THE SMART PARKING MANAGEMENT SYSTEM

ABSTRACT

With growing, Car parking increases with the number of car users. With the increased use of smartphones and their applications, users prefer mobile phone-based solutions. This paper proposes the Smart Parking Management System (SPMS) that depends on Arduino parts, Android applications, and based on IoT. This gave the client the ability to check available parking spaces and reserve a parking spot. IR sensors are utilized to know if a car park space is allowed. Its area data are transmitted using the WI-FI module to the server and are recovered by the mobile application which offers many options attractively and with no cost to users and lets the user check reservation details. With IoT technology, the smart parking system can be connected wirelessly to easily track available locations

KEYWORDS

Internet of Things
Cloud Computing
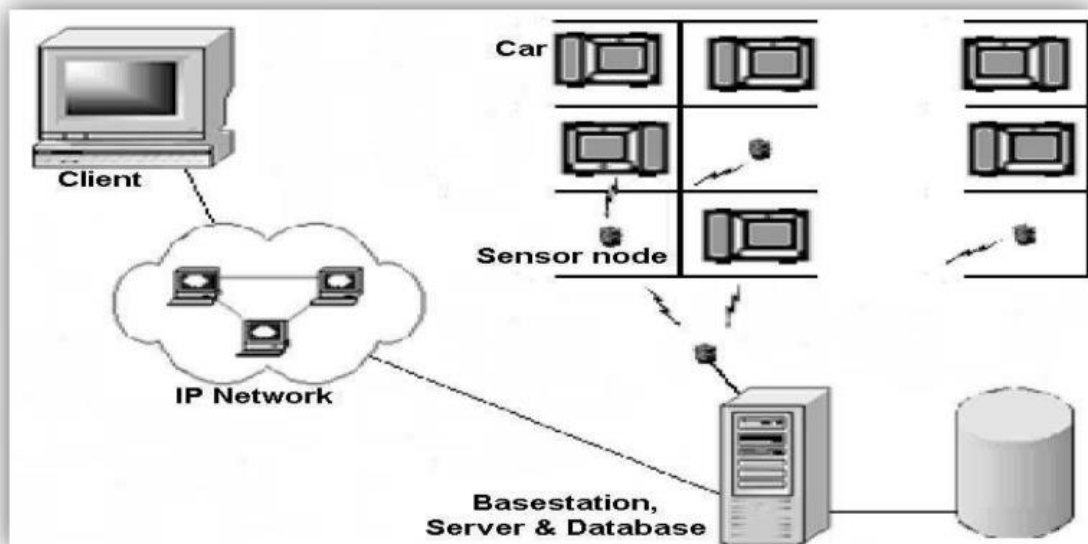Smart Parking
Smart City
 Mobile Application.

INTRODUCTION

The number of car client's increases was requested more parking spots, and with the growth the internet of things causes smart urban areas to have picked up grind popularity. In this way, issues, for example, traffic blockage, constrained vehicle leaving offices, and street security are being tended to by IoT. So, several parking organization systems have been organized to decrease such traffic issues and improve the comfort of car users, it has combined smart mobiles, wireless algorithms, and mobile applications. The idea of the Internet of Things (IoT) started with things with Personal communication devices, which the devices could be tracked, controlled to use remote PCs connected with the internet [1]. The Internet of Things (IoT) equals "=' Physical devices, vehicles, structures, and different thingsimplanted with hardware "+" Controller, Sensor, and Actuators "+" organize a network that lets these things to gather and exchange information (Internet) [2]. Sensors are deployed in smart systems, which in turn collect information from the device for processing and analysis .So, Sensors would be deployed in the parking area and through the

mobile application for helping the user to know the freedom of parking places on a real-time basis with more efficiency, and less cost [3]. A smart parking system reduces the time to locate available places and reduces fuel consumption. The paper is organized as follows: First, it presents the concept of the smart parking system and its various functions, then its reviews previous research and studies on the implementation of smart parking. Then it describes the system implementation and operation and gives a conclusion of the smart parking application.

SMART PARKING SYSTEM

One of the most important problems facing large cities is congestion and parking . So, using Automated Parking System Management is an efficient technique using the Internet of Things to manage the garage [4]. Smart parking is an electronic tool that enables the user to find vacant parking spaces through information technology and by using appropriate sensors [5]. Among the most used types in smart parking, systems are data routing systems, smart payment systems, and electronic car parks. These types require disclosure of whether parking spaces are vacant or not. With the user registration in the system, a unique identifier is created for him, and with the booking, it has the booking details, and via their smartphones, the entire time, exit time, and money are calculated. The System building consists of, the lowest level, including the functions of sensing, data transmission is created during a middle level, and upper-level deals with the storage and processing information, and user interfaces.

Smart parking system building
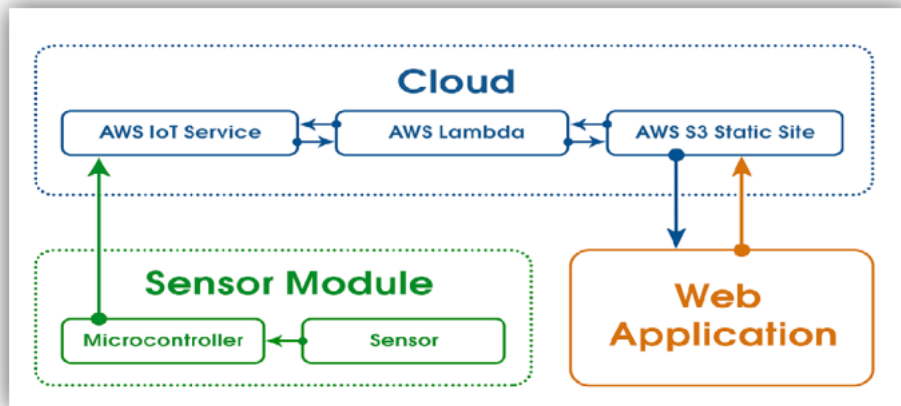
Smart Parking System.
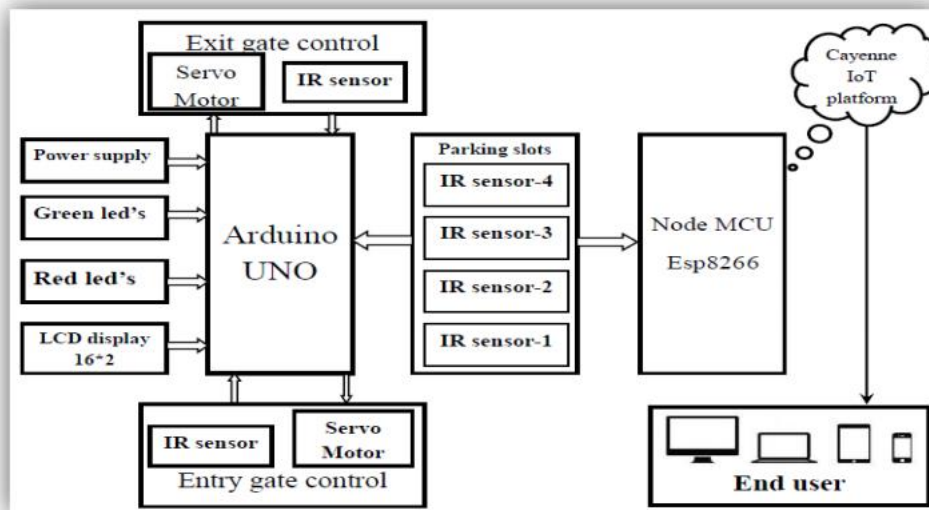
Power Supply :

IR sensor and Bluetooth device takes the power from Arduino.. - Ground pin of IR sensor is connected with the ground pin of Arduino. - 5V power supply is connected with IR sensor VCC pin. - Output of IR sensor is connected with 7th digital pin of Arduino.

Green Led's :

If the slot is empty, then the sensor would sense it and give the notice to controller and controller will activate the LEDs as per the notification. If the car is parked in any slot then the LED would glow as RED showing that slot is not empty, otherwise when the slot would be empty or available it will glow GREEN

Red Led's :

Three color can be shown: green (free parking space), red (occupied space)/blue (handicapped reserved).

LCD Display 16*2 :

Whenever a car comes to the parking gate the sensor will read this and open the gate if there is a slot available. also, there we are using a 16×2 LCD display which displays every information of the system likewise how many slots available, How many cars are inside the parking, etc.

Arduino UNO :

The system utilizes an Arduino Uno board along with an ultrasonic sensor, IR sensor, servo motor, and object counter to efficiently park vehicles. This prototype aims to optimize parking space utilization, reduce human error, and enhance overall parking efficiency.

Explanation :

Smart parking is an IoT (Internet of Things) solution that uses sensors and/or cameras in combination with a software to inform users of vacant parking spaces in a certain area. Most of the time, people can also directly reserve the spot and pay for it with an app. It should not be confused with mobile parking. This is only a way to pay with your phone or smartphone, to extend the parking time and find your car. Here you still need to find free spots by yourself.

The way smart parking works is, that a sensor detects if, or if not, a car is standing on a parking spot. This can either be a proximity sensor or often also a camera. The advantage of using a camera is that it can view a wider space. On the other hand, if the environment is not ideal for one of these, for example if trees or objects are in the way, then they can become quite expensive in comparison to sensors.

After the sensor detected a change (parking space free or not) on the parking spot, it sends a message to the cloud of the provider. Afterwards, the user receives a notification that there is a free parking space and gets the direction towards it.

Smart parking coding

import random

```python
class ParkingSpace:
    def __init__(self):
        self.is_occupied = False


    def occupy(self):
        self.is_occupied = True


    def vacate(self):
        self.is_occupied = False


class ParkingLot:
    def __init__(self, num_spaces):
        self.spaces = [ParkingSpace() for _ in range(num_spaces)]


    def check_availability(self):
```

```python
        return [i for i, space in enumerate(self.spaces) if not
space.is_occupied]


    def occupy_space(self, space_number):
        if 0 <= space_number < len(self.spaces):
            if not self.spaces[space_number].is_occupied:
                self.spaces[space_number].occupy()
                return True
        return False


    def vacate_space(self, space_number):
        if 0 <= space_number < len(self.spaces):
            self.spaces[space_number].vacate()


    def __str__(self):
        return "Parking Lot Status:\n" + "\n".join(f"Space {i + 1}:
{'Occupied' if space.is_occupied else 'Vacant'}" for i, space in
enumerate(self.spaces))


def main():
    num_spaces = 10
    parking_lot = ParkingLot(num_spaces)
```

```python
while True:

    print(parking_lot)

    available_spaces = parking_lot.check_availability()

    if available_spaces:

        print("Available spaces:", available_spaces)

    else:

        print("No available spaces")


    action = input("Enter 'p' to park, 'v' to vacate, or 'q' to quit: ").lower()


    if action == 'p':

        if available_spaces:

            space_to_park = random.choice(available_spaces)

            parking_lot.occupy_space(space_to_park)

            print(f"Parked in space {space_to_park + 1}")

        else:

            print("No available spaces to park.")

    elif action == 'v':

        space_number = int(input("Enter space number to vacate: ")) - 1

        if parking_lot.vacate_space(space_number):

            print(f"Space {space_number + 1} is now vacant.")
```

```python
        else:

            print(f"Space {space_number + 1} is already vacant or
invalid.")

    elif action == 'q':

        break

    else:

        print("Invalid input. Please try again.")


if __name__ == "__main__":

    main()
```
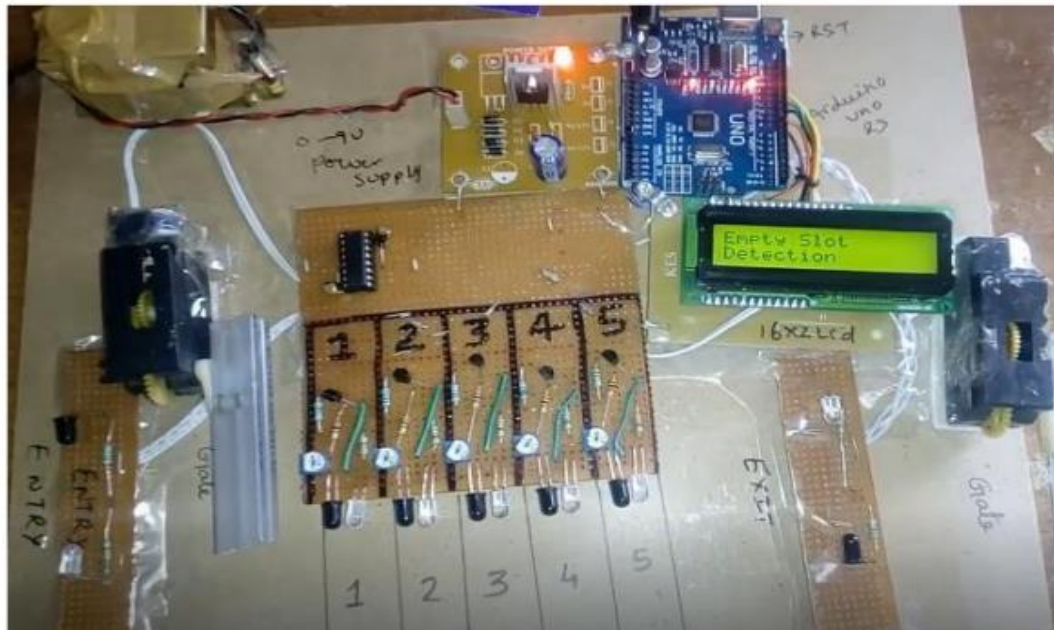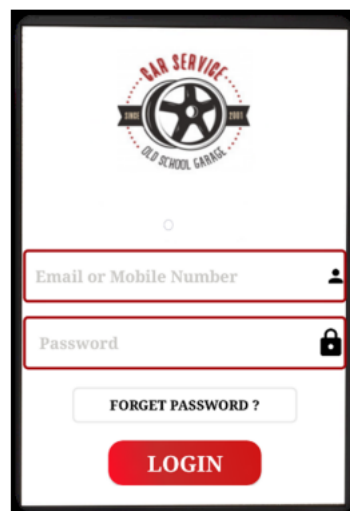
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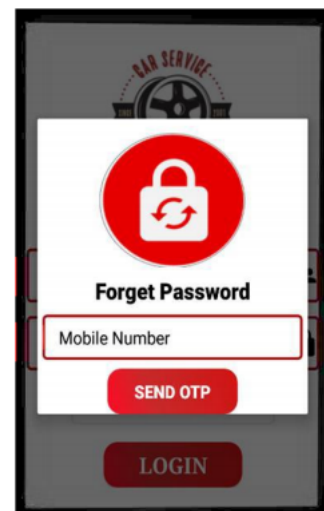
Hardware Implementation

Android Parking App is developed using the Android Studio application platform. Figure
17 (A- B- C- D- E- F- G- H) displays the android mobile application pages.

A. Splash screen of application   B. Login page   C. Reset forget password

CONCLUSION

The services provided by smart parking have become the essence of building smart cities. This paper focused on implementing an integrated

solution for smart parking. The proposed system has several advantages, including detecting parking spaces using the Internet of Things and calculating the time of entry and exit and calculating the expected cost. An attractive and effective application was designed for Android mobile phones. The system benefits from avoiding wasting time and reducing pollution and fuel consumption. Users can book a car park for 24 hours.