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Smart Car Parking System Using Raspberry Pi

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Abstract :
This paper deals with a simple smart vehicles parking system by using basic components like micro controller, IR Sensors, Servo Motor, LCD etc. Parking, offered in malls, shopping areas, etc., are provided with help of a person which is very time consuming. Because of this, we created a straightforward vehicle parking system that uses IR sensors installed at parking spaces to detect the presence of parked vehicles, an LCD display board that shows the number of vacant and occupied parking spaces, and an LCD display board that shows the number of parking spaces currently available. Therefore, the research methodology work solution creates and implements an experimental setup that will regulate traffic in parking areas while also informing drivers about free spots. The main function of the servomotor is to permit and prohibited vehicles in and out of indoor spaces by opening and turning off the entry or exit barrier according to the data obtained from the IR sensors which are present on the entry gate, exit gate, parking spots.

I. INTRODUCTION

In smart cities, there is a greater need for new and effective technology to tackle many of the problems that are visible on the surface, as well as to make cities less crowded. Finding a parking spot is one of the most aggravating issues for drivers. Particularly in public venues such as shopping malls, 5-star hotels, and multiplex cinema halls. Even within the park, drivers waste time and fuel hunting for a spot to park their cars. This will damage the driver's emotions as well as pollute the environment while searching for a parking spot. In this study, we create and design a smart parking system that effectively addresses these issues. Many research have been conducted in recent years with the goal of reducing car parking issues and making it more convenient and humane. It has recommended a smart parking system survey. They concentrate on practical smart parking technologies developed to address existing issues through the use of a wireless sensor network and real-time data processing from the sensors. The system appears to be unfixable and employs a complicated access technology; additionally, there is no guidance mechanism for parking places. The Arduino Uno is used to create a smart car parking system. The device uses IR sensors mounted in the parking slots to detect empty slots and assists the driver in finding parking in a new city. The system lacks a payment mechanism as well as guide technology that can automatically find available parking spaces. The goal of the smart auto parking initiative is to make parking simple and

straightforward. This project assists car drivers in parking their vehicles with the least amount of wasted time by providing reliable information on the availability of parking spaces. The servo motors, LCD display, and IR sensor are all connected to an Arduino Uno microcontroller unit. The LCD shows how much space is available, and the IR sensors keep track of how many automobiles enter and exit the parking place. The IR sensors identify whether or not a parking place is available.

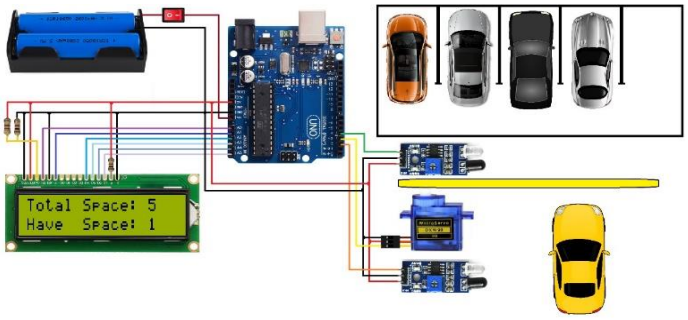
II. LITERATURE SURVEY

The paper by Arjun Dutta, Ankur Bhattacharjee, Abhijit Kar Gupta - In this modern world, the paradigm of smart cities have gathered major popularity. Thanks to the evolution of microcontrollers, the notion of smart city seems more convincing. This study proposes a novel algorithm that helps users to find a free parking space for cars automatically. Microcontrollers like Arduino has already made a huge impact on learning. The widespread affirmation gave a new life to this open source hardware component which potentially became a big challenge to many industrial products and new interests in electronic system and prototyping. The automatic parking system aims to enhance the comfort and safety of driving in constrained environments where much attention and experience are required to steer the car. This paper deals with two major objectives: an automated parking system and automated vehicle. The first objective is to design a low-cost microcontroller-based model of a car whose working is to park the car by itself when free space is obtained. The second objective is related to automated car parking garage setup. The speciality of the system is the use of efficient low-cost sensors such that the two systems are embedded together working with single power source. The sensors are fixed in the track through which the cars move into the garage or when moving out from the garage. Our proposed system, however, forecasts upon developing an intelligent, user friendly automated car parking system that not only reduces manpower but also reduces traffic congestion, facilitating secure parking system within a limited area.

III. METHODOLOGY

WORKING:

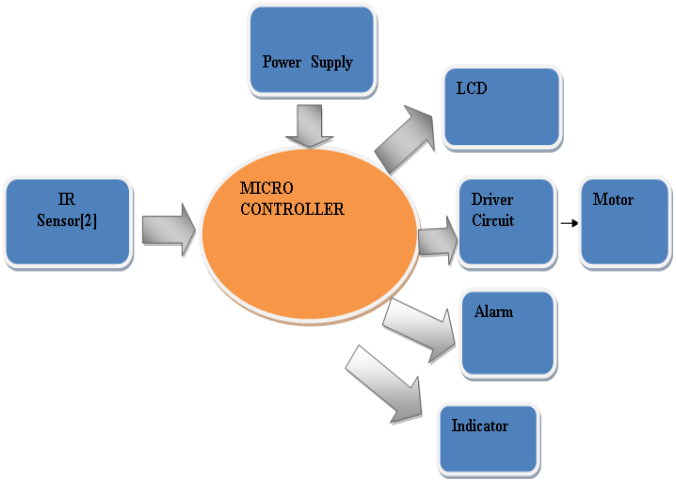
To create a smart car parking system with a Raspberry Pico, you'll need to go through several key steps. First, set up sensors at each parking spot to detect whether they're occupied or vacant. These sensors could include proximity, ultrasonic, or infrared sensors, and they'll be connected to the Raspberry Pico. Next, program the Raspberry Pico to gather data from these sensors. When a car enters or leaves a spot, the sensor sends a signal to the Pico, which processes this information to determine the spot's status. Then, develop a user interface to display this information. This interface could be a simple LED display or an LCD screen connected to the Raspberry Pico, showing which spots are available and which are taken. Optionally, you can add communication capabilities to the system, allowing it to send updates to a central server or a mobile app via Wi-Fi or Bluetooth. Additionally, implement a feedback mechanism so users know when a spot's status changes, such as through visual indicators or notifications to a mobile app. Finally, thoroughly test and calibrate the system to ensure accurate detection and optimal performance. By following these steps, you'll be able to create a straightforward yet efficient smart car parking system using a Raspberry Pico.



IV. BLOCK DIAGRAM:

Before presenting the block diagram of our smart car parking system using Raspberry Pi, it's essential to understand the pressing challenges our urban areas face regarding parking management. With rapid urbanization, the demand for parking spaces has

surged, leading to congestion, wasted time, and increased pollution. Our project aims to tackle these
issues by leveraging Raspberry Pi's versatility and affordability to create an intelligent parking solution. By integrating sensors, microcontrollers, and cloud connectivity, our system provides real-time monitoring and efficient utilization of parking spaces. Through this initiative, we envision not just a reduction in traffic congestion but also a step towards creating smarter, more sustainable cities.



1. Power Supply:
The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.
The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

2.LCD:
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 5x7 pixel matrix. This LCD has two registers, 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 display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

3. Microcontroller:
The Raspberry Pi Pico currently exists in two main versions:
Raspberry Pi Pico: The original one.
Raspberry Pi Pico W: A similar version, with an added wireless module that allows you to connect it to a Wi-Fi network on boot.
The Raspberry Pi foundation changed single-board computing when they released the Raspberry Pi computer, now they're ready to do the same for microcontrollers with the release of the brand-new Raspberry Pi Pico. This low-cost microcontroller board features a powerful new chip, the RP2040

4. Motor:
A DC motor in simple words is a device that converts direct current(electrical energy) into mechanical energy. It's of vital importance for the industry today.
A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homo-polar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty.
By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source—so they are not purely DC machines in a strict sense.
We in our project are using brushed DC Motor, which will operate in the ratings of 12v DC 0.6A.
The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current.

5.Driver Circuit:
L293D IC generally comes as a standard 16-pin DIP (dual-in line package). This motor driver IC can simultaneously control two small motors in either direction; forward and reverse with just 4 microcontroller pins (if you do not use enable pins).

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor.

6.IR Sensor:

IR sensor is very useful if you are trying to make a obstacle avoider robot or a line follower. In this project we are going to make a simple IR sensor which can detect a object around 6-7 cm. IR sensor is nothing but a diode, which is sensitive for infrared radiation. This infrared transmitter and receiver is called as IR TX-RX pair.

7.Alarm:

In addition to optimizing parking space utilization, our smart car parking system includes an alarm feature to enhance security and streamline user experience. When unauthorized access or suspicious activities are detected within the parking area, the alarm system triggers, alerting both users and administrators. This proactive measure serves as a deterrent against theft, vandalism, and other security threats, ensuring the safety of parked vehicles and peace of mind for drivers. With customizable alert settings and seamless integration with mobile devices, our alarm system provides instant notifications, empowering users to take swift action when necessary. Through this robust security feature, we aim to safeguard both vehicles and the overall integrity of the parking facility, contributing to a safer and more reliable parking experience for all.

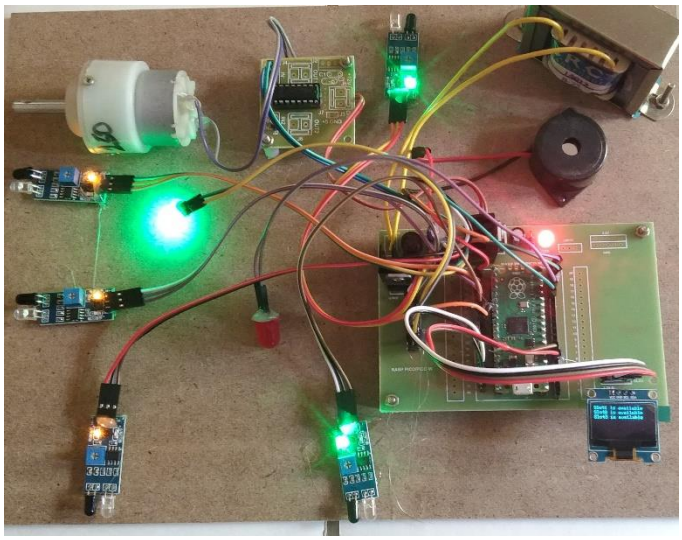
V. RESULTS

Upon completion and rigorous testing of our smart car parking system using Raspberry Pi, we are delighted to present promising results that signify its effectiveness in addressing urban parking challenges. Our system demonstrated remarkable accuracy in detecting parking space availability in real time, with sensors promptly updating occupancy statuses. Through seamless integration with cloud services, users accessed up-to-date parking information remotely, reducing the time spent searching for available spaces. The implementation of the alarm system proved highly effective in enhancing security, with prompt alerts notifying users of any unauthorized access or suspicious activities within the parking area. Additionally, our system's user-friendly interface received positive feedback, facilitating effortless navigation and operation for both administrators and drivers. Notably, the system's scalability was tested successfully, demonstrating its potential for deployment in various urban environments with diverse parking infrastructures. Overall, the results showcase the viability of our smart car parking system as a reliable, efficient, and user-centric solution for optimizing parking management in smart cities.

VI. CONCLUSION

In conclusion, The Internet of Things (IoT) was the key concept used to construct the proposed parking system employing an infrared sensor, and this study proposes an effective way for identifying a parking space. The IoT-based Car Parking Management System with IR Sensor was created as a prototype to help drivers locate a vacant or available parking spot. This parking system presented employed an infrared sensor to detect the presence and absence of a car in order to determine the state of a parking slot's availability. The parking places are continuously monitored, and the data on the LCD screen is updated on a regular basis. The LCD screen shows the exact location of the parking slot availability status. In the meantime, the data from the infrared sensor is also saved in the database. The suggested parking system's prototype was designed for a single storage parking space, but the concept can be expanded to accommodate several storage spaces. In addition, for administrative purposes, a car parking management system interface was created to record the state of a parking slot as well as the precise time a car enters or quits a parking slot. The proposed parking system's conclusion is beneficial for implementing in any parking zone region to assist drivers in finding a vacant parking spot quickly. Furthermore, the proposed parking system was evaluated utilising a

user acceptance test to determine public acceptance of the proposed parking system. The majority of respondents thought the proposed parking system with IR sensor was a wonderful concept and that developing a parking system that can help cars find a vacant parking spot quickly was a terrific idea. As a result, it provides convenience to users by allowing them to save time, energy, and fuel. This work might be expanded by creating a mobile app that allows users to navigate, identify, and reserve a parking spot online.



FUTURE POSSIBILITIES

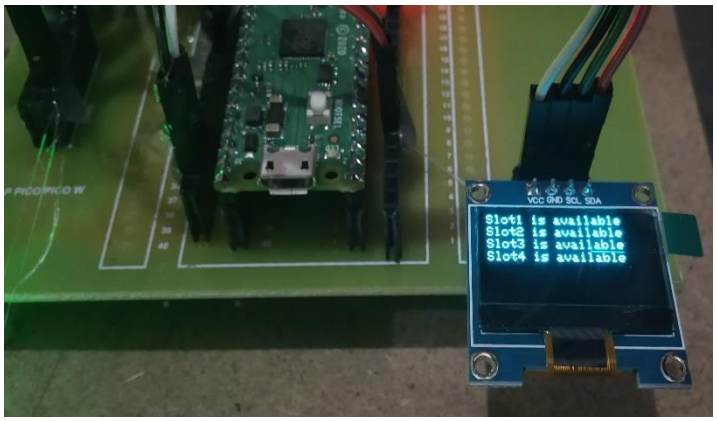
Looking ahead, the future possibilities for our smart car parking system using Raspberry Pi are abundant, promising continued innovation and enhancement in various aspects of urban parking management:

Scalability and Expansion: Our system can be scaled to accommodate larger parking facilities, including multi-level parking structures and expansive city-wide deployments. This scalability opens opportunities for integration with existing smart city infrastructure and collaboration with municipal authorities to address broader urban mobility challenges.

Advanced Analytics and Predictive Maintenance: Leveraging the wealth of data collected by our system, future developments could focus on implementing advanced analytics algorithms to derive actionable insights. These insights could include parking demand patterns, peak usage hours, and predictive maintenance schedules for sensors and equipment, optimizing operational efficiency and resource allocation.

Integration with Autonomous Vehicles: As autonomous vehicle technology continues to evolve, our smart parking system can seamlessly integrate with self-driving cars, offering automated parking assistance and reservation services. This integration holds potential for enhancing traffic flow, reducing congestion, and maximizing the utilization of parking spaces.

Enhanced Security Features: Future iterations of our system could incorporate advanced security features, such as license plate recognition, facial recognition, and geofencing capabilities. These enhancements would further strengthen security measures and provide additional layers of authentication for access control and vehicle identification.



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