A
Project Report
on

Smart Multilevel Car Parking System

Submitted to

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Submitted in partial fulfillment of
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Bachelor of Engineering in
Electronics and Telecommunication Engineering

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Certificate

This is to certify that the project report entitled **"Smart Multilevel Car Parking System"** is hereby approved as a creditable study carried out and presented by

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Abstract

The industrialization of the world increased with the population. City development and mismanagement of the available parking space have resulted in parking-related problems. There is a need for a secure, efficient, and reliable system that can be used for parking facilities.

A Smart Multilevel Car Parking System is a mechanical system designed to minimize the area or volume required for parking cars. It provides parking for cars on multiple levels stacked vertically to maximize the number of parking spaces while minimizing land usage. The system, however, utilizes a mechanical system to transport cars to and from parking spaces (rather than the driver) in order to eliminate much of the space wasted in a multi-story parking garage. So, we are using Arduino, LCD display, Motor driver, and DC gear motor for the parking system and in order to access the parking system we are using an RFID system.

Acknowledgement

We would like to take this opportunity to express our heartfelt thanks to our guide Prof. **Dr. D. D. Nawgaje** for his esteemed guidance and encouragement, especially through difficult times. His suggestions broaden our vision and guided us to succeed in this work. We are also very grateful for his guidance and comments while designing part of our project and learned many things under his leadership. Also, we would like to thank Dr. M. N. Tibdewal, Head of the Electronics and Telecommunication Department, and all teaching and non-teaching staff of the EXTC Department for their encouragement and suggestions for our project.

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Abbreviations

LCD	- Liquid Crystal Display
RFID	- Radio Frequency Identification
IDE	- Integrated Development Environment
DC	- Direct Current
GND	- Ground
PWM	- Pulse Width Modulation
AREF	- Analog Refrence
LED	- Light Emitting Diode
EV	- Electric Vehicle
MQTT	- MQ Telemetry Transport
AWS	- Closed Circuit Television
TX	- Transmitter
RX	- Receiver
IC	- Integrated Circuit
EEPROM	- Electrically Erasable Programmable Read-Only Memory
RPM	- Rotation Per Minute
ASCII	- American Standard Code for Information Interchange
SQL	- Structured Query Language
DBMS	- Data-Based Management System
HTML	- Hyper Text Markup Language
CSS	- Cascading Style Sheets
DOM	- Document Object Model

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Chapter 1

Introduction

In today's world vehicle parking is becoming a big problem. As the population is increasing, the number of vehicles is also increasing but the area to park the vehicle is not increasing. And this creates a big problem for vehicles like car and minivans for parking People end up parking cars on roads which further leads to traffic jams.

The multi-storied car parking system will help in parking a large number of cars in smaller parking land. This Smart Multilevel Car Parking System enables the parking of vehicles, floor after floor and thus reducing the space used Also automating this will help in less manual intervention and thus will lead to fewer problems.

A Smart Multilevel multi-stored car parking system is a very good substitute for a car parking area. In the modern world, where space has become a very big problem and in the era of miniaturization it become a very crucial necessity to avoid the wastage of space in modern. big companies and apartments etc. In a space where more than 100 cars need to be parked, it is a very difficult task to do, and also to reduce the wastage of area, this system can be used. This Car Parking enables the parking of vehicles floor after floor and thus reduces the space used here any number of cars can be parked according to requirement. This makes the system modernized and even a space-saving one.

Fig. 1.1 Multilevel Car Parking System

Smart parking solutions can be used to locate available parking spaces with the help of sensors. This saves customers time as well as minimizes the wastage of fuel Various technologies are being used to ease parking problems in public places. For example, using RFID technology, the check-in and checkout time for the vehicle can be reduced and also the payment system can be automated. Similarly using wireless sensors information like parking duration, available slot, billing details, directional details, etc. can be obtained which will help the drivers and will thus ease out parking vows Using the software, short messages can also be used to provide drivers with relevant parking information. In Smart multilevel car parking, the car is lifted and placed at the available slot.

1.1 Motivation

The aim of the work is to design an Automatic Multi-level car parking system that can help the common public to park their vehicles in less space and secure the aim of the work is to design an Automatic Multi-level car parking system which can help the common public to park their vehicles in less space and secure environment. An innovation to design something which can avoid the wastage of space in big companies and apartments is needed. This leads to the following parameters, which are required in day-to-day life.

- Traffic management
- Fuel Saving
- Time-saving
- System reduces maintenance cost
- Safe parking of cars as compared to a traditional system

1.2 Literature review

An EV charging point in a crowd-sensing area was developed by Dr.V.S. Arulmurugan (2021) [1]. This smart parking improvement suggests an IoT founded scheme that directs information about open and full parking spaces via mobile or web application. The IoT is expedient, and includes microcontroller and sensor devices with Electric Vehicle (EV)–charging point, is situated in respective car parks place. HC-SR04 distance dimension instrument, ESP8266 microcontroller, MQTT grid rules, and AWS IoT, AWS Lambda cloud analytics are utilized.

P. Mrunalini proposed Multilevel Smart Parking system based on IOT that assigns a parking lot in multiple level parking structure in 2018 [2]. IR sensors detect changes within the lot and help maintain a database of lots where we can easily identify free and parked lots. This is done by dividing a parking lot into multiple sectors and maintaining an array of Arduino's to monitor them and interface them with a Raspberry Pi so that changes can be pushed into the database through the network module. The system assigns a spot to a customer in an efficient manner prior to entry into the complex by dynamically monitoring and update its state according to the changes internally.

A. Olowolayemo 2018 constructed "SPOT: A Low-Cost Intelligent Parking System for Urban Malls" [3]. This work is aimed at providing a low-cost intelligent parking system for shopping mall consumers to conveniently reserve parking spots just before arrival at the mall and an easier way of making payment during their visits. Using this system, they are also able to keep track of consumers activities of entering and leaving the car park and may be able to forecast the usage or demand for parking spots.

1.3 Objectives

The objective of a smart multilevel car parking system is to optimize the use of space, reduce traffic congestion, and improve the efficiency of parking for drivers. This can be achieved through the implementation of cutting-edge technology and automation, such as:

1. Real-time monitoring of parking space availability, allowing drivers to easily locate available parking spots.
2. Smart payment processing that eliminates the need for cash transactions and reduces waiting times.
3. Integration with mobile applications and other platforms to provide drivers with a seamless parking experience.

Overall, the objective of a smart multilevel car parking system is to provide a comprehensive solution to parking management that improves traffic flow, reduces waiting times, and increases customer satisfaction.

Chapter 2

SYSTEM OVERVIEW

2.1 Arduino Uno

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, is used to write, and upload computer code to the physical board.

2.2 RFID

An RFID system can be broken down into two key dimensions The technical infrastructure includes the actual data capture technology comprised of tags, readers, and transmission medium.

The logical infrastructure refers to the overall identification (ID) scheme used in representing objects. The ID scheme includes the actual coding or naming system for objects, the database or registry that contains the information relating to the codes or IDs, and lastly an ID resolution mechanism for matching the ID data with object information.

2.3 Motor

Center shaft DC motors are simple DC Motors featuring gears for the shaft for obtaining the optimal performance characteristics. They are known as Center Shaft DC Geared Motors because their shaft extends through the center of their gearbox assembly.

2.4 Motor Driver

L298N Motor Driver Module is a high-power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

2.5 LCD Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. It uses very small amounts of electric power and is, therefore, suitable for use in battery-powered electronic devices.

2.6 Software Required

- Arduino IDE
- Visual Studio Code
- MongoDB

Chapter 3

HARDWARE DESCRIPTION

3.1 Arduino Uno

Arduino Uno is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board. Specifications of Arduino-

Microcontroller	ATmega328
Clock Speed	16MHz
Operating Voltage	5V
Maximum supply Voltage (not recommended)	20V
Supply Voltage (recommended)	7-12V
Analog Input Pins	6
Digital Input/Output Pins	14
DC Current per Input/Output Pin	40mA
DC Current in 3.3V Pin	50mA
SRAM	2KB
EEPROM	1KB
Flash Memory	32KB of which 0.5KB used by boot loader

Table 3.1 Specifications of Arduino Uno

The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.

- **GND (3):** Short for 'Ground". There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- **5V (4) & 3.3V (5):** As you might guess, the SV pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
- **Analog (6):** The area of pins under the "Analog In' label (A0 through AS on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.

- **Digital (7):** Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).
- **PWM (8):** You may have noticed the tilde (-) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).
- **AREF (9):** Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

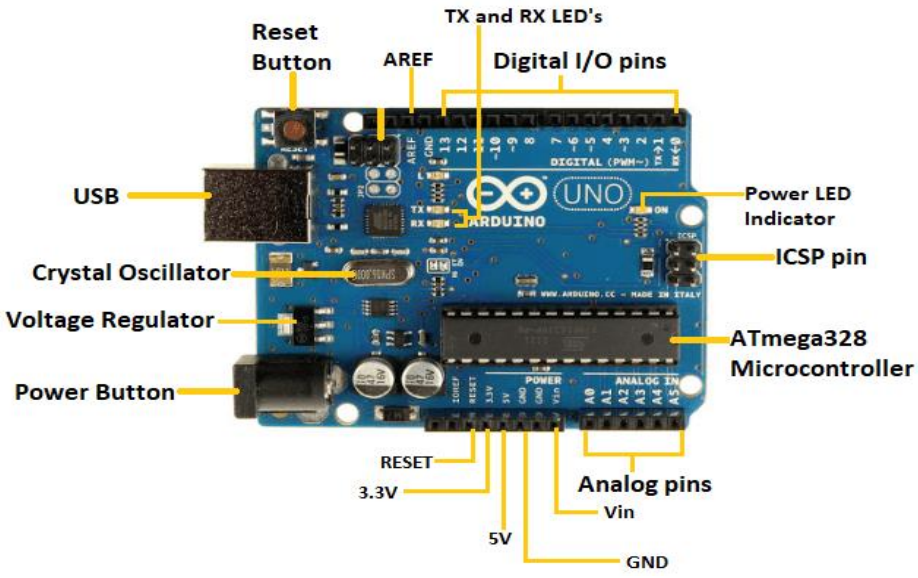


Fig 3.1 Arduino Uno

Reset Button

Just like the original Nintendo, the Arduino has a reset button (10). Pushing it will temporarily connect the reset pin to the ground and restart any code that is loaded on the Arduino. This can be very useful if your code does not repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino does not usually fix any problems.

Power LED Indicator

Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON' (11). This LED should light up whenever you plug your Arduino into a power source. If this light does not turn on, there's a good chance something is wrong. Time to re-check your circuit.

TX RX LEDS

TX is short for transmit; RX is short for receive. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication. In our case, there are two places on the Arduino UNO where TX and RX appear - once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs (12). These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we are loading a new program onto the board).

Main IC

The black thing with all the metal legs is an IC, or Integrated Circuit (13) Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type but is usually from the ATmega line of ICs from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various ICs, reading the datasheets is often a good idea.

Voltage Regulator

The voltage regulator (14) is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it is for. The voltage regulator does exactly what it says -- it controls the amount of voltage that is let into the Arduino board.

3.2 RFID Module

Radio Frequency Identification (RFID) is a wireless non-contact method, that uses a radio frequency electromagnetic field as a medium for communication for the purpose of identifying and tracking a tag attached to an object. The RFID system is a combination of an RFID reader and a transponder also known as a tag.

Fig.3.2. RFID Reader and Tags

3.2.1 RFID Frequency Bands

RFID systems can be classified according to the radio frequency used to communicate between the RFID systems components. Radio frequency is defined as the frequency of the sine wave generated by the reader to send a request to the tag. The rate of data transfer is influenced by the frequency of the carrier wave used to carry the data between the tag and its reader RFID tags and readers must tune to the same frequency in order to communicate effectively. An RFID system typically uses one of the following ranges. The frequency range and some features are shown in the table.

3.2.2 RFID Tag

An RFID tag is a microchip combined with an antenna in a compact package: the packaging is structured to allow the RFID tag to be attached to an object to be tracked "RFID" stands for Radio Frequency Identification. Tags are classified by the manner

in which they derive their operating power, even though the power levels required are invariably very small (micro to milli-watts) Tags are either passive or active

3.2.2.1 Active Tags

An RFID tag is an active tag when it is equipped with a battery that can be used as a partial or complete source of power for the tag's circuitry and antenna. Some active tags connect the tag to an external power source.

The advantages of an active RFID tag are:

- It can be read at longer distances than a passive tag.
- It may have other sensors that can use electricity for power.

The disadvantages of an active RFID tag are:

- The tag cannot function without battery power, which limits the lifetime of the tag.
- The tag is typically more expensive.
- The tag is physically larger, which may limit applications.

3.2.2.2 Passive Tag

A passive tag is an RFID tag that does not contain a battery: the power is supplied by the reader and thus has a low range limited up to a few meters. When radio waves from the reader reach the chip's antenna, the coiled antenna within the tag forms magnetic field electricity and energizes the circuit that can power up the microchip in the tag. The tag can send back any information stored on the tag by reflecting the electromagnetic waves

The advantages of a passive tag are

- The tag functions without a battery, these tags have a useful life of twenty years or more.
- The tag is typically much less expensive to manufacture
- The tag is much smaller and lighter in size than active tag

The disadvantages of a passive RFID tag are

- The tag can be read only at very short distances, typically a few feet at most. This greatly limits the device for certain applications
- It may not be possible to include sensors that can use electricity for power
- The tag remains readable for a very long time, even after the product to which the tag is attached has been sold and is no longer being tracked.

3.2.2.3 RFID TAG STRUCTURE

The RFID tag is a small device that stores and sends data to RFID readers. The tag's antenna picks up signals from an RFID reader and then returns the signal, usually with some additional data (like a unique serial number or other customized information. The basic internal structure of the RFID transponder RFID tag contains a copper coil known as an antenna. The main function of the coil is to provide power to the

chip as well as to work as an antenna to receive and transmit data. Two wires from the coil relate to a chip i.e., a microchip is attached to an antenna. The chip is the heart of the RFID tag. The microchip stores the unique ID and incorporates the necessary logic circuitry for the functioning of the tag. It has an internal EEPROM to store the unique ID. The antenna in an RFID tag is a conductive element that permits the tag to exchange data with the reader. Passive RFID tags make use of a coiled antenna that can create a magnetic field using the energy provided by the reader's carrier signal.

3.2.3 RFID Reader

The reader has an antenna that emits radio waves, and the tag responds by sending back its data. The reader receives the modulated waves and converts them into digital data. Several factors can affect the distance at which a tag can be read (the read range), RFID readers are usually a microcontroller-based unit with a wound output coil. The overall function of an RFID reader is to provide a way of communicating with the tags and facilitating data transfer. The reader continuously emits radio waves called an active reader, which works with a passing tag, and a reader which does not emit the radio wave is called a passive reader, it only receives the signal from an active tag.

3.2.4 RFID Communication

The communication between the RFID reader and tag is done by electronic coupling. Electromagnetic couplings systems are systems in which a magnetic field is used to transfer data or power. Electromagnetic coupling techniques are generally applied to RFID systems operating in the low to medium frequency bands, with relatively short reading distances. The reader antenna loop and the tag coil windings establish a loosely connected "space transformer" resulting in power transfer across short bidirectional reading distances, Maximum power transfer between the reader antenna coil and the tag coil occurs when the two coupled coils are placed or aligned in the same plane.

Range	**0 to 100m**
Frequency	2.4GHz to 2.5GHz (UHF) ISM
Weight	550g
Modulation	GFSK
Power	12 to18μA, 3V
Anti-collision	100 tags are read simultaneously
Operation	Read only
Battery	4 years
Dimensions	Card, 85.5mm x 54mm x 4mm

Table 3.2. Specifications of RFID

3.3 Center Shaft DC Gear Motor

These motors are simple DC Motors featuring gears for the shaft for obtaining optimal performance characteristics. They are known as Center Shaft DC Geared Motors because their shaft extends through the center of their gearbox assembly.

The L298N H-bridge module with onboard voltage regulator. These motors are simple DC Motors featuring gears for the shaft for obtaining optimal performance characteristics. They are known as Center Shaft DC Geared Motors because their shaft extends through the center of their gearbox assembly. The L298N H-bridge module with onboard voltage regulator motor driver can be used with this motor that has a voltage of between 5 and 35V DC. This DC Motor – 300 RPM – 12Volts can be used in all-terrain robots and a variety of robotic applications.

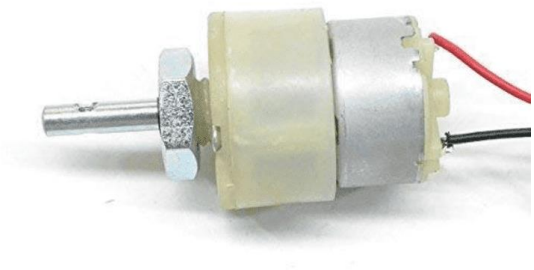


Fig 3.3. Center shaft DC gear motor

This DC Motor with Metal Gear Head is ideal for low RPM, High Torque applications like lifting an object through a Hookator motor driver can be used with this motor that has a voltage of between 5 and 35V DC. This DC Motor – 60 RPM – 12Volts can be used in all-terrain robots and a variety of robotic applications. This DC Motor with Metal Gear Head is ideal for low RPM, High Torque applications like lifting an object through a Hook.

- 60 Rpm 12V Dc Motors with Gearbox
- 6mm Shaft Diameter with Internal Hole
- 125Gm Weight
- Stall Torque = 1.5Kgcm Torque
- No-Load Current = 60 Ma (Max), Load Current =60 Ma (Max)

3.4 L298N Motor driver

This L298N Motor Driver Module is a high-power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control. The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, and 5V jumper in an integrated circuit.

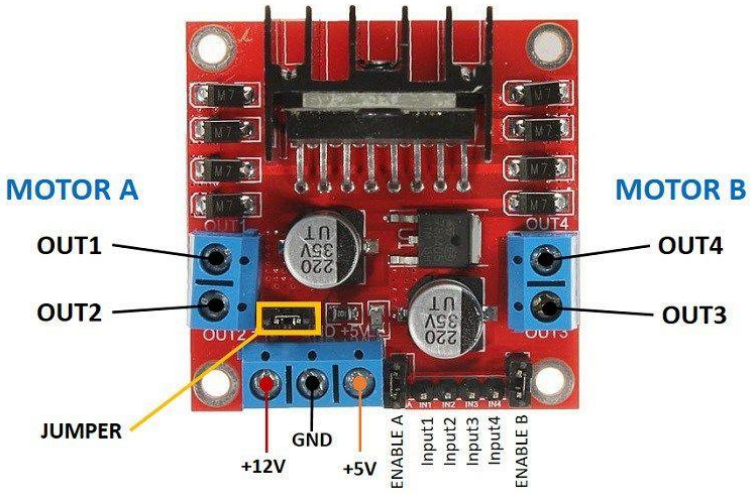


Fig 3.4. L298N Motor Driver

Features and Specifications:

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor

- Heatsink for better performance
- Power-On LED indicator

3.5 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of applications A 16x2 1CD display is a very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi-segment LEDs. The reason is LCDs are economical: easily programmable; have no limitation of displaying special and even custom characters (unlike in seven segments), animations, and so on. In this system, we are using these 16x2 LCDs for displaying various messages for customer information. It is possible by interfacing these LCDs with corresponding core controllers.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5-8 dots with the cursor. This LCD has two registers to operate the LCD module, namely, Command, and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling the display, etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value (8 bits) of the character to be displayed on the LCD.

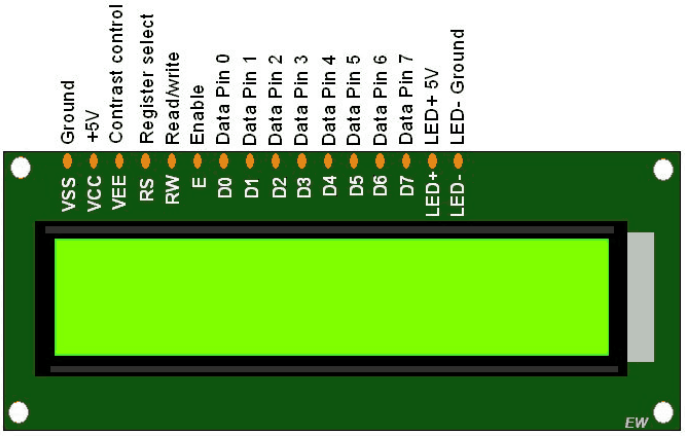


Fig. 3.5 LCD Display

The interface consists of the following pins:

- A **register select (RS)** pin that controls where in the LCD's memory you're writing data to. You can select either the data register, which holds what goes

on the screen or an instruction register, which is where the LCD's controller looks for instructions on what to do next.

- A **Read/Write (R/W)** pin that selects reading mode or writing mode
- An **Enable pin** that enables writing to the registers
- **8 data pins (D0 -D7).** The states of these pins (high or low) are the bits that you are writing to a register when you write or the values you're reading when you read.

There's also a **display contrast pin (Vo), power supply pins (+5V and GND),** and **LED Backlight (Bklt+ and BKlt-)** pins that you can use to power the LCD, control the display contrast, and turn on and off the LED backlight, respectively.

ITEM	SYMBOL	LEVEL	FUNCTIONS
1	LEDA	+5V	Power supply For LED Backlight
2	LEDK	0V	
3	VSS	0V	Power Ground
4	VDD	+5V	Power Supply For Logic
5	V0	—	Contrast adjust
6	RS	H/L	H:data L:command
7	R/W	H/L	H:read L:write
8	E	H. H→L	Enable singnal
9-16	DB0-DB7	H/L	Data Bus

Table 3.3 Pin Configurations and Functions of LCD

Chapter 4

HARDWARE INTERFACING

4.1 Interfacing LCD with Arduino Uno

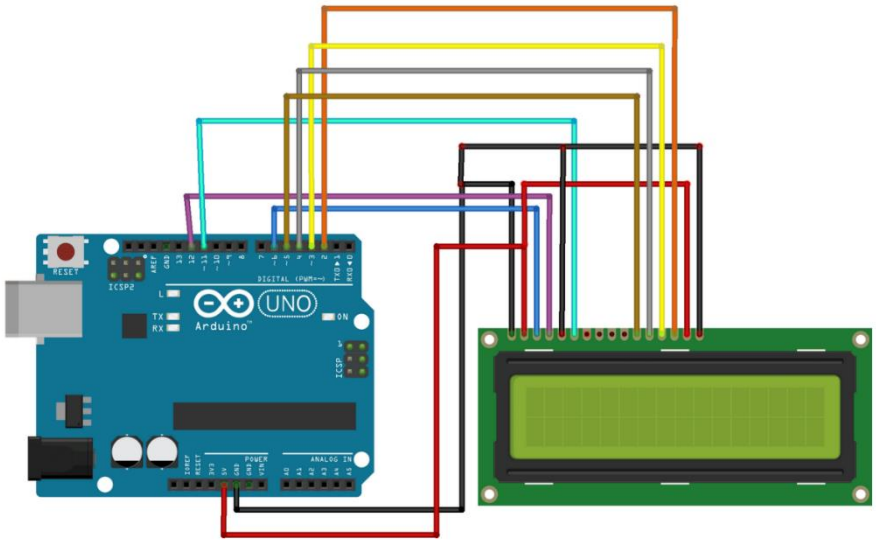


Fig. 4.1 Interfacing LCD with Arduino Uno

LCD Pin	Arduino Pin
1	GND
2	5V
3	D6
4	D12
5	GND
6	D11
11	D5
12	D4
13	D3
14	D2
15	5V
16	GND

Table 4.1 Arduino Interface with LCD

3.2 Interfacing RFID with Arduino Uno

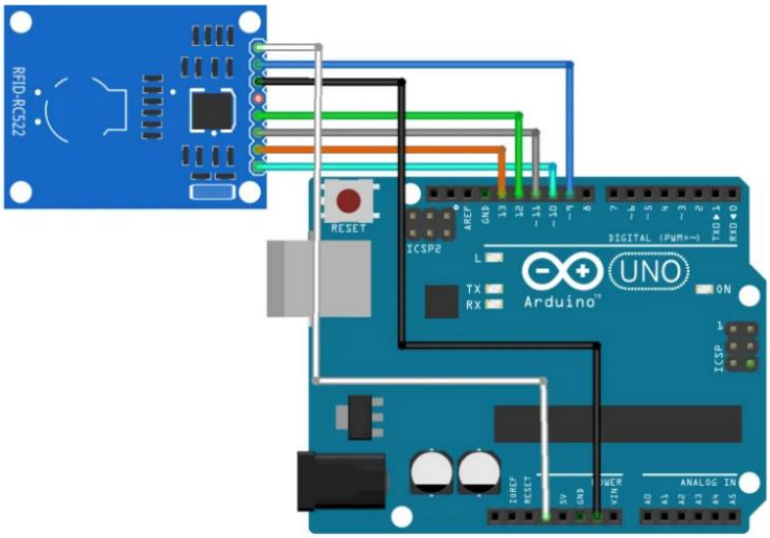


Fig. 4.2 Interfacing RFID with Arduino Uno

RFID-RC522 PIN	ARDUINO UNO PIN
SDA	10
SCK	13
MOSI	11
MISO	12
IRQ	UNUSED
GND	GND
RST	9
3.3 V	3.3 V

Table 4.2 Interfacing Arduino with RFID

Chapter 5

SOFTWARE ASPECTS

5.1 Arduino IDE

The Arduino integrated development platform application (for Windows, macOS, Linux) is written in the programming language Java. It is used to write and upload programs to Arduino-compatible boards, but also, with the help of 3rd party cores, and other vendor development boards The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, which is compiled and linked with a program stub mam) into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program AVRDUDESS to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

5.1.1 Sketches:

A sketch is a program written with the Arduino IDE. Sketches are saved on the development computer as text files with the file extension ino" Arduino Software (IDE) pre-1.0 saved sketches with the extension" pde"**.**

A minimal Arduino C/C++ program consists of only two functions:

- Setup (): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch
- Loop (): After the setup () function exits (ends), the loop () function is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

5.1.2 Arduino Programming

```
#include <SPI.h>
#include   <MFRC522.h>
#include <LiquidCrystal_I2C.h>
#define SS_PIN 10
#define RST_PIN   9
MFRC522 mfrc522(SS_PIN, RST_PIN);
LiquidCrystal_I2C lcd(0x27,16,2);

int EN_A = 5; //Enable pin for first motor
int IN1 = 3; //control pin for first motor
int IN2 = 4; //control pin for first motor
int IN3 = 7; //control pin for second motor
int IN4 = 8; //control pin for second motor
int EN_B = 6; //Enable pin for second motor

void setup()
{
  lcd.init();
 lcd.clear();
 lcd.backlight();      // Make sure backlight is on
 SPI.begin();
 mfrc522.PCD_Init();
 lcd.print("Scan RFID Card");
pinMode(EN_A, OUTPUT);
pinMode(IN1, OUTPUT);
```

```
pinMode(IN2, OUTPUT);
pinMode(IN3, OUTPUT);
pinMode(IN4, OUTPUT);
pinMode(EN_B, OUTPUT);
}
int x=0;
void loop()
{

 if ( ! mfrc522.PICC_IsNewCardPresent())
 {
  return;
  }

 if ( ! mfrc522.PICC_ReadCardSerial())
 {
  return;
 }
 lcd.print("UID tag :");
 String   content= "";
 byte letter;
 for (byte i = 0; i < mfrc522.uid.size; i++)
 {
  lcd.setCursor(0, 1);
   lcd.print(mfrc522.uid.uidByte[i] < 0x10   ? " 0" : " ");
   lcd.print(mfrc522.uid.uidByte[i], HEX);
```

```
    content.concat(String(mfrc522.uid.uidByte[i]   < 0x10 ? " 0" : " "));
    content.concat(String(mfrc522.uid.uidByte[i],   HEX));
  }
lcd.clear();
 lcd.print("Message : ");
  content.toUpperCase();
 if (content.substring(1) == "BA A2 61 A3") //Plz change   to your cards UID
 {
  if (x==0)
 {
  lcd.setCursor(0,1);
   lcd.print("Authorized");
   delay(100);
 digitalWrite(IN1, HIGH); // control motor A spins clockwise(uppar)
 digitalWrite(IN2, LOW);  // control motor A spins clockwise
 analogWrite(EN_A, 255);
 delay(30000);
 digitalWrite(IN1, LOW); // control motor A spins clockwise
 digitalWrite(IN2, LOW);
 delay(200);
 digitalWrite(IN3, HIGH); // control motor A spins clockwise
 digitalWrite(IN4, LOW);
 analogWrite(EN_B, 255);
 delay(23000);
 digitalWrite(IN3, LOW); // control motor A spins clockwise
 digitalWrite(IN4, LOW);
```

```
delay(100);
digitalWrite(IN1, LOW); // control motor A spins clockwise
digitalWrite(IN2, HIGH);
analogWrite(EN_A, 255);
delay(30000);
digitalWrite(IN1, LOW); // control motor A spins clockwise
digitalWrite(IN2, LOW);
delay(100);
digitalWrite(IN3, LOW); // control motor A spins clockwise
digitalWrite(IN4, HIGH);
analogWrite(EN_B, 255);
delay(23000);
digitalWrite(IN3, LOW); // control motor A spins clockwise
digitalWrite(IN4, LOW);


  setup();
  x=1;
  return;
}
else (x==1);
{
  lcd.setCursor(0,1);
  lcd.print("Authorized");
  delay(100);
  digitalWrite(IN1, HIGH); // control motor A spins clockwise
  digitalWrite(IN2, LOW);  // control motor A spins clockwise
```

```
analogWrite(EN_A, 255);
delay(8000);
digitalWrite(IN1, LOW); // control motor A spins clockwise
digitalWrite(IN2, LOW);
delay(200);
digitalWrite(IN3, HIGH); // control motor A spins clockwise
digitalWrite(IN4, LOW);
analogWrite(EN_B, 255);
delay(25000);
digitalWrite(IN3, LOW); // control motor A spins clockwise
digitalWrite(IN4, LOW);
delay(100);
digitalWrite(IN1, HIGH); // control motor A spins clockwise
digitalWrite(IN2, LOW);
analogWrite(EN_A, 255);
delay(26000);
digitalWrite(IN1, LOW); // control motor A spins clockwise
digitalWrite(IN2, LOW);
delay(100);
digitalWrite(IN3, LOW); // control motor A spins clockwise
digitalWrite(IN4, HIGH);
analogWrite(EN_B, 255);
delay(23000);
digitalWrite(IN3, LOW); // control motor A spins clockwise
digitalWrite(IN4, LOW);
delay(100);
```

```
    digitalWrite(IN1, LOW); // control motor A spins clockwise(niche)
    digitalWrite(IN2, HIGH);
    analogWrite(EN_A, 255);
    delay(40000);
    digitalWrite(IN1, LOW); // control motor A spins clockwise
    digitalWrite(IN2, LOW);
    delay(100);
    setup();
    x=0;
    return;
    }
  }  else
  {
   lcd.setCursor(0, 1);
    lcd.print(" Access denied");
    delay(1000);
      setup();
      }
}
```

Chapter 6

USER WEBPAGE

6.1 User website

To make a web page, we need to have knowledge of Frontend and Backend technologies.

6.1.1 Front-end (client-side) technologies.

Front-end technologies are for the “client side” of your website or application. They’re used to develop the interactive components of your website, and produce the elements that users see and interact with. This includes text colours and styles, images, buttons, and navigation menus.

6.1.2 Back-end (server-side) technologies.

Back-end technologies are for the “server-side” of your website or application. They are for developing the technical foundation. They store and arrange data and make sure everything on the front-end works. For example, when a user provides login credentials to a social media application, back-end technologies are used to check if those credentials are accurate. Once the credentials are verified, the server will send back the profile name, picture, and other associated information.

Back-end technologies are also used to streamline core business processes. In cases where you have lots of data that needs to be processed, you could run a script in the back end to generate a meaningful report on the front end. You can also send automatic emails to groups of users. Emails can be triggered by certain dates, such as the expiration of a user’s free website trial.

6.2 HTML

HTML is the language for describing the structure of Web pages. HTML gives authors the means to:

- Publish online documents with headings, text, tables, lists, photos, etc.
- Retrieve online information via hypertext links, at the click of a button.
- Design forms for conducting transactions with remote services, for use in searching for information, making reservations, ordering products, etc.
- Include spread-sheets, video clips, sound clips, and other applications directly in their documents.

With HTML, authors describe the structure of pages using *markup*. The *elements* of the language label pieces of content such as "paragraph," "list," "table," and so on.

6.3 CSS

CSS is the language for describing the presentation of Web pages, including colors, layout, and fonts. It allows one to adapt the presentation to different types of devices, such as large screens, small screens, or printers. CSS is independent of HTML and can be used with any XML-based markup language. The separation of HTML from CSS makes it easier to maintain sites, share style sheets across pages, and tailor pages to different environments. This is referred to as the *separation of structure (or: content) from presentation.*

6.4 JavaScript

JavaScript is a lightweight, cross-platform, single-threaded, and interpreted compiled programming language which is also known as the scripting language for webpages. It is well-known for the development of web pages, and many non-browser environments also use it. JavaScript is a weakly typed language (dynamically typed). JavaScript can be used for Client-side developments as well as Server-side developments. JavaScript is both an imperative and declarative type of language. JavaScript contains a standard library of objects, like Array, Date, and Math, and a core set of language elements like operators, control structures, and statements

JavaScript can be used for Client-side developments as well as Server-side developments. JavaScript is both an imperative and declarative type of language.

JavaScript contains a standard library of objects, like Array, Date, and Math, and a core set of language elements like operators, control structures, and statements.

- Client-side: It supplies objects to control a browser and its Document Object Model (DOM). Like if client-side extensions allow an application to place elements on an HTML form and respond to user events such as mouse clicks, form input, and page navigation. Useful libraries for the client side are AngularJS, ReactJS, VueJS, and so many others.
- Server-side: It supplies objects relevant to running JavaScript on a server. For if the server-side extensions allow an application to communicate with a database, and provide continuity of information from one invocation to another of the application, or perform file manipulations on a server. The useful framework which is the most famous these days is node.js.
- Imperative language – In this type of language we are mostly concerned about how it is to be done. It simply controls the flow of computation. The procedural programming approach, object, oriented approach comes under this as async await we are thinking about what is to be done further after the async call.
- Declarative programming – In this type of language we are concerned about how it is to be done; basically,
- here logical computation requires. Her main goal is to describe the desired result without direct dictation on how to get it as the arrow function does.

JavaScript can be added to your HTML file in two ways:

- Internal JS: We can add JavaScript directly to our HTML file by writing the code inside the <script> tag. The <script> tag can either be placed inside the <head> or the <body> tag according to the requirement.
- External JS: We can write JavaScript code in other files having an extension.js and then link this file inside the <head> tag of the HTML file in which we want to add this code.

6.5 Sharing HTML form data on Google Sheet

HTML forms are one part of the frontend development cycle that every web developer has had to deal with.

The steps below are used to link the forms and Sheet together:

1.) Create your HTML Form and add the appropriate input fields.

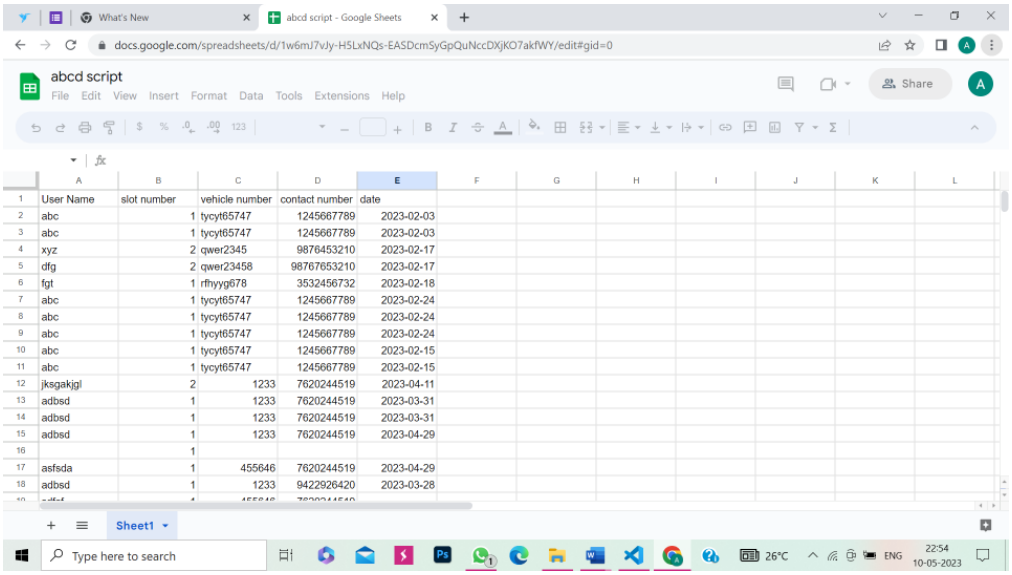
2.) Then log in to your Google account and create a Spreadsheet, fill in the first row of the sheet with the name of the input fields in your HTML form. OMIT THE FIRST COLUMN; it would be used to track the date of each entry.

3.) While still on the sheet, click on the extension menu and select app script. This would open in another browser tab.

4.) Rename the app script from "untitled project" to whatever you want. After replacing the myFunction function with the one below. Save the project (Ctrl + S or click the floppy disk icon).

5.) Run the script. This should bring up a permission dialog, follow the steps and grant all permissions required. When you get to this part click in advance and continue to the form. If permissions have been given properly, then you should see this.

The above script submits the form data and prevents the page from reloading.



	A	B	C	D	E
1	User Name	slot number	vehicle number	contact number	date
2	abc	1	tycyt65747	1245667789	2023-02-03
3	abc	1	tycyt65747	1245667789	2023-02-03
4	xyz	2	qwer2345	9876453210	2023-02-17
5	dfg	2	qwer23458	98767653210	2023-02-17
6	fgt	1	rfhyyg678	3532456732	2023-02-18
7	abc	1	tycyt65747	1245667789	2023-02-24
8	abc	1	tycyt65747	1245667789	2023-02-24
9	abc	1	tycyt65747	1245667789	2023-02-24
10	abc	1	tycyt65747	1245667789	2023-02-15
11	abc	1	tycyt65747	1245667789	2023-02-15
12	jksgakjgl	2	1233	7620244519	2023-04-11
13	adbsd	1	1233	7620244519	2023-03-31
14	adbsd	1	1233	7620244519	2023-03-31
15	adbsd	1	1233	7620244519	2023-04-29
16		1			
17	asfsda	1	455646	7620244519	2023-04-29
18	adbsd	1	1233	9422926420	2023-03-28

Fig. 6.1 HTML form data on Google Sheet

6.6 Visual Studio Code

Visual Studio Code is a source code editor that can be used with a variety of programming languages, including C, C#, C++, Fortran, Go, Java, JavaScript, Node.js, Python, etc. It is based on the Electron framework, which is used to develop web applications.

Visual Studio Code includes basic support for most common programming languages. This basic support includes syntax highlighting, bracket matching, code folding, and configurable snippets. Visual Studio Code also ships with IntelliSense for JavaScript, TypeScript, JSON, CSS, and HTML, as well as debugging support for Node.js. Support for additional languages can be provided by freely available extensions on the VS Code Marketplace.

6.7 MongoDB

MongoDB is a popular NoSQL document-oriented database management system (DBMS) that is designed to handle large volumes of structured and unstructured data. It is an open-source database that is used to store and manage data in JSON-like documents, which are called BSON (Binary JSON) documents. MongoDB allows for flexible schema design and has built-in features that allow for scalability, high availability, and easy integration with other applications.

Key features of MongoDB:

- Schema-less Design: MongoDB uses a flexible document model, which allows for dynamic schema design. Unlike traditional relational databases, MongoDB does not require you to define a strict schema before storing data. This means that you can store data of varying types and structures within the same collection.
- Document-Oriented: In MongoDB, data is stored in collections, which are made up of documents. A document is a set of key-value pairs that represent the data being stored. This document-oriented approach is well-suited for handling complex and hierarchical data structures.
- High Scalability: MongoDB is designed to scale horizontally, which means that you can add more servers to your cluster to handle increased traffic or data volume. MongoDB can also share your data across multiple servers to distribute the load evenly.

- Automatic Sharing: MongoDB has built-in support for automatic sharing, which allows you to scale your database horizontally by automatically partitioning data across multiple servers.
- Aggregation Framework: MongoDB provides a powerful aggregation framework that allows you to perform complex queries and aggregations on your data.
- Indexing: MongoDB supports a variety of indexing options, including geospatial, text, and compound indexes. Indexing can significantly improve query performance.
- Document Validation: MongoDB allows you to define rules for data validation, which helps ensure data integrity and consistency.

6.8 Frontend and Backend Coding

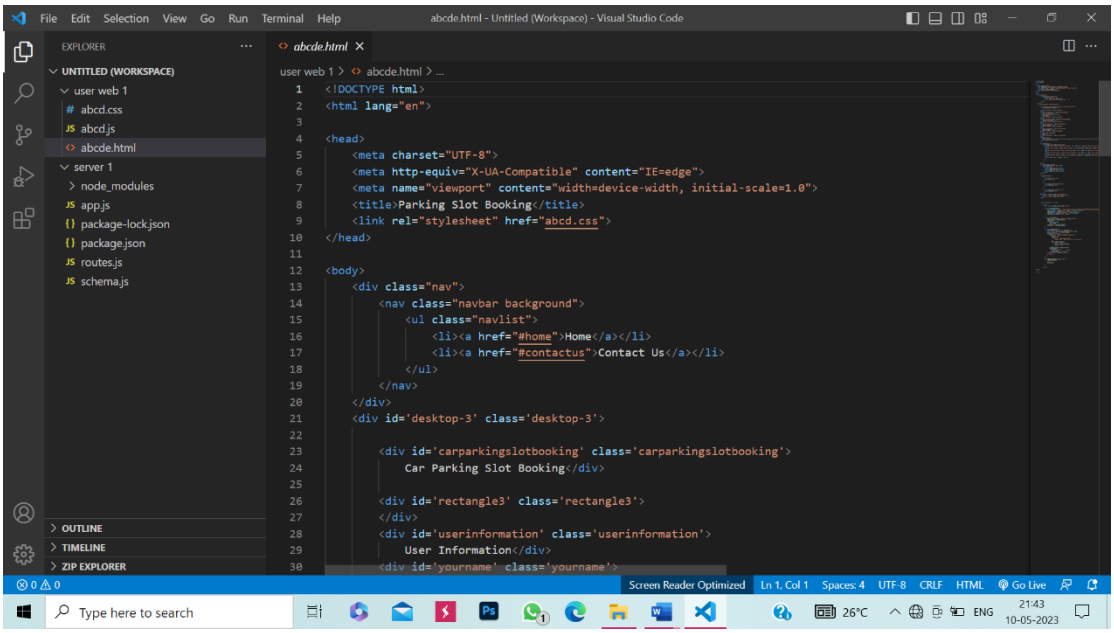


Fig. 6.2 HTML Code

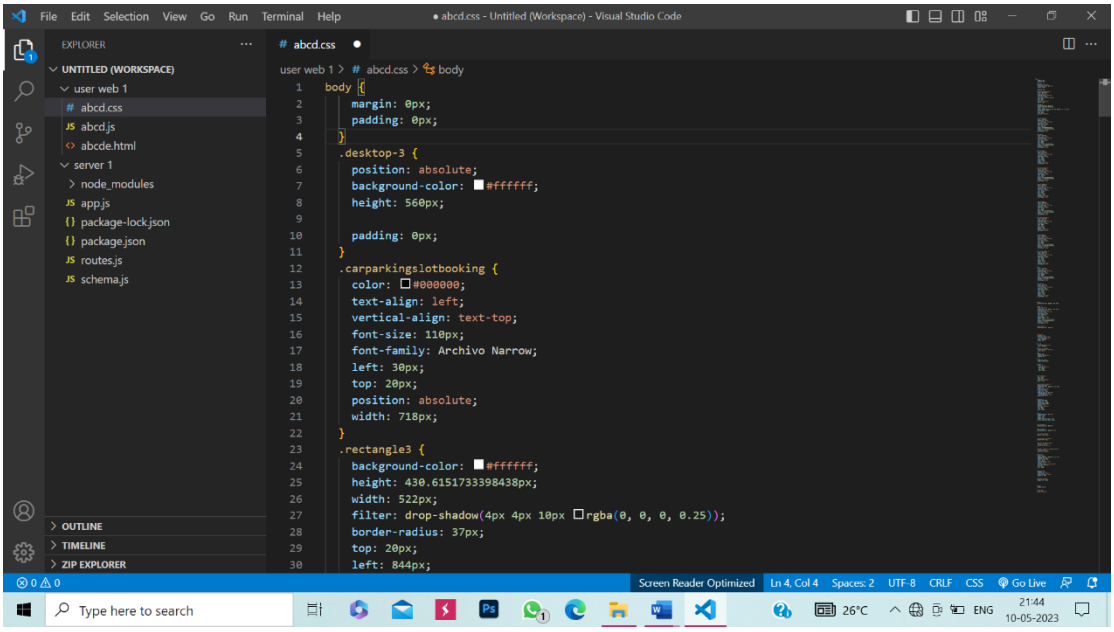


Fig. 6.3 CSS Code

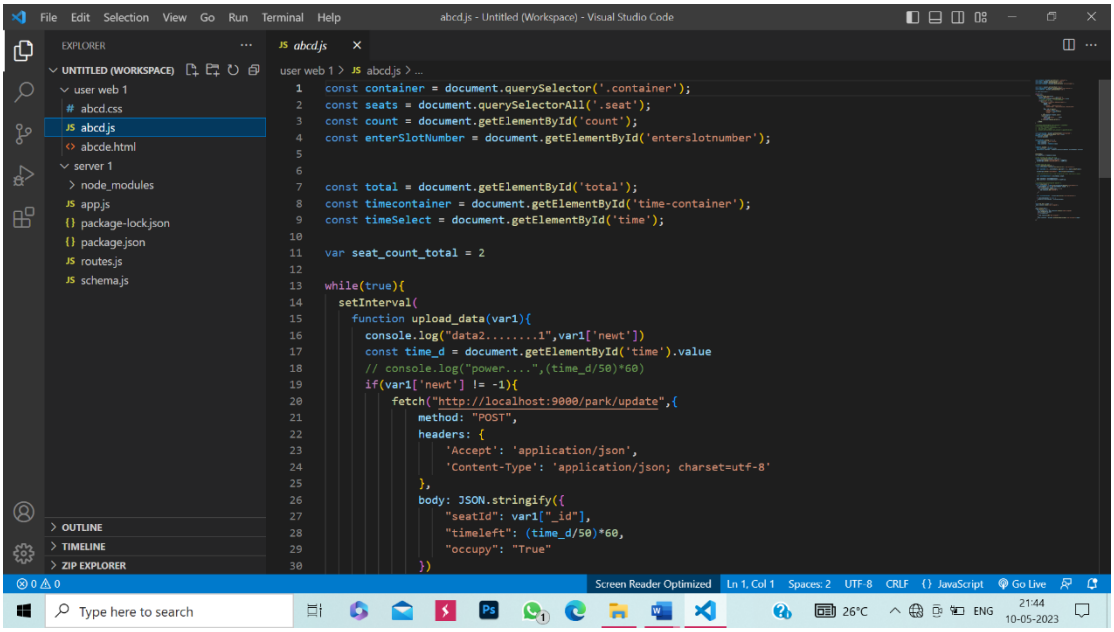


Fig. 6.4 JavaScript Code-1

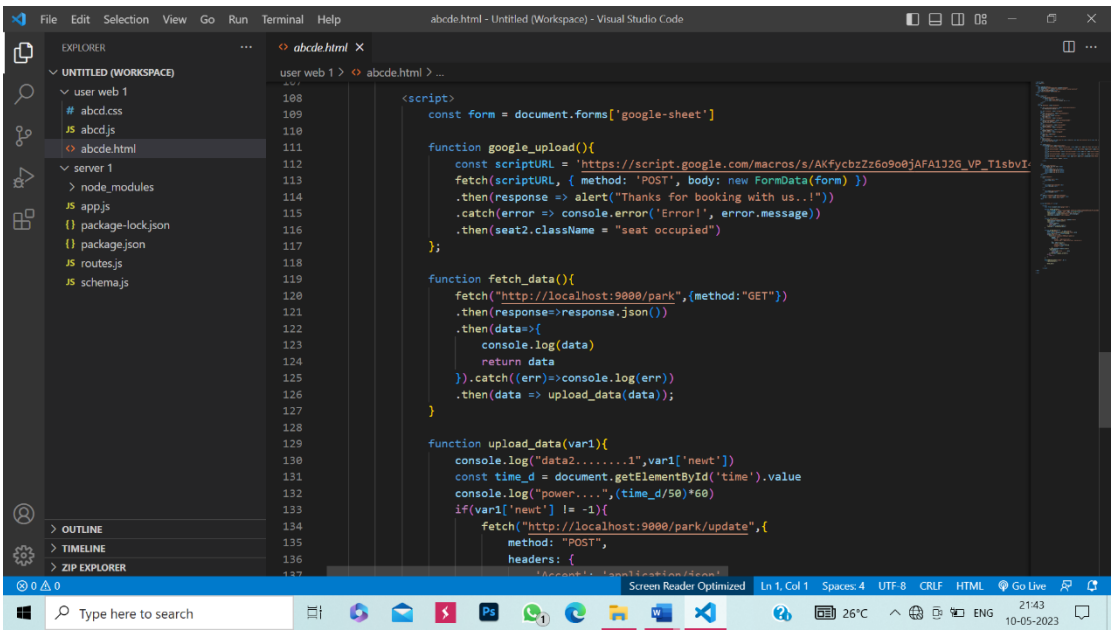


Fig. 6.5 JavaScript Code-2

6.9 Webpage

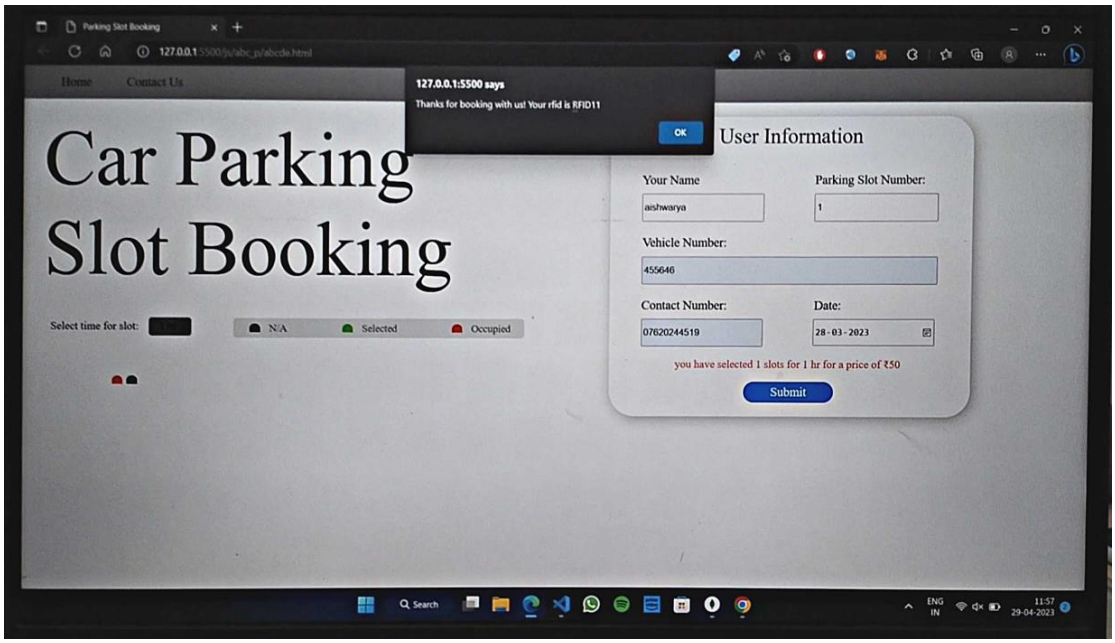


Fig. 6.6 Webpage with selected slot and RFID number

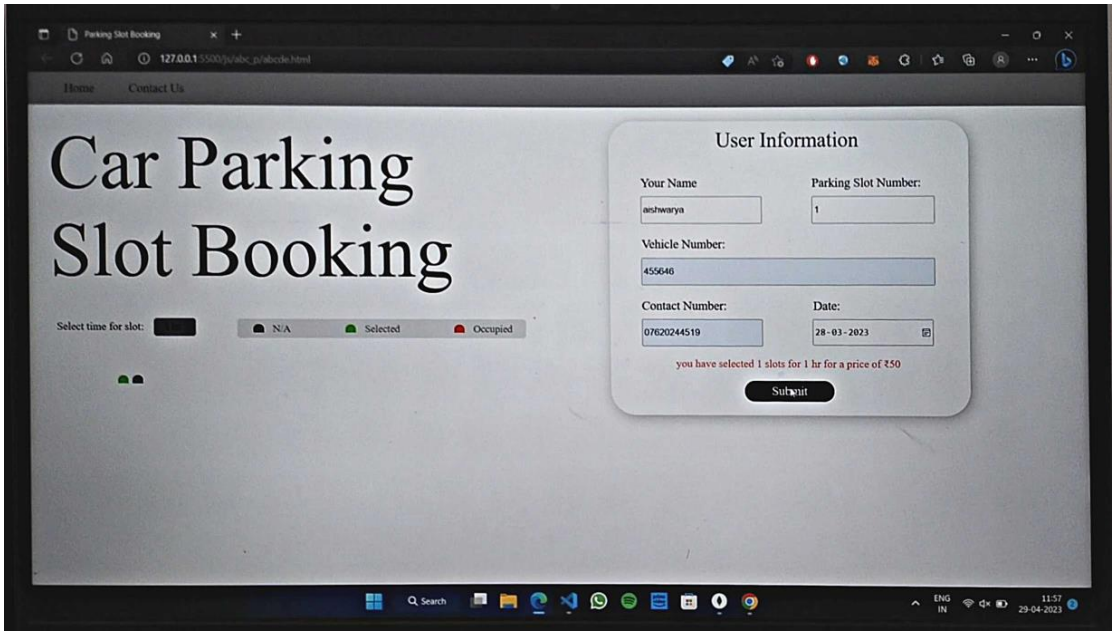


Fig. 6.7 Webpage with vacant slots

Chapter 7

PHOTOGRAPHS RELATED TO PROJECT

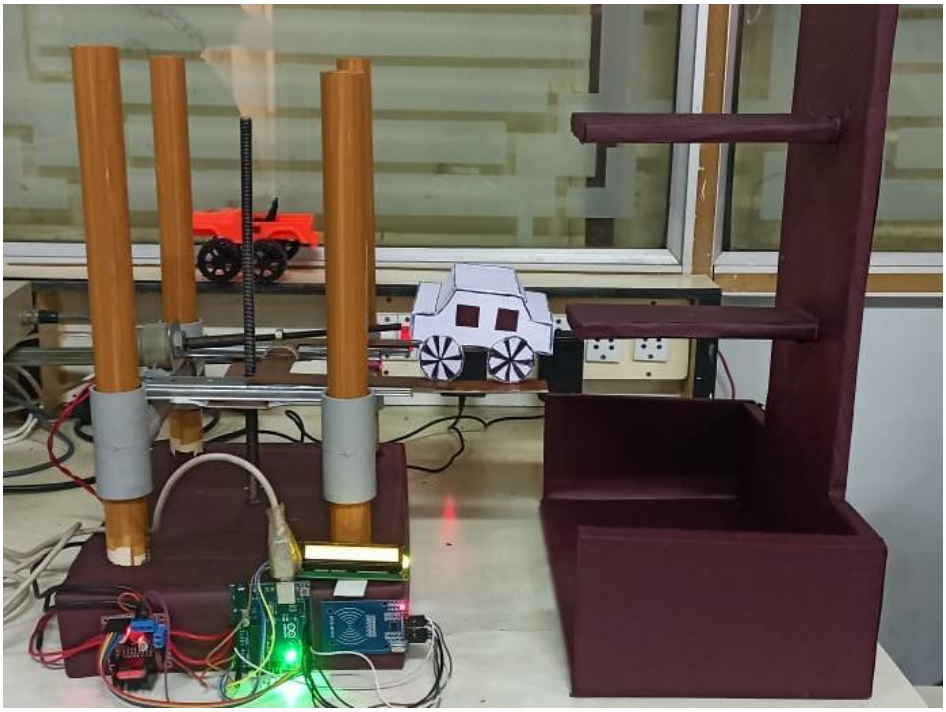


Fig. 7.1 Prototype model of Smart Multilevel Car Parking System-1

Fig. 7.2 Prototype model of Smart Multilevel Car Parking System-2

Chapter 8

DISSEMINATION OF WORK

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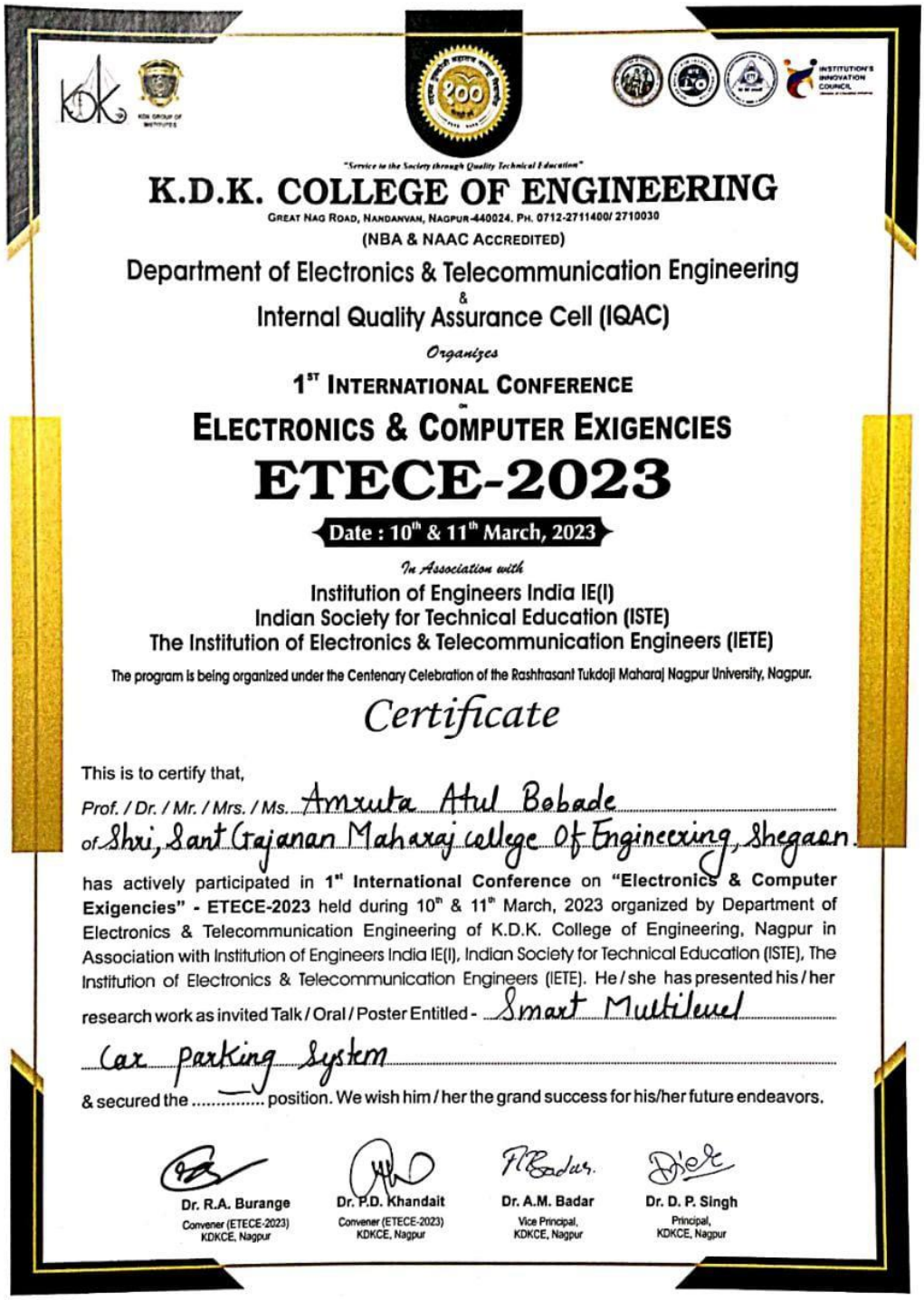

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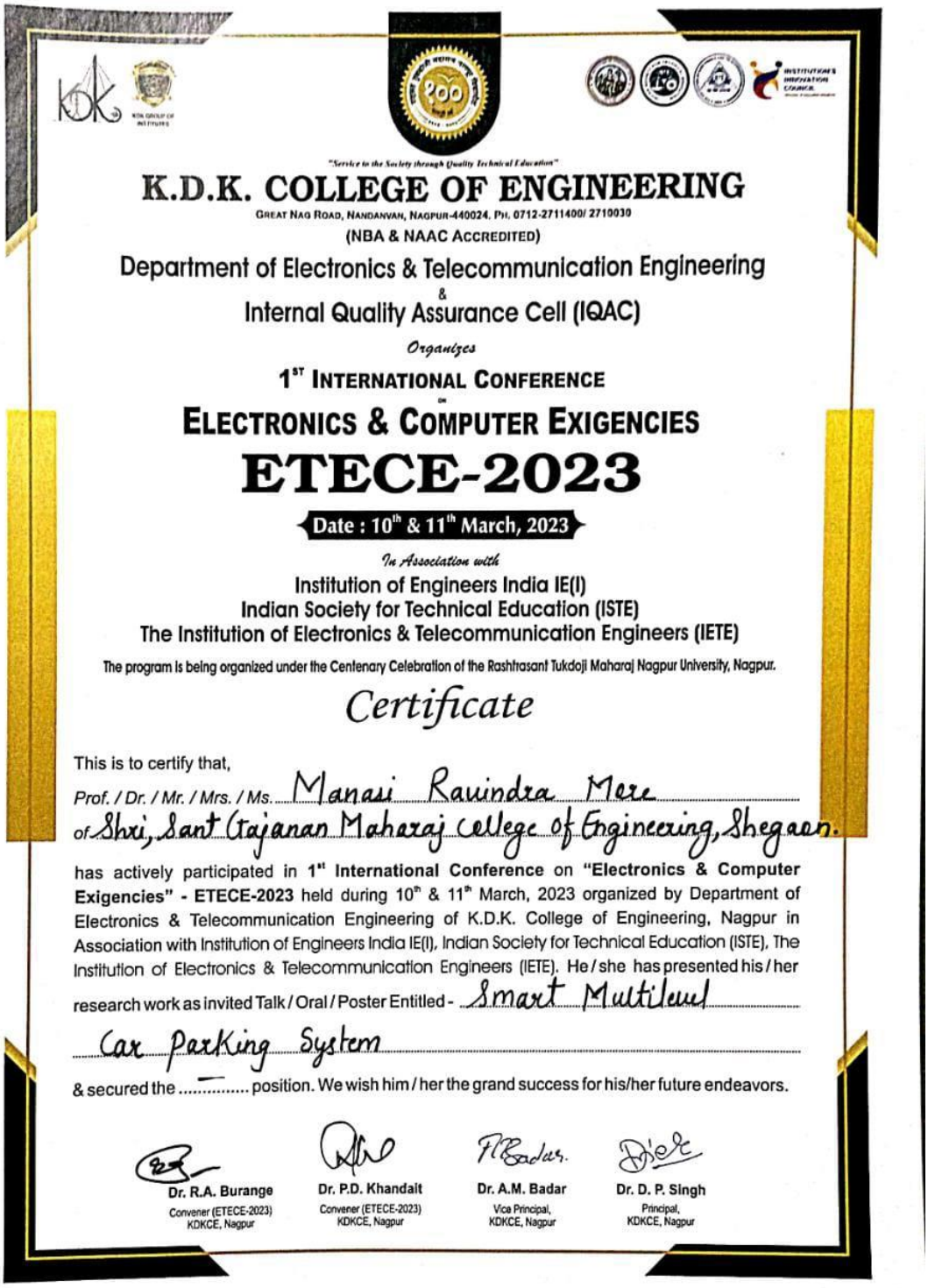

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Chapter 9

CONCLUSION

To conclude, we have designed an efficient, smart multilevel car parking system to aid in the dissolution of crowded and poorly managed parking lots in today's growing cities. Using RFID technology and powerful embedded processors, we can provide users with a lag-free and "no-wait" scenario at parking entrances. Our product can be adapted to suit the needs of any parking vendor. Be it a mall, a shopping complex or even a theater, our product can be molded to fit very specific needs. We have used of website to pre-book or locate parking spots.

Our future work will be aimed towards making the system more user-oriented. We also aspire to further research the field with extra in-flows such as traffic moderation, user error control and rectification and more precise duration and sensor computations.

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