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# Automatic Vehicle Parking System

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**A B S T R A C T**

The Automatic Vehicle Parking System utilizes advanced technologies such as sensors, cameras, and automated machinery to streamline the process of parking vehicles. Upon entering the parking facility, vehicles are guided to designated parking spots by a centralized control system. Sensors installed throughout the parking area detect the presence of vehicles, enabling real-time monitoring and management of available parking spaces. Integrated cameras provide visual assistance for precise vehicle positioning and enhance security measures within the facility. One of the primary advantages of AVPS is its ability to significantly reduce the time and effort required for parking, thereby enhancing overall efficiency and convenience for vehicle owners. By eliminating the need for manual intervention, AVPS minimizes the risk of human errors and optimizes the utilization of parking space. Furthermore, the system can accommodate a larger number of vehicles within a given area compared to traditional parking methods, making it particularly suitable for densely populated urban environments where parking space is limited. Additionally, AVPS offers various benefits in terms of environmental sustainability and cost-effectiveness. The automated parking process results in reduced fuel consumption and emissions, contributing to environmental conservation efforts. Moreover, the efficient use of space allows for the development of compact parking structures, thereby minimizing construction costs and maximizing revenue generation potential for parking facility operators. In conclusion, Automatic Vehicle Parking Systems represent a transformative solution to address the challenges associated with conventional parking systems. By harnessing the power of automation and advanced technologies, AVPS offers enhanced efficiency, convenience, and sustainability in urban parking environments.

Keywords: Automatic Vehicle Parking System(AVPS), Parking Automation, Sensor based parking, Smart parking technology, automated parking facilities, Vehicle guidance systems, Parking space utilization, Smart city parking, Parking facility automation.

## 1. Introduction:

The increasing urbanization and the ever growing number of vehicles on the road have led to a significant challenge in managing parking spaces efficiently. Finding a parking spot in crowded urban areas can be a time-consuming and frustrating task for drivers. To address this issue, Automatic Vehicle Parking System have emerged as a promising solution leveraging advanced technology like Arduino micro controllers to optimize the parking experience. Automatic Vehicle Parking System is a modern, automated approach to parking management that aims to enhance convenience for both drivers and parking facility operators. This system employs a network of sensors, actuators and micro controllers to monitor, control and streamline the parking process. Arduino is the brain of the system, responsible for processing data from sensors and making real-time decisions to manage parking spaces efficiently. IR sensors are these sensors are deployed at each parking space to detect the presence of a vehicle.

Figure 1.1 Schematic image of system

They transmit signal and measure the time it takes for the signal to bounce back, allowing the system to determine whether a space is occupied or vacant. LCD displays are often placed at the entrance and throughout the parking facility to guide drivers to available parking spaces. The methodology employed a systematic approach, starting with the establishment of a hardware setup consisting of an Arduino Uno, IR sensor and servo motor. Software development focused on coding the initialization and control of the sensors and servo motor. Calibration and rigorous testing were conducted to ensure the system's accuracy and functionality. Performance evaluation involved measuring key metrics, such as detection accuracy, response time, and reliability. Automatic Vehicle Parking System utilizing Arduino platform. It begins with an introduction to the importance of efficient parking systems in urban environments and the challenges associated with traditional parking methods. The review explores various types of automatic vehicle parking system.

### *1.1 Components Description:*

- Arduino UNO

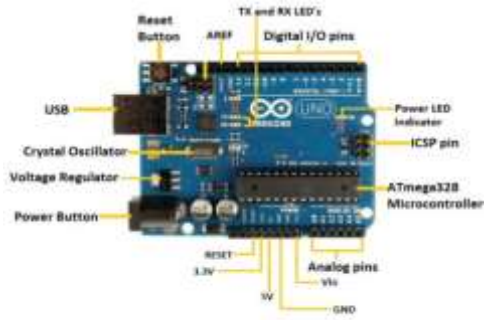


Figure 1.2 Arduino UNO

Arduino UNO is based on an Atmega328 micro- controller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consist of digital and analog Input/Output pins (I/O), shields and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and a ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms. The Arduino Uno is a micro-controller board based on the Atmega328. Arduino is an open-source, prototyping platform and its simplicity makes it ideal for hobbyists to use as well as professionals.

- LCD Display


Figure 1.3 LCD Display

This is a basic 16 character by 2-line Alphanumeric display. black text on yellow background. Utilizes the extremely common HD44780 parallel interface chipset. Interface code is freely available. You will need Minimum 6 general I/O pins to interface to this LCD screen. Includes LED backlight. Works in 4bit and 8-bit Mode.

- Servo Motor SG-90

Figure 1.4 Servo motor

The SG90 Micro Servo Motor is a small, high-performance servo motor commonly used in robotics, model making, and other hobbyist projects. It has a compact form factor and is relatively low-cost, making it an attractive choice for many applications. The SG90 has a 9-gram weight and a size of 22.8 x 11.8 x 22.7 mm, making it small enough to be used in compact and lightweight robotic designs. It has a torque rating of 1.8 kg/cm, which is sufficient for most hobbyist applications and small robotic projects. The servo motor also features a dead- band width of only 1 µs, which provides precise control and positioning of the servo's output shaft. Servo motor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback. It also requires a servo drive to complete the system. The drive uses the feedback sensor to precisely control the rotary position of the motor.

- IR sensor

Figure 1.5 IR Sensor

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herschel in 1800. While measuring the temperature of each colour of light (separated by a prism). IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degrees Kelvin) gives off infrared radiation.

- Power Supply

Figure 1.6 Power Supply

A power supply takes the AC from the wall outlet, converts it to unregulated DC, and reduces the voltage using an input power transformer, typically stepping it down to the voltage required by the load. For safety reasons, the transformer also separates the output power supply from the mains input. By definition, a power supply is a device that converts the output from an ac power line to a steady dc output or multiple outputs. The ac voltage is first rectified to provide a pulsating dc and then filtered to produce a smooth voltage.

## 3. Methodology:

Using Arduino UNO

Justification of selected methodology:

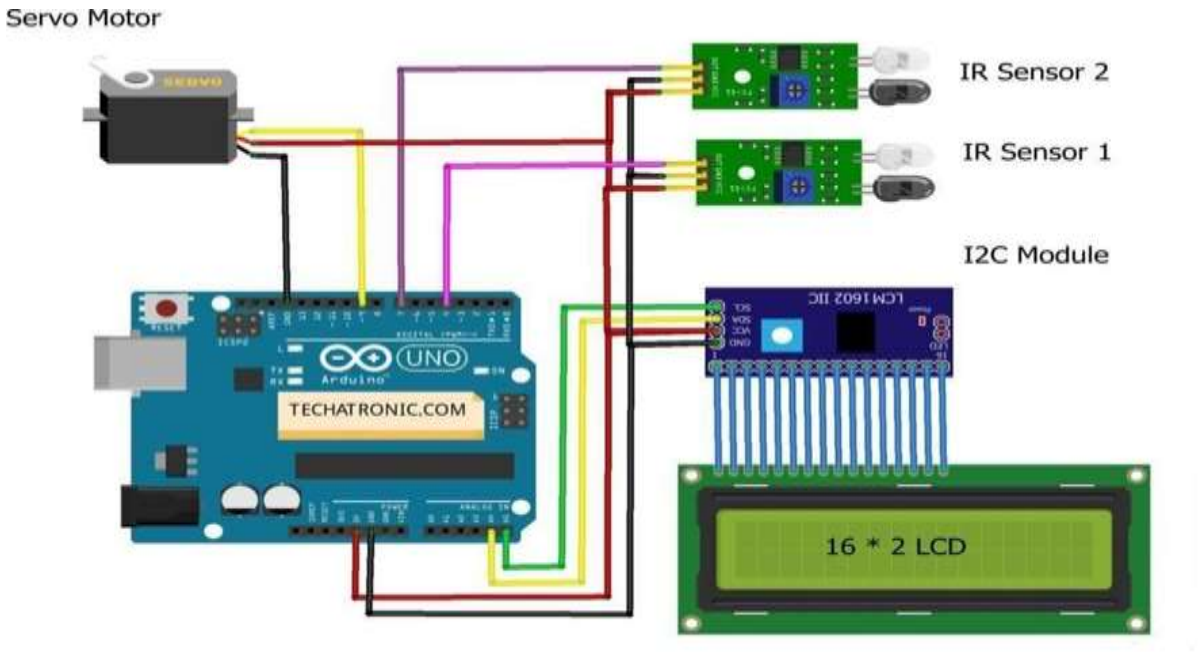


Figure 2.1 Block Diagram of the System

Using Arduino for an automatic vehicle parking system offers a cost-effective, customizable, and scalable solution that can be tailored to specific needs while providing ample room for innovation and expansion. Using an Arduino-based automatic vehicle parking system offers several advantages over other methods:

1. Arduino allows for highly customizable solutions. We can tailor the parking system to fit specific requirements, such as the size and layout of the parking area, as well as any additional features you may want to incorporate.
2. Arduino is an open-source platform with a vast community of developers and enthusiasts. There are countless tutorials, libraries, and forums available online, making it easier to find resources and support for the project.
3. It simplifies the prototyping process, allowing you to quickly test and iterate on the parking system design. This can significantly reduce development time and costs compared to other methods that may require more complex development environments or specialized hardware.
4. While Arduino is suitable for small-scale projects, it can also be scaled up for larger applications by incorporating additional hardware or networking multiple Arduino boards together. This scalability makes it a versatile option for various parking system requirements.
5. Arduino boards can easily interface with a wide range of sensors and actuators, such as ultrasonic sensors for distance measurement or servo motors for controlling barriers or gates. This enables to create a fully automated parking system that can detect vehicles, allocate parking spaces, and manage entry and exit procedures efficiently.
6. Arduino-based parking systems can be easily modified or expanded to accommodate future upgrades or changes in requirements. Whether you want to add new features, improve performance, or integrate with other systems, Arduino provides the flexibility to adapt your parking solution accordingly.

## 4. Future Scope:

The future scope for automatic vehicle parking systems looks promising. These systems are designed to make parking easier, faster, and more efficient by using technology like sensors, cameras, and robotics to guide vehicles into parking spaces without human intervention. In simple terms, imagine a parking lot where you drive your car to a designated area, and it automatically parks itself with the help of sensors and computers. This not only saves time and effort for drivers but also optimizes parking space usage, reducing congestion and making parking lots safer and more organized. As technology advances, these systems could become even more sophisticated, potentially integrating with mobile apps for reservation and payment, providing real-time updates on parking availability, and even offering services like car washing or charging while parked. Overall, the future of automatic vehicle parking systems is bright, with the potential to revolutionize the way we park our cars, making urban mobility more convenient and efficient.

## 5. Conclusion:

The automatic vehicle parking system represents a significant advancement in urban infrastructure addressing the ever growing challenges of limited parking space, traffic congestion, and environmental concerns. Through the integration of cutting-edge technologies such as sensors, camera, machine learning algorithms, and automation, these systems offer a plethora of benefits to both vehicle owners and city planners. Firstly, automatic parking system optimize the utilization of available space by efficiently allocating parking slots based on real-time demand. This leads to a reduction in the time spent searching of parking, thereby decreasing traffic congestion, fuel consumption, and carbon emissions. additionally by minimizing the need for large parking lots, these systems contribute to the conservation of valuable urban land, which can be repurposed for other community needs or green spaces.

Moreover, the convenience and ease of use offered by automatic parking systems enhance the overall user experience. Vehicle owners can seamlessly navigate through the parking process, from locating an available space to retrieving their vehicle, with minimal hassle. This not only saves time but also reduces stress and frustration associated with traditional parking methods. Automatic vehicle parking systems represent a transformative solution to the challenges posed by urbanization and increasing vehicle ownership. By leveraging technology to optimize space utilization, improve convenience, and enhance security, these systems pave the way for smarter, more sustainable cities of the future

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