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Department of Information Science and Engineering

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PROJECT REPORT ON

SMART PARKING SYSTEM

UNDER THE GUIDANCE OF

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ABSTRACT

In current times, the concept of smart cities has gained much popularity. Consistent efforts are being made to maximize the productivity and reliability of urban infrastructures. Parking is costly and limited in almost every major city of India. Innovative parking systems for meeting near term parking demand are needed. Due to rapid increase in vehicle density especially during the peak hours of the day it is a tedious task for the public to find a secured parking space for their vehicles. This proposes a novel, secured, efficient and intelligent parking system based on Arduino and sensors. The proposed smart parking system includes of an onsite slot module development that will monitor the availability of each parking slot. Due to number of vehicles on road, causes traffic problems our smart parking system helps us to find parking spaces in parking lot with the implementation of smart parking system patrons can easily locate vacant parking spaces subsequently , the various sensor systems used in developing the systems and our car parking system reducing congestion in cities and our proposed models such that no man is needed to park the cars and no receipt system problem in our project has the automatic receipt system and this project helps in reducing the average time of users for that they wait for the parking of car all such systems will coordinate they do not require to wait we have automatic door opening and closing system using Servo motor by using push buttons such that car enter and exit though entry and exit parking system we have created this project to 7 cars we can increase the parking spaces such that many cars are parked in our parking lot and we have used IR sensors for visualization . Further modifications include a mobile application that allows the user to track the availability of parking space in the required locality. This smart parking can increase the economy by lowering the labour cost, reducing the fuel consumption and pollution in urban cities.

CHAPTER-1

1.1 INTRODUCTION

Whenever we plan for an outing, the major concern that troubles us is the availability of parking space at the desired location. A lot of fuel is wasted in searching proper parking space, which increases the pollution as well as cost. Generally, the parking areas are managed by some private agencies that appoint people to help in finding parking space and they charge an amount which could be minimised if we opt for smart parking system. This was the problem case for our minor project. In the development of traffic management systems, an intelligent parking system was created to reduce the cost of hiring people and for optimal use of resources for car - park owners. Currently, the common method of finding a parking space is manual where the driver usually finds a space in the street through luck and experience. This process takes time and effort and may lead to the worst case of failing to find any parking space if the driver is driving in a city with high vehicle density. The alternative is to find a predefined car park with high capacity. However, this is not an optimal solution because the car park could usually be far away from the user destination. In recent years, research has used vehicle-to-vehicle and vehicle-to infrastructure interaction with the support of various wireless network technologies. However, the current intelligent parking system does not provide an overall optimal solution in finding an available parking space, does not solve the problem of load balancing, does not provide economic benefit, and does not plan for vehicle-refusal service. To resolve the afore mentioned problems and take advantage of the significant development in technology, the Arduino based applications has created a revolution in many fields in life as well as in smart-parking system (SPS) technology. This research also implements a system prototype with wireless access in an open-source physical computing platform based on Arduino technology using a smartphone that provides and the vehicles to verify the feasibility of the proposed system.

1.2 PROBLEM STATEMENT

Insufficient parking spaces in large complexes lead to chaos and uncertainty for drivers searching for available spots. Hence, it is very much important to develop a parking system that is efficient and provides more organized parking experiences.

1.3 OBJECTIVES

In order to make smart parking system we have to come up with a robust system that should be efficient as well as uses least resources.

• **Optimized parking** – Users find the best spot available, saving time, resources and effort. The parking lot fills up efficiently and space can be utilized properly by commercial and corporate entities.

• **Reduced pollution** – Searching for parking burns around one million barrels of oil a day. An optimal parking solution will significantly decrease driving time, thus lowering the amount of daily vehicle emissions, and ultimately reducing the global environmental footprint.

• **Real-Time Data and Trend Insight** – Over time, a smart parking solution can produce data that uncovers correlations and trends of users and lots. These trends can prove to be invaluable to lot owners as to how to adjust and improvements to drivers.

• **Decreased Management Costs** – More automation and less manual activity saves on labor cost and resource exhaustion.

1.4 METHODOLOGY

Our goal is to keep track of the total number of cars inside the parking area by subtracting the number of exiting cars from the number of entering cars. We achieve this by implementing Arduino Uno microcontroller board as the central control unit for the parking system and install IR sensors at the entrance and exit points of the parking area to detect cars entering and exiting. With the help of LCD Display we display the number of slots available.

1.5 Limitation

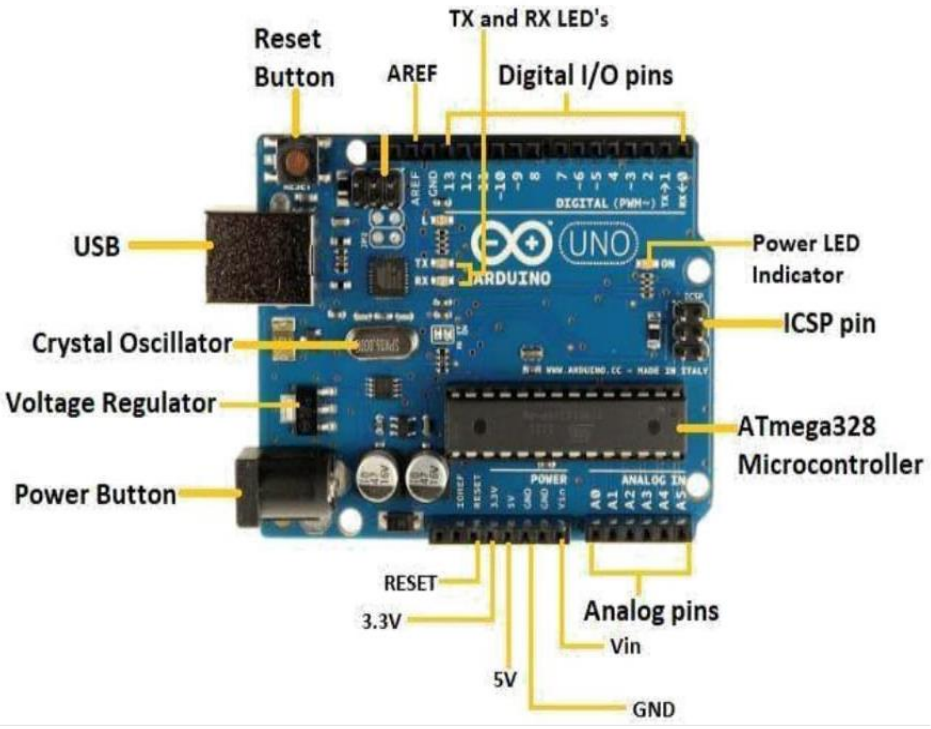
1. In cases of power outages or system failures, retrieving parked cars might become challenging, potentially causing inconvenience to users.
2. The complexity of these systems might intimidate or confuse some users, especially those who are not familiar with advanced technology.
3. Some systems may not be compatible with larger vehicles, specialty vehicles, or vehicles with non-standard dimensions, limiting their usability.

CHAPTER-2

2.1 Technologies used

2.1.1 Arduino

In this project we have used Arduino UNO board. It is microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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 Arduino/Genuino Uno can be programmed with the (Arduino Software (IDE)).



2.1.2 LCD DISPLAY

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels

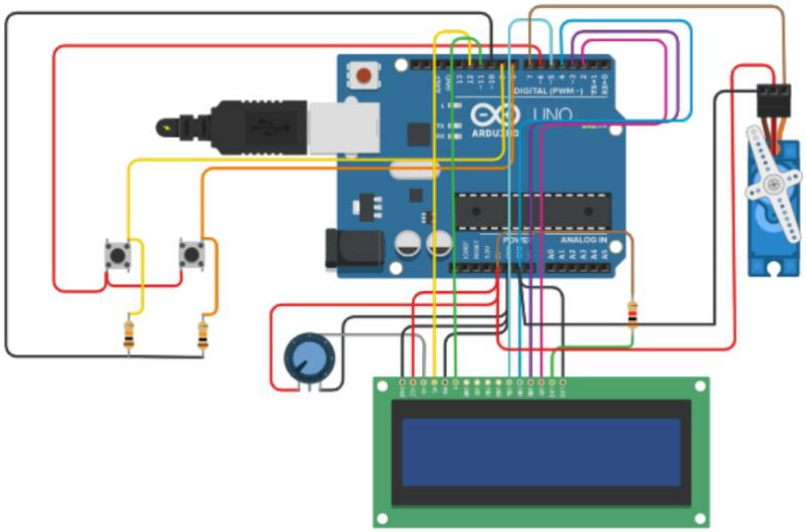
2.1.3 IR Sensors:

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.

CHAPTER-3

3.1 Architectural design:

Architectural design for an automatic parking system involves integrating user-friendly interfaces, safety features, and efficient circulation. Consider aesthetics, structural compatibility, and sustainability. Plan for user comfort, emergency procedures, and future adaptability while adhering to regulations and optimizing space utilization.



3.2 Data flow diagram

Data Flow Diagrams are used to graphically represent the flow of data in a business information system. DFD describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation. Data flow diagrams can be divided into logical and physical. The logical data flow diagram describes flow of data through a system to perform certain functionality of a business. The physical data flow diagram describes the implementation of the logical data flow.

CHAPTER-4

4.1 Module 1- Sender and Receiving functioning

While making all the connections firstly we have Arduino in which it has 6 analogue inputs and 10 digital input/output pins and its operating voltage is 5 v and input voltage is 20 v and servo motor provides rotatory actuator of motor for precise control in terms of angular position velocity and acceleration and LCD is used to display the things then we require and potentiometer when the wiper rotates it shows output on LCD screen and push buttons helps to detect available parking spaces fascinating the task of drivers looking for vacant parking spots in closed spaces .

When we push a push button accordingly our servo motor rotates then it shows output on LCD using potentiometer shows “space left of 7 cars” through entry port then accordingly it “shows space left for 6 cars” after then again pressing on push button multiple times then at last it displays “no space left” means all the 7 cars are inside in parking lot there is no space left or car to park so to park more cars inside the parking lot we try to exit cars in parking lot so this is done by exit port when cars exit in parking lot then when we press a push button accordingly servo motor rotates it shows output on LCD “space left for one car” similarly second car exit accordingly servo motor rotates and shows output on LCD “space left for 2 cars” similarly all the cars exit in parking lot and at last it shows “Space left for 7 car”.

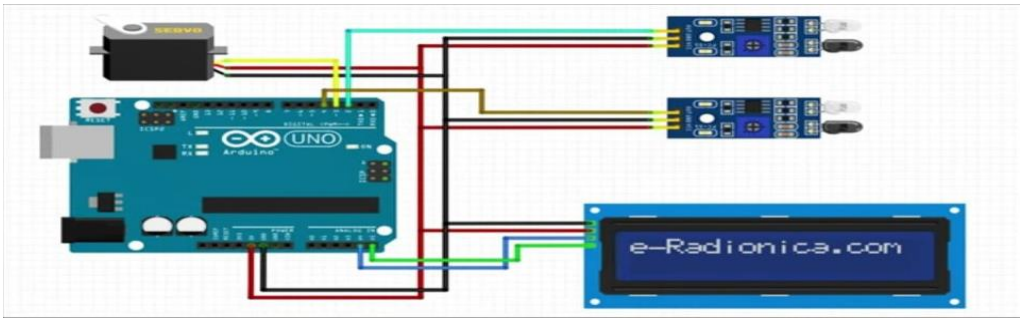
Then again same process happens in Entry and Exit push buttons in this way the smart parking system project works.

4.2 Module 2- Connectivity

Connections are made as follows:

Connect the 5 volts pin of the Arduino with the VCC pin of the I2C module and the VCC pin of both the IR sensors. Join the SDA pin of the I2C module with the analog-4 pin of the Arduino and the SCL pin of the I2C module with the analog-5 pin of the Arduino in this automatic car parking system project. Connect the GND pin of the Arduino with the GND pin of the I2C module, the brown wire of the servo motor, and the GND pin of both IR sensors. Attach the

orange(signal) wire of the servo motor to the digital-9 pin of the Arduino.Now connect the pins of the I2C module with the pins of the 16×2 LCD.



4.3 Code:

4.3.1 Arduino 16x2 LCD I2C Scanner:

```
/*
Analog Pin 4 - SDA
Analog pin 5 - SCL
5V  - Vcc
GND - GND
*/


#include <Wire.h>
void setup()
{
Wire.begin();
Serial.begin(9600);
Serial.println("\nI2C Scanner");
}
void loop()
```

```
{
byte error, address;
int Devices;
Serial.println("Scanning...");
Devices = 0;
for(address = 1; address < 127; address++ )
{

Wire.beginTransmission(address);
error = Wire.endTransmission();
if (error == 0)
{
Serial.print("I2C device found at address 0x");
if (address<16)
Serial.print("0");
Serial.print(address,HEX);
Serial.println("  !");
Devices++;
}
else if (error==4)
{
Serial.print("Unknown error at address 0x");
if (address<16)
Serial.print("0");
```

```
Serial.println(address,HEX);

}

}

if (Devices == 0)

Serial.println("No I2C devices found\n");

else

Serial.println("done\n");

delay(5000);

}
```

4.3.2 Arduino Car Parking System:

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);  //Change the HEX address

#include <Servo.h>


Servo myservo1;


int IR1 = 2;

int IR2 = 4;


int Slot = 4;           //Enter Total number of parking Slots


int flag1 = 0;

int flag2 = 0;
```

```
void setup() {
  lcd.init();
  lcd.begin(16,2);
  lcd.backlight();
pinMode(IR1, INPUT);
pinMode(IR2, INPUT);

myservo1.attach(3);
myservo1.write(100);

lcd.setCursor (0,0);
lcd.print("     ARDUINO    ");
lcd.setCursor (0,1);
lcd.print(" PARKING SYSTEM ");
delay (2000);
lcd.clear();
}

void loop(){
if(digitalRead (IR1) == LOW && flag1==0){
if(Slot>0){flag1=1;
if(flag2==0){myservo1.write(0); Slot = Slot-1;}
}else{
```

```
lcd.setCursor (0,0);
lcd.print("    SORRY :(    ");
lcd.setCursor (0,1);
lcd.print("  Parking Full  ");
delay (3000);
lcd.clear();
}
}

if(digitalRead (IR2) == LOW && flag2==0){flag2=1;
if(flag1==0){myservo1.write(0); Slot = Slot+1;}
}

if(flag1==1 && flag2==1){
delay (1000);
myservo1.write(100);
flag1=0, flag2=0;
}
lcd.setCursor (0,0);
lcd.print("    WELCOME!    ");
lcd.setCursor (0,1);
lcd.print("Slot Left: ");
lcd.print(Slot);
}
```

CHAPTER-5

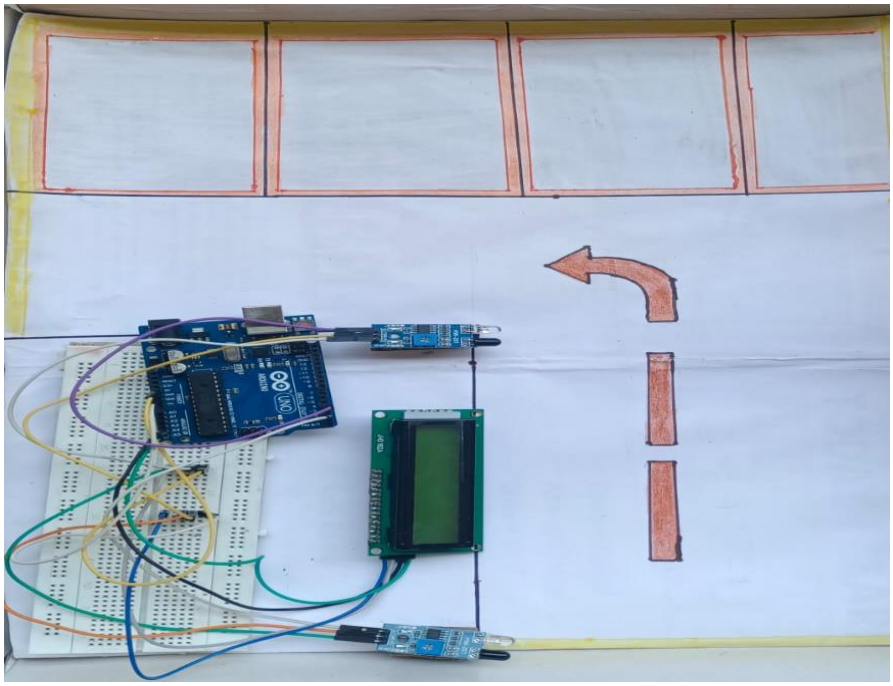
5.1 Results and Discussions

The results of an automatic parking system project can include increased parking capacity, improved efficiency in vehicle storage and retrieval, reduced congestion, enhanced user convenience, and optimized land usage. Additionally, the project may lead to a modernized and technologically advanced image for the facility, potentially attracting more visitors or tenants.

Our project result is to achieve the following two modules:

Vehicle Detection Module: This module utilizes sensors like IR sensors to detect the presence and occupancy of vehicles in parking spaces. It provides real-time data about the availability of parking spots and updates the system accordingly.

Entry and Exit Management Module: This module controls the entry and exit of vehicles into and out of the parking facility. It also manages the opening and closing of gates or barriers for smooth vehicle flow.



CHAPTER-6

6.1 Applications

This can be directly implemented in various locations such as

- Malls
- Offices
- Parks
- Complexes

  & more.

CHAPTER-7

7.1 CONCLUSIONS:

This study has proposed a parking system that improves performance by reducing the number of users that fail to find a parking space and minimizes the costs of moving to the parking space. Our proposed architecture and system have been successfully simulated and implemented in a real situation. The results show that our algorithm significantly reduces the average waiting time of users for parking. Our results closely agree with those of our proposed mathematical models. The simulation of our system achieved the optimal solution when most of the vehicles successfully found a free parking space. The average waiting time of each car park for service becomes minimal, and the total time of each vehicle in each car park is reduced. In our future study, we will consider the security aspects of our system as well as implement our proposed system in large scales in the real world. If this smart parking system with all the mentioned modifications is implemented, then surely this would be a revolution in the field of parking. This system would save time, fuel, labour and thus would decrease the cost. All we need is just a single time investment. We would be able to check the availability of parking space a well as book a slot just by a single click. Since the details of the vehicle as well as the driver are being collected, so they can be referred for any discrepancy in the parking slots, thus improving the security of our vehicles too.

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on Information science,2010

CHAPTER-8

8.1 Further Modifications:

8.1.1 Automatic Ticketing:

An automatic ticket generating system can be added to this project. The parts of to be added for implementing this extension are as follows:

➢ Object detection: The object detection model will analyse the size of the vehicle and detect the type of it. And accordingly, it will provide a suitable parking slot for your vehicle.

➢ Optical Character Recognition: For an automatic ticketing system, it needs to have a registration number and brand of the vehicle on the parking ticket. So, for extracting the registration number and the brand, we will use the OCR model to detect the number plate and the text on it. To generate tickets

8.1.2 Mobile App for Realtime Data:

We can also have the mobile app or WebApp to display the real time status of parking lots in the parking area in nearby locations. The main components of the Mobile app can be:

➢ List of Parking Areas in the location: Users can see the list of all the parking areas available in the nearby locations. Location can be automatically detected by the app (depends on the user).

➢ The Parking Slot Map: Users can also see the map of the parking slots in any parking area. This will help the user to quickly find the Parking slot he is allotted.

8.1.3 Extension to the Mobile App:

Users can see the real time status of the total number of slots and free slots in the nearby Parking Areas. But they still have to go and get a token manually for parking the car. With this extension, users will be able to book the parking slot in advance from the application itself. They do not have to worry about whether there will be any spot available for them at 3 pm tomorrow or not. They can have tickets in advance.