

NodeMCU ESP8266 based Smart Car Parking System

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Abstract - Smart car parking system mainly used for locating free space in parking slot. The system is designed to reduce the time and effort of human being, that they put in case of car parking. The complete setup is made up of four components, which can help to build a smart city.

Index Terms – NodeMCU, car parking, IoT, smart city

I. INTRODUCTION

In the present scenario around us we see an excessive amount of vehicles and the ineffectiveness to control them in the correct order. An omnipresent problem around the world is finding a parking space to park your vehicle. This job looks simple on side roads and interior lanes but the main problem arises when parking in malls, multistory parking facilities where hundreds of cars are parked and it becomes arduous to perceive a spot.

The Internet-of-Things (IoT) technology has originated a revolution in many ways and forms in life as well as in smart parking system technology, as parking becomes a very crucial need of our daily life. Therefore, this system looks further to planning and acquiring a smart parking system before heading out towards our destination in order to minimize the hassle of driving around looking for a parking spot during peak hours. These circumstances can be seen as an opportunity for smart cities to undertake actions in order to enhance the efficiency of their parking resources, thus leading to depletion in searching times, traffic congestion and road accidents. As the number of population increased. Ultimately, it causes hazards in parking which leads to traffic congestion, driver frustration, and air pollution as well. When we visit different public places, for example shopping malls, multiplex cinema halls and hotels during the festival time or weekends it creates a lot of problems related to parking. Here, by the help of this project, we are going to see how to reduce the parking problem and to do secured parking using the smart parking system.

II. OBJECTIVE

1. *Improve parking efficiency:* Traditional parking systems often result in time consuming searches for accessible parking slots, leading to traffic congestion and frustration among the drivers. By this system, the objective is to streamline the parking process and minimize the time spent searching for a free parking spot.

2. *Optimize parking space utilization:* Efficiently making use of parking spaces is crucial in urban areas where parking area is limited. The purpose here is to maximize the usage of available parking spaces and reduce wastage. By continuously analyzing parking patterns and occupancy data, the system can recognize trends and patterns to allocate parking spaces.

3. *Reduce carbon emissions:* We know that, transportation is a remarkable contributor to greenhouse gas emissions, and circling around in search of parking spaces adds irrelevant fuel consumption and emissions. The purpose of reducing carbon emissions in a smart car parking system is to reduce the time, thereby minimizing vehicle congestion and the associated emissions.

III. THEORY

THEORY ON INTERNET-OF-THINGS (IoT):

The internet of things helps people to live and work in a smarter way, as well as accumulate total control over their lives. In addition to offer smart devices to automated homes, IOT is essential for business purpose. IOT allows companies to motorized processes and to minimize the labor costs. It also cuts down on waste and enhances service delivery, making it slightly expensive to manufacture and to deliver goods. It is one of the most significant technologies of our regular life, and it will continue to pick up steam as more businesses realize the potential of connected devices to keep they are competitive.

Some of the advantages are: Capacity to gain information from anywhere at any time on any device, improved communication between connected electronic devices, transferring data packets over a connected network saving time and money, automating tasks helps to improve the quality of a business's services and reducing the need for human intervention.

Some of the disadvantages are: The number of connected devices increases and more information is shared between devices, the potential that a hacker could steal confidential information also increases. Enterprises might have to deal with huge numbers and managing the data from all those devices will be challenging. If there is a bug, present in the system, it's likely that every connected device will become corrupted.

IV. COMPONENTS USED

1. NodeMCU ESP8266

2. IR Sensor

3. Servo motor

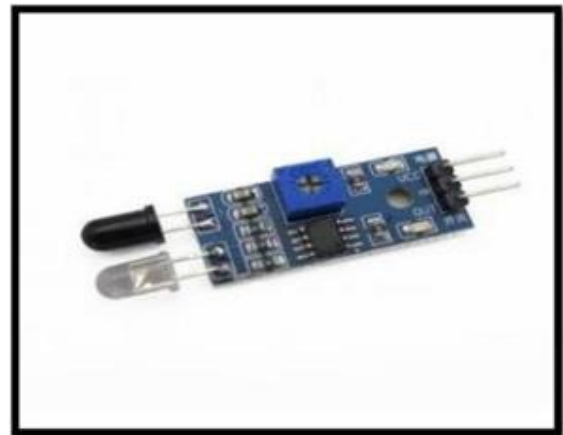
4. Liquid Crystal I2C

1. NodeMCU ESP8266



The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-chip (SoC) called the ESP8266. The ESP8266, designed and constructed by Expressive systems, contains the important elements of a computer: CPU, RAM, WiFi, and a modern operating system and SDK. That makes it an magnificent choice for IOT projects of all kinds. You need a program it in low-level machine instructions that can be interpreted by the chip hardware. It is a large amount of burden for hobbyists, hackers, or students who want to observe it in their own IoT.

2. IR Sensor



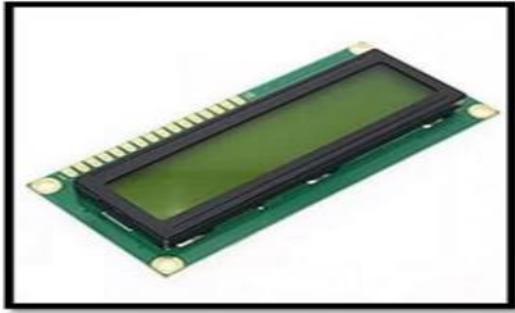
An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its adjoining environment. IR is discreet to the human eye, as the wavelength is longer than that of the apparent light. Anything which can emit heat, gives off infrared radiation. There are two types of IR sensors: active and passive. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. Passive IR sensors only detect infrared radiation and do not emit it from an LED. Passive IR sensors have four parts: two strips of pyro electric material, an IR filter, a Fresnel length and a housing unit.

3. Servo Motor



It has a suitable motor coupled to a sensor for position feedback. It also needs a relatively experienced controller, a dedicated module designed specially for use with servomotors. Servomotors are wormed in applications such as robotics, CNC machinery and motorized manufacturing. It is a servomechanism, uses position feedback to control its motion and final position. The input to its control is a signal representing the position commanded for the output shaft. The most simple servomotors use position-only sensing via potentiometer of their motor, the motor always rotates at full speed.

4. Liquid Crystal I2C



The module has an LCD screen, a backlight, a controller chip, and an I2C interface. The LCD screen is typically composed of a grid of pixels organized in rows and columns. The controller chip performs as an intermediary between the microcontroller or the other controlling device and the LCD screen, handling the processing and check of the display.

V. APPLICATIONS

A smart car parking system can have many applications, some of which are listed below:

1. *Commercial parking facilities:* For example shopping malls, airports, hospitals, office buildings can be benefited from a smart car parking system.
2. *Municipal parking management:* Municipalities can take the advantage of this system to manage parking in urban areas more effectively.
3. *Residential parking management:* A smart car parking system can help the residents, so that they can conserve parking spaces in advance.
4. *Tourist parking management:* It can help the tourist destinations in managing parking more successfully. It provides a real-time information about parking availability and help the drivers.
5. *Parking guidance and navigation:* It can provide drivers with the guidance and navigation assistance. By integrating with GPS or mapping services, drivers can receive directions to the nearest available parking spaces.

VI. ADVANTAGES

1. *Optimized parking:* Optimized parking is a notable advantage of smart car parking systems that can provide a lot of advantages to both drivers and parking facility operators. The smart car parking system can help to reduce the time and efforts that are needed for drivers to find a parking area. This can be especially beneficial in busy,

congested urban areas where parking is limited, and drivers may require to circle around several times before finding a spot. By optimizing parking, smart car parking systems can also help to minimize the congestion and improve traffic flow around the parking facility. This can lead to a more efficient, effective and streamlined parking experience for drivers and a more organized and profitable operation for facility operators.

2. *Reduced traffic:* One of the key primacy of a smart car parking system is that it can assist to minimize traffic congestion, because traditional parking systems often involve drivers circling around searching for an available parking spot, which can lead to traffic jams, wasted time, and increased fuel consumption. With the help of a smart car parking system, drivers can be directed to an available parking spots using real-time data and sensors. This means that they can quickly and easily find a spot without having to spend time searching for one. In addition, since the system is able to optimize the use of available space, it can reduce the number of cars that need to circulate in search of a parking spot, further reducing traffic congestion.

3. *Reduced pollution and traffic congestion:* Smart car parking systems can help reduce traffic congestion in urban areas by guiding drivers to available parking spaces. This can reduce the time drivers spend circling the block looking for a parking spot, which in turn reduces the amount of emissions released by idling vehicles.

Smart parking systems can also reduce traffic congestion by directing drivers to the nearest available parking spot. This can help reduce the amount of time drivers spend looking for a parking spot, which in turn minimizes the amount of traffic on the road.

4. *Efficient parking and improved safety:* It can also help drivers find the most efficient parking spot based on their destination and the time of day. This means that drivers can park closer to their destination, reducing the distance they need to travel on foot or by car. This can reduce the amount of emissions released by vehicles during short trips. Smart parking systems can improve safety by providing well-lighted clearly marked parking areas. They can also help reduce the possibility of collisions and

accidents by guiding drivers directly to their reserved parking spots.

5. *Enhance user experience:* Smart car parking systems fulfilled the need of drivers to circle a car park looking for an empty spot. Instead, drivers can simply use the smart parking system's app to locate and conserve an available space in advance. This saves drivers time, efforts and reduces frustration. Smart parking systems provide.

VII. DISADVANTAGES

As we know that smart car parking system offers several advantages, they also have some disadvantages.

1. *Initial cost and infrastructure requirements:* The installation of sensors and other technologies, along with the mandatory infrastructure for data collection and communication, must be expensive. Retrofitting existing parking facilities with the required equipment may pose logistical challenges and increase the overall cost.

2. *Technical complexity and maintenance:* Smart car parking systems rely on various technologies, like sensors and data processing systems. These components need proper regular maintenance and calibration to ensure accurate performance of the entire system. Technical issues, such as sensor malfunctions or system failures, may occur and require prompt troubleshooting, that can be time-consuming and costly.

3. *Limited accessibility for non tech-savvy users:* Not all drivers may be familiar with or comfortable using the technology required to access and utilize a smart car parking system. Elderly or technologically inexperienced people may face difficulties navigating the system's mobile applications or digital interfaces.

4. *Technical issues:* Just like any complex technological system or arrangement, smart car parking systems are not immune to failures or inaccuracies. False readings from sensors, technical glitches in the data processing algorithms, or outdated information may result in incorrect parking availability details, leading to confusion and inconvenience for drivers.

While the disadvantages exist, they can be mitigated through careful planning, regular

maintenance, user education, and addressing privacy and security concerns.

VIII. FUTURE SCOPE

The future scope of smart car parking systems is promising, as developments in technology and urban development continue to shape the transportation landscape in a better way. The smart parking industry continues to evolve as an rising number of cities struggle with traffic congestion and inadequate parking availability. While the distribution of sensor technologies continues to be core to the advancement of smart parking, a wide range of variety of other technology innovations are also enabling more adaptable systems. It is an efficient way out for solving parking problems, that overcomes the traffic congestion and also provides automated billing process. Safety measures like tracing the vehicle number, face recognition of the drivers for avoiding theft & can also be designed. We plan to expand the tests to the real time environment where the users can have the "Smart Parking" system in their handheld devices.

IX. CONCLUSION

In conclusion, a smart car parking system, empowered by Internet of Things technologies, revolutionizes the way we approach parking.

The ability to reserve parking spots in advance ensures a guaranteed parking space, particularly in crowded areas or during events.

IoT sensors enable parking violation monitoring, allowing authorities to detect and address violations promptly. This promotes fair utilization of parking spaces and improves enforcement. A smart car parking system improves the parking experience for drivers, optimizes space utilization, enhances traffic flow, and contributes to sustainability. With the continued advancement of IoT technologies, smart parking systems hold great potential for transforming the way we manage parking in the future.

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