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Smart Parking System using Node – MCU

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ABSTRACT: The ever-growing number of vehicles on the road has created a pressing need for more and more designated parking spaces. However, simply having a large parking area isn't enough. Drivers often waste time circling and searching for an empty spot, leading to frustration and congestion. Additionally, the lack of clear information regarding available spaces can tempt drivers to park illegally, further compounding the problem. This project proposes a smart parking system that leverages the power of the Internet of Things (IoT) to address these challenges. The system acts as a potential solution to the ongoing parking struggles by efficiently managing parking lots. Imagine a scenario where drivers can easily locate vacant spaces upon arrival, eliminating the need for time-consuming searches. This system achieves this by utilizing strategically placed infrared sensors that connect to ESP12-E (Node-MCU) modules programmed through Arduino IDE. These sensors act as the eyes of the system, detecting the presence or absence of vehicles in each parking space.

I. INTRODUCTION

1.1 PROBLEM DESCRIPTION

The growing number of vehicles creates a critical demand for efficient parking space management. This project addresses the challenge of locating available parking spaces within large lots and deterring illegal parking. We propose a smart parking system utilizing Internet of Things (IoT) technology to alleviate these parking woes. The system will streamline parking lot organization by employing infrared sensors to detect occupancy in real-time. This data will be transmitted to a mobile application, allowing drivers to effortlessly locate vacant spots. To enhance security and user convenience, a registration process will be implemented, granting access to the app through a unique login code. This innovative system has the potential to significantly improve parking efficiency and adherence to regulations.

1.2 OBJECTIVE

The project aims to implement a novel smart parking system leveraging Internet of Things (IoT) technology to tackle the burgeoning challenges of limited parking spaces and non-compliant parking practices. This system will employ infrared sensors to detect unoccupied spaces and transmit this data in real-time to a dedicated smartphone application. Users can then leverage this application to access real-time parking availability, navigate directly to vacant spaces, and optimize their parking experience. Furthermore, the system prioritizes user security by implementing a login code requirement for registered users. By creating an efficient, user-friendly, and secure parking solution, this project seeks to significantly contribute to a more organized and streamlined parking ecosystem.

1.3 SCOPE

This project proposes a smart parking system using IoT (Internet of Things) to address the growing problem of limited parking space due to increasing vehicle ownership. The system aims to tackle two issues: finding empty spaces in large parking areas and deterring illegal parking. It will use infrared sensors to detect available spots and transmit this data to a smartphone application. Users can access real-time parking information and locate vacant spaces easily. For added security and convenience, a login system with unique codes will be implemented for registered users. This project aims to demonstrate the effectiveness of this smart parking system in improving parking lot organization and driver experience.

II. LITERATURE SURVEY

TITLE: SMART CAR PARKING SYSTEM

AUTHOR: Viraj Patil, Anup Randive, Mr. Deepak Gaikwad

This project tackles a common frustration: efficiently managing parking in complex, multi-story structures. It achieves this by utilizing a network of infrared (IR) sensors to detect the presence or absence of vehicles within each parking space. This data is then processed to provide real-time feedback on available parking spots. The beauty of this system lies in its simplicity. It forgoes the need for complex programming or expensive equipment. Instead, it relies on a carefully designed circuit, built specifically for its intended purpose. This automation goes beyond simply indicating vacancy. It actively guides drivers towards available spaces using visual cues, streamlining the entire parking experience and significantly reducing the time spent searching for a spot. The applicability of this system extends far beyond a single location. It holds immense value for malls, multi-story parking structures, IT hubs, and any other facility with a significant parking demand. By automating the process, the need for manual monitoring by staff is minimized, reducing labour costs and ensuring a consistently smooth parking experience for users.

TITLE: Smart Parking System using IoT

AUTHOR: ElakyaR, Juhi Seth, Pola Ashritha, R Namith

In the face of ever-growing metropolitan areas and a corresponding surge in vehicle ownership, traffic congestion has become a significant hurdle to urban mobility. One major factor contributing to this congestion is the time wasted by drivers circling parking lots in search of an available space. This paper proposes a solution that leverages Internet of Things (IoT) technology to automate parking management and optimize space allocation, thereby reducing traffic congestion and improving the overall parking experience. The proposed system utilizes a network of sensors embedded within each parking space. These sensors, which could be ultrasonic, magnetic, or camera-based, can detect vehicle presence and transmit real-time data on available parking spots to a central hub via a wireless network. This data is then made accessible to users through a mobile application or a web interface. With a few clicks, users can access real-time information on available parking spaces within a designated area, eliminating the frustration and wasted time associated with physically searching for a spot. The system not only benefits drivers by streamlining the parking search process, but also offers enhanced security through the integration of Radio Frequency Identification (RFID) technology. RFID tags affixed to vehicles can be linked to the parking management system, allowing for automated entry and exit upon identification. This not only expedites the parking process but also deters potential car theft by restricting unauthorized access to the parking facility. In conclusion, this IoT-based smart parking system offers a multifaceted solution to the growing issue of urban parking congestion. By providing real-time parking availability information and implementing advanced security measures, the system aims to create a more efficient and user-friendly parking experience for drivers while simultaneously alleviating traffic congestion in metropolitan areas.

TITLE: IOT BASED VEHICLE PARKING PLACE DETECTION USING ARDUINO

AUTHOR: Yuvaraju. M*, Monika. M

In today's world, navigating busy urban environments is often fraught with challenges, and a major one is the scarcity of parking spaces. This lack of readily available parking creates a domino effect, leading to traffic congestion as drivers circle endlessly searching for a spot. This paper proposes a solution that leverages the power of the Internet of Things (IoT) to streamline the parking experience – an IoT-based parking space detection system integrated with a mobile application. This innovative system empowers users to take control of their parking woes. Imagine the convenience of using a mobile app to check the real-time availability of parking spaces in your vicinity. No more aimlessly driving around, wasting time and fuel. The app would act as a user-friendly interface, providing real-time data and allowing you to reserve a parking slot with just a few taps. The magic behind this system lies in the ingenious combination of hardware and software. Each parking space would be equipped with an infrared sensor, paired with an Arduino microcontroller. This sensor acts as a digital eye, detecting whether the space is occupied or vacant. This information is then transmitted to the cloud using a GSM module, ensuring the data is constantly updated and accessible. The Arduino unit plays a crucial role in keeping track of the total number of vehicles parked in the designated area, providing valuable insights for overall parking management. In essence, this IoT-based parking system offers a win-win situation for both drivers and city authorities. Drivers can enjoy a stress-free parking experience, eliminating the frustration of endlessly searching for a spot. City planners can gain valuable data on parking usage patterns, allowing them to optimize parking infrastructure and improve traffic flow. This innovative approach has the potential to significantly reduce traffic congestion, leading to a more efficient and environmentally friendly urban landscape.

III. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

In today's world, finding a parking space can be a frustrating and time-consuming ordeal. Many existing parking systems rely solely on vision-based monitoring, which estimates available spaces by tracking incoming and outgoing vehicles. This method, however, is far from perfect. It requires significant processing power and can be easily fooled by factors like lighting conditions or double-parked cars. Furthermore, it offers no way to reserve a spot in advance, leading to wasted time circling for an open space. This inefficiency not only frustrates drivers but also contributes to traffic congestion as cars continue to search for parking. Clearly, a more effective solution is needed to streamline the parking experience.

3.2 PROPOSED SYSTEM

Leveraging the power of the Internet of Things (IoT), our proposed car parking system offers a user-centric solution to the age-old problem of finding available parking spaces. This system incorporates two key components: a mobile application and a cloud-based network. The mobile application acts as the user interface, providing real-time data on parking space availability. This empowers drivers to make informed decisions before even reaching their destination. Imagine the convenience of knowing exactly where to find a parking spot, eliminating the frustration of endlessly circling crowded parking lots. The magic behind this system lies in its connection to the cloud. Here, data collected from sensors strategically placed within the parking area is processed and made accessible to the mobile application. These sensors, typically infrared sensors or ultrasonic sensors, can detect the presence or absence of a vehicle in each parking space and displays that in a display board.

IV. SYSTEM SPECIFICATION

4.1 HARDWARE REQUIREMENTS

- Node-mcu
- Power supply
- IR sensor
- Lcd display
- buzzer

4.2 SOFTWARE REQUIREMENTS

- Software = Arduino IDE
- Language = embedded C.

4.3 SOFTWARE DESCRIPTION

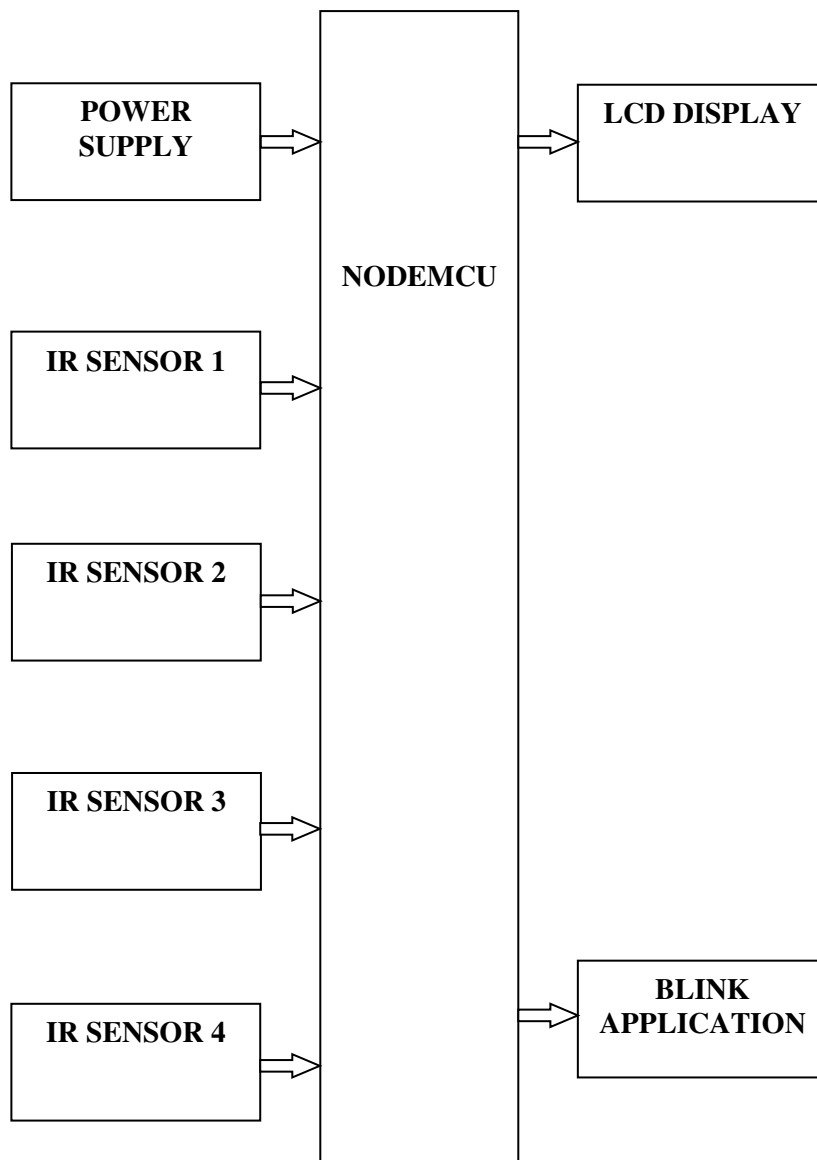
(a) ARDUINO IDE

The Integrated Development Environment (IDE) combines essential tools like a text editor, linker, and compiler into a single platform. This allows programmers to write, compile, and upload firmware – the software that instructs a device how to function – onto their hardware. The Arduino IDE is a shining example within the open-source realm, particularly valued for its role in rapid prototyping. Its user-friendly interface makes it approachable for beginners, and it even supports programming languages like embedded C and Luna. The impact of Arduino extends far beyond its software. Over the years, it has become the mastermind behind countless projects, from the familiar objects we encounter daily to intricate scientific instruments. This influence extends to the hardware itself, with the Arduino platform encompassing a diverse range of boards – from the widely-recognized Arduino Uno to the compact Nano and the feature-rich Mega. As the Arduino community flourished, the platform itself continuously evolved to meet new requirements and challenges. This adaptability is evident in the expansion beyond simple 8-bit boards, venturing into territories like Internet of Things (IoT) applications, wearables, 3D printing, and embedded environments. By embracing transformation, Arduino solidified its position as a cornerstone for innovation across various technological frontiers.

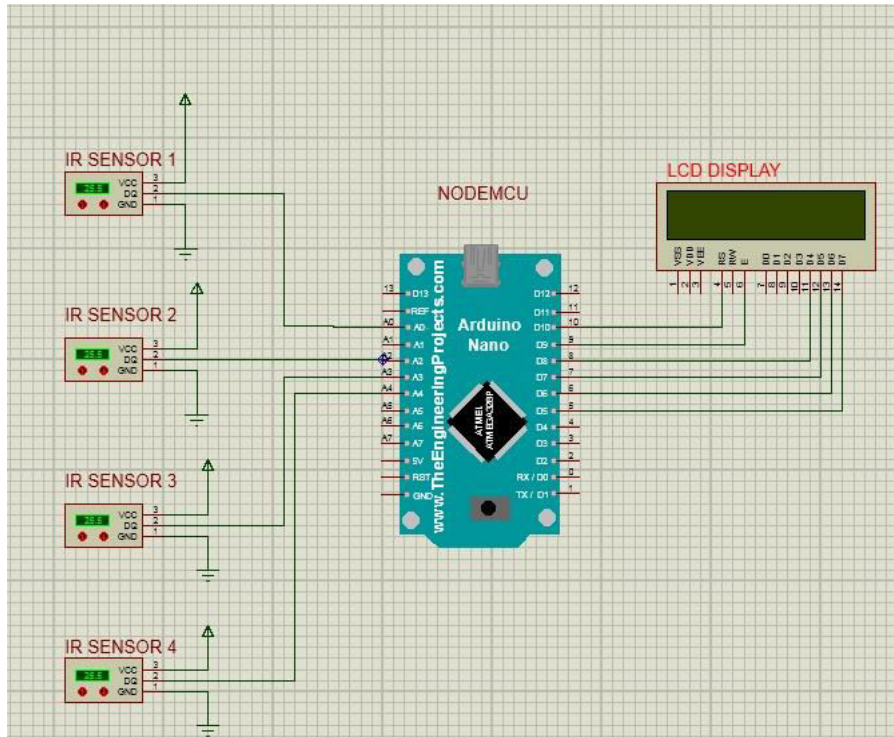
(a) EMBEDDED C

Embedded C is programming language that used in the development of Embedded Systems. Embedded Systems are specialized systems designed to perform very specific functions or tasks. Embedded System is the combination of hardware and software and the software is generally known as firmware which is embedded into the system hardware. Embedded C is to program a wide range of microcontrollers and microprocessors. Embedded C requires small number of resources to execute in comparison with high-level languages such as assembly programming language. Embedded C has some additional data types and keywords. There are some special datatypes in Embedded C like sbit, sfr which are used for addressing special function registers in memory. Embedded C allows us to work with hardware devices like sensors, and input-output devices. There are various Embedded C compilers to compile the embedded C program such as Keil Compiler, SPJ Compiler, Embedded GNU C Compiler, etc. Embedded Systems can be classified into small-scale, medium-scale, and sophisticated embedded systems. The devices like air conditioners, printers, and mobile phones that we use in our day-to-day are programmed by embedded C.

4.4 BLOCK DIAGRAM



4.5 CIRCUIT DIAGRAM



V. WORKING PRINCIPLE AND RESULT ANALYSIS

5.1 WORKING PRINCIPLE

A smart parking system relies on a network of components working together. At the heart of the system are IR obstacle sensors, which detect the presence or absence of a car in a parking space. These sensors are connected to a microcontroller unit, like the Node-MCU. This microcontroller wouldn't be much use without a way to communicate. That's where the Node-MCU's ESP8266 Wi-Fi module comes in.

IR SENSOR

This sensor used to detect objects in its surrounding environment. It has two parts light emitting diode and receiver. Infrared light will go out from the LED and if it reflects back from the object the receiver will detect it and pass an information that says there is a obstacle detected and if the receiver didn't detect any thing it means there is no obstacle in front, in our case there is no parking on the slot.

NODEMCU

It is opensource development board and firmware based in the widely used ESP8266 -12E Wi-Fi module. It combines features of WIFI access point and station + microcontroller. These features make the Node-MCU extremely powerful tool for Wi-Fi networking.

5.2 RESULT

The demand for smart parking systems is surging as they revolutionize the way drivers locate available spaces. These systems leverage real-time data to provide users with immediate insights into parking availability, significantly reducing wasted time and frustration associated with traditional methods. This not only enhances the overall parking experience for drivers but also contributes to improved traffic flow and reduced emissions in urban areas.

VI. CONCLUSION AND FUTURE ENHANCEMENT

6.1 CONCLUSION

This proposed IoT based parking model comprises of remote sensor systems. This framework comprises of remote sensor systems, Blynk cloud and mobile application. The condition of the stopping opening is distinguished by sensor hub and that were accounted for intermittently to the blynk server through the remote sensor systems. This data is sent to blynk server through Wi-Fi organizes progressively. The user can discover empty parking spot by utilizing their portable application. This project helps us to build smart cities and helps to save time that were spend on searching the parking space and also save the fuel consumption. It can be used to complete the idea of making smart cities. We also provided security features to the user for better development. Positive performance results indicate that our initial motivational goals have been successfully achieved. This achievement extends beyond internal targets, as the initiative also holds the potential to improve business objectives by providing much-needed parking options for the local community.

6.2 FUTURE ENHANCEMENT

Functionality can be expanded to include remote parking space reservation via mobile app or dedicated platform, enhancing user convenience. Integration of GPS, reservation systems, and license plate recognition technology could further optimize the parking experience in the future.

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