slots in the parking area.

When a vehicle arrives at the gate of the parking area, the display continuously shows the number of empty slots. RFID tag is scanned and if any empty slots are available then the system opens the entry gate by the servo motor. After entering the car into the parking area, when it will occupy a slot, then the display shows this slot is full.

If there is no empty parking slot then the system displays all slots are full and does not open the gate.

There are two parking slots in this project, IR sensor-3 and 4 are placed at slot 1 and 2 respectively. IR sensor-1 and 2 are placed at the entry and exit gate respectively and a servo motor is used to operate the common single entry and exit gate. The LCD display is placed near the entry gate.

The system used IR sensor-3 and 4 to detect whether the parking slot is empty or not and IR sensor-1, and 2 for detecting vehicles arriving or not at the gate.

In the beginning, when all parking slots are empty, then the LCD display shows all slots empty. When a vehicle arrives at the gate of the parking area then the IR sensor-1 detects the vehicle and if the RFID tag is authorised the system allowed to enter that vehicle by opening the servo barrier. After entering into the parking area when that vehicle occupies a slot then the LCD display shows that the slot is full. In this way, this system automatically allows 2 vehicles.

In case the parking is full, the system blocked the entrance gate by closing the servo barrier. And the LCD display shows that slot-1 and 2 all are full.

When a vehicle leaves a slot and arrives at the gate of the parking area then the IR sensor-2 detects that vehicle and the system open the servo barrier. Then the LCD display shows that the slot is empty. Again the system will allow entering a new vehicle.

Arduino code :

```
#include <MFRC522.h>
#include <Servo.h>
#include <LiquidCrystal_I2C.h>
#include <SPI.h>

#define ir_1 6
#define ir_2 7
#define ir_e 5
#define ir_b 4
#define SS_PIN 10
#define RST_PIN 9

String UID = "DC D5 EB 38";
```

```
Servo myservo;
LiquidCrystal_I2C lcd(0x27, 16, 2);
MFRC522 rfid(SS_PIN, RST_PIN);
int s1=0, s2=0, se=0, sb=0;
int flag1=0, flag2=0;
int slot=2;

void setup() {
  Serial.begin(9600);

  pinMode(ir_1, INPUT);
  pinMode(ir_2, INPUT);
  pinMode(ir_e, INPUT);
  pinMode(ir_b, INPUT);

  myservo.attach(3);
  myservo.write(90);
  lcd.init();
  lcd.backlight();
  lcd.begin(20,4);
  lcd.setCursor(2,1);
  lcd.print("  car parking  ");
  lcd.setCursor(2,2);
  lcd.print("   system  ");
  delay(2000);
  lcd.clear();
  SPI.begin();
  rfid.PCD_Init();
  Read_Sensor();
  int total = s1+s2;
  slot = slot-total;
}

void loop() {

  Read_Sensor();
  lcd.setCursor(2,0);
  lcd.print("  Have Slot: ");
  lcd.print(slot);
  lcd.print("  ");
  lcd.setCursor(0,1);
  if(s1==1){lcd.print("s1:Fill ");}
  else{lcd.print("s1:Empty");}
  lcd.setCursor(10,1);
  if(s2==1){lcd.print("s2:Fill ");}
     else{lcd.print("s2:Empty");}
```

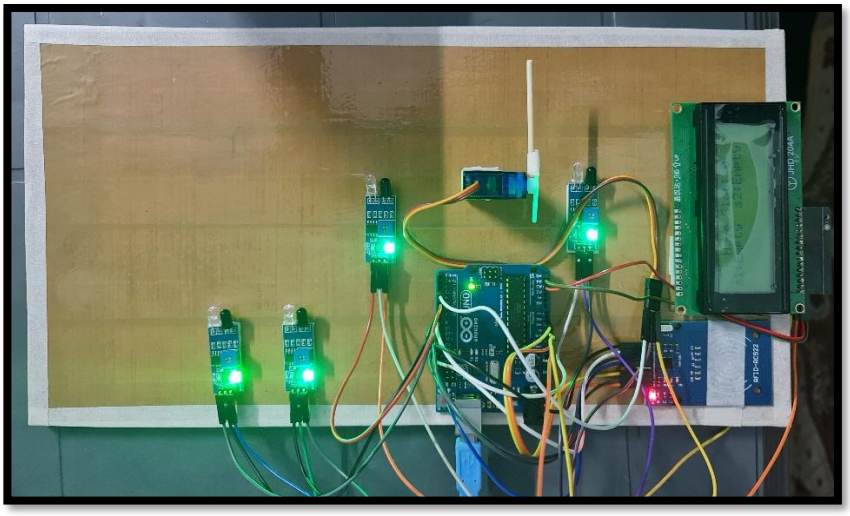
```
    lcd.setCursor(4,2);lcd.print("           ");
    if(digitalRead(ir_e)==0 && flag1==0){
      if(slot>0){flag1=1;
      if(flag2==0){
if ( ! rfid.PICC_IsNewCardPresent())
    return;
  if ( ! rfid.PICC_ReadCardSerial())
    return;
  lcd.setCursor(4, 3);
  lcd.print("Scanning");
  String ID = "";
  for (byte i = 0; i < rfid.uid.size; i++) {
    ID.concat(String(rfid.uid.uidByte[i] < 0x10 ? " 0" : " "));
    ID.concat(String(rfid.uid.uidByte[i], HEX));
    delay(300);
    lcd.setCursor(4,3);
    lcd.print("         ") ;

  }
  ID.toUpperCase();
        if (ID.substring(1) == UID )
        {myservo.write(180);
      slot=slot-1;
      delay(1000);}else{flag1=0;lcd.setCursor(4,2);
lcd.print("not allowed");
      delay(600);
      flag2=1;
      }
 return;
      }
      }else{
        lcd.setCursor (0,0);
        lcd.print("sorry parking full");
        delay(1500);
        lcd.clear();
         }
    }
    if(digitalRead(ir_b)==0 && flag2==0){flag2=1;
    if(flag1==0){myservo.write(180);slot=slot+1;}
    }
    if(flag1==1 && flag2==1){
      delay(1000);
      myservo.write(90);
      flag1=0,flag2=0;
    }
  delay(1);
```

```
  }
void Read_Sensor(){
  s1=0, s2=0;
if(digitalRead(ir_1)==0)(s1=1);
if(digitalRead(ir_2)==0)(s2=1);

}
```

Results :



Power on the system :

Both slots are empty :

Slot S1 is full and S2 empty :

Both slots are full :

Parking full condition :

Slot S1 empty and S2 full :

Invalid tag condition :

Limitations of RFID based car parking system :

- Security Risks :

  While the transferability of the RFID tags adds to the convenience of its use, it can lead to increased security risks when the cards, fobs or hang tags get lost or fall into the wrong hands. Users might also abuse the system and share their RFID tag with their friends and family members.

  There is also the danger of RFID skimming- the method of unlawfully obtaining an RFID tag's unique credentials and in the case of parking management, possibly gaining unauthorized access to the facility and getting the user's private information.

- High cost :

  The whole RFID parking system- security gates, RFID readers, self-check stations, sorting equipment, inventory wands, configuration with the parking software- requires a big financial investment ,depends on the size of the car park.

Future Enhancements :

- To differentiate the vehicles from VIP's and staff
- The camera can be used for security
- By using GPS system we can find where the car park and also we can find number of vacancy available in parking system.
- The range of the RFID reader can be increased, so the reader can detect the tag from far distance.
- GSM module to send the parking lot subscribers notifications via SMS informing about the availability of parking slots.
- Video surveillance can be implemented.
- The Database has all the vehicle information stored in it such as: Vehicle type, model etc. The transferred data can be saved and stored in computer as a database using specific software.

Conclusion :

The integration of RFID with IR sensor technology has enhanced the security level in the Parking Area. The objectives have been fulfilled. This system is fully automated and it does not require any human interaction therefore eliminated the paper work. This system is accurate and can avoid theft. Power saving is also one of the important aspect of this system. The project has been successfully implemented to park the vehicle automatically. In this project IR sensor section is used to detect the parking slots and basic component in this project is the microcontroller which controls all the actions performed by various devices.

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