

## Smart Car Parking System Using Arduino and Sensor

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### Abstract

As population grows perpetually with an ever-rising rate of urbanization, the rate of vehicles on the road has been rising drastically, a phenomenon that has posed a severe problem of parking within most cities. Finding an empty parking lot has become a frustrating and time-consuming activity particularly during commercial places and urban zones that have a high density. As a result of this, drivers tend to embark on an endless tour of finding car space and this creates undue movement of vehicles, traffic jam, wastage of fuel and higher levels of air and noise pollution. To solve these problems, intelligent parking systems can now be thought of to monitor the parking space in a better way and organize the parking space in a more efficient manner.

The proposed system will be an arduino and sensors smart car parking system, which will be designed to provide a simple yet intelligent and automated way of controlling parking slots. It uses a microcontroller in the form of arduino uno, an infrared (ir) sensor, a servo motor, and a 16×4 lcd display. The ir sensors scan the entry and exit of cars and relay it to arduino. With this information, the servo motor will automatically either close or open the gate. In the meantime, the lcd screen shows the availability of parking slot in real time where the drivers can know immediately whether a parking spot is available or not.

Such a system conserves time, man power and unnecessary wastage of fuel expenses occasioned by time trying to find a parking spot. It will also help to reduce pollution, improve efficiency of parking

facilities. This is a feasible parking system which is not expensive, has proven reliability and can be easily utilized to help make cities of to-morrow cleaner and smarter.

**Keywords:** arduino uno, automation, infrared sensors, smart parking system, ultrasonic sensors, vehicle detection

### 1. Introduction

The contemporary urban cities have had great difficulties in controlling the parking facilities as the number of vehicles is rising and the available space is inadequate. It takes many hours by drivers to find empty parking spaces leading to unnecessary use of fuel, traffic jams, and pollution of the environment. Das and basu [1] claim that one of the largest sources of urban mobility issues is inefficient parking management.

Smart parking systems have come out as a viable solution to these challenges. These systems incorporate sensors, microcontrollers and digital displays which show real time slot availability information. Recent research indicates that sensor-based parking models can help to save considerable time on search and enhance the overall parking efficiency, particularly in congested parking lots as noted by lin et al. [2].

Arduino-based automation is popular in academia and prototype-level projects due to its affordability, flexibility, and ability to work with various sensors. Shaikh and pathan [3] showed that arduino in conjunction with ir or ultrasonic sensors offer precise and dependable vehicle identification

about experimental smart parking systems. More recent efforts by patel and karamta [4] justify the application of ir sensors in short-range detection in low-budget designs.

The suggested project aims at creating a low-cost, easy-to-use smart car parking system based on an arduino uno, ir sensors, and lcd display. Previous studies demonstrate that lcd-based display guidance is more effective in enhancing user experience by enabling drivers to find available slots faster and minimize time wastage and congestion as reported by kim and lee [5]. This background sets the necessity and pertinence of smart parking systems in the contemporary city setting.

## 2. Methodology

The methodology starts with the analysis of the current parking problems including the inability to find free parking places, the congestion due to slow movement of vehicles, and the use of more fuel. According to das and basu [1], a large percentage of traffic in urban areas is as a result of drivers who are trying to find parking spaces.

This was followed by a comprehensive literature review based on the need to know the current smart parking methods such as arduino based automation, ir sensor detection and real-time display system. Surveys on research undertaken by lin et al. [2] and shaikh and pathan [3] clarified the existing progress and constraints in smart parking technologies.

Using the results of this review, an arduino uno microcontroller and ir sensors to detect vehicles were used to design the proposed system. The choice of ir sensors was due to their precision in short-range detection and their cost-effective applications as proved by patel and karamta [4]. The arduino interprets the sensor signals received and determines the occupancy or freedom of each slot.

The slot availability is then displayed on a liquid crystal display (lcd) and the drivers can easily

locate the free spaces. Earlier literature, such as that by kim and lee [5], indicates that lcd-based guidance has the capability of minimizing the duration of search and enhancing the parking process.

Calibration tests were done so that their sensing under various lights and environments could be accurate. The last methodology will provide an efficient and cost-effective smart parking system that will improve the convenience of users and help decongest the parking areas.

## 3. Literature survey

To enhance the process of slot detection and decrease manual surveillance, several researchers have created arduino- and sensor-based smart parking systems. Gupta et al. [6] developed an ultrasonic parking model using arduino that was able to detect the presence of a vehicle with great accuracy. On the same note, patel and kaur [7] utilized ir sensors in order to use a low-cost parking detection system that is applicable in an indoor setting. A gsm-based parking availability design was also suggested by raut and kale [8] and enhanced the accuracy of notifications.

Rahman et al. [9] added iot-enabled models with wi-fi modules to monitor them on the cloud. In order to minimize energy usage in real-time parking systems, banerjee and iqbal [10] investigated energy-efficient sensor networks. Thomas et al. [11] conducted a comparative survey of various urban smart parking designs and emphasized the advantages and difficulties of the iot-based systems.

Sinha and mehta [12] experimented with hybrid systems, with automated gate control via servo motors. In choudhary et al. [13], rfid was used to establish secure entry systems to increase authentication accuracy.

Fernandes and pinto [14] suggested more sophisticated methods and used machine-learning to forecast the occupancy of parking slots. Khan et al.

[15] optimized sensor networks to build real-time monitoring techniques that are more reliable.

Based on the literature review, it can be noted that despite the existence of different smart parking models, most of them are faced with the challenge of being costly, complex, and have the challenge of interfering with the environment. Ir sensor systems based on arduino are still a viable and cheap alternative to low-budget prototypes.

## 4. Design System

### 4.1 block diagram

The initial stage of the project started with a literature review and the assembly of all the required components. This was followed by preparing the block diagram as shown in figure 1. And studying the circuit connections in detail. Arduino microcontroller is programmed with the arduino ide software. As a car approaches the entrance, the ir sensor will sense that it is there and transmit a signal to the Arduino. Arduino then takes this signal and turns on the servo motor to open the gate to allow the car to pass through. I have another ir sensor at the exit to sense cars who are moving out of the parking space and the arduino will update the number of available parking spaces. In the case where all parking slots are occupied, the servo motor will be off until a car leaves. The analog signal of the ir sensors is converted into a digital signal by the built-in adc of arduino to be processed.

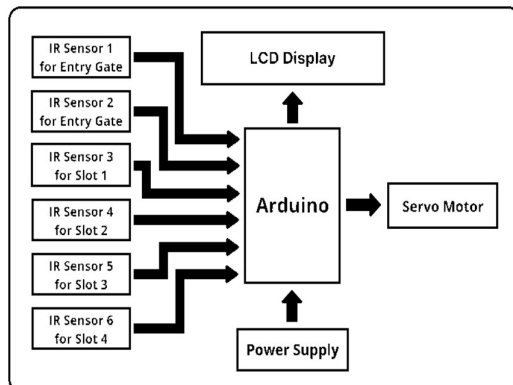


Figure 1: block diagram of smart parking system

## 5. Components List and Specification

### 5.1. Arduino uno

Figure 2. Arduino uno is an open-source microcontroller board, and is built based on the microchip atmega328p microcontroller, created by arduino. The board has a set of digital and analog input/output (i/o) pins which can be connected to other expansion boards (shields) and other circuits. It has 14 digital i/o pins (six of which can produce pwm data), 6 analog i/o pins and can be programmed using the arduino ide (integrated development environment), through a type b usb cable. It can be charged by the usb cable or an external 9-volt battery.



Figure 2. Arduino uno board

### 5.2. Lcd display

A liquid crystal display (lcd) as shown in figure 3. Is an electronic screen that shows numbers, letters, or messages using liquid crystals. These crystals do not produce light by themselves; instead, a backlight helps make the display visible. Lcds are widely used in digital clocks, calculators, and electronic projects.

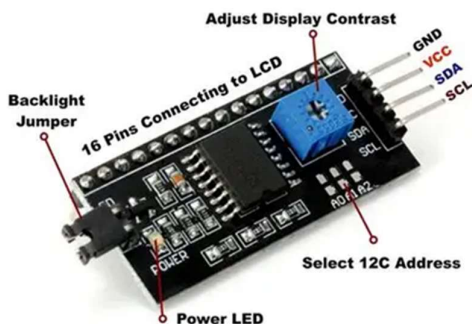
In this smart car parking system, the lcd is used to display the number of available parking spaces and system status. It works by controlling light passing through the crystals to form readable characters. The 16x2 lcd module connected to arduino can show two lines of text, making it simple, reliable, and easy to use for small embedded systems.



**Figure 3. Lcd display**

### 5.3. I<sup>2</sup>c module

I<sup>2</sup>c or iic stands for inter-integrated communication. I<sup>2</sup>c is a serial communication interface to communicate with other i<sup>2</sup>c devices. I<sup>2</sup>c uses multi-master / multi slave method. As shown in figure 4. I<sup>2</sup>c uses 2 lines named scl and sda for transmission/reception and another 2 lines for power supply and ground. Each i<sup>2</sup>c device has i<sup>2</sup>c address to identify. I<sup>2</sup>c addresses of multiple devices may have the same address. The address is in the format of "0x20".



**Figure 4. I<sup>2</sup>c module**

Steps to find out i<sup>2</sup>c address device is discussed in the following. The serial clock (scl) pin is to synchronize the transmitter and receiver. Serial data (sda) pin is to transfer data.

### 5.4. Servo motor

A servo motor is an electromechanical motor that can turn to a certain angle in an extremely precise manner. As in figure 5. It consists of three primary wires; one is a power (positive) wire, another is a ground (0v) wire, and the third wire is the control signal which is supplied by the arduino. The arduino transmits a sequence of electrical pulses to the servo, which calculates how much the motor should rotate.

Servo motors come in various sizes of mini, standard, and giant, based on the amount of torque they can manage. Most small and standard servos can be operated directly by the arduino without a driver.

The servo motor, in this smart automobile parking system, is to raise or lower the entry gate when the sensors identify a vehicle. The rotation angle (generally between 0° to 180°) is controlled by the width of the signal pulse. For example, a 1.5 ms pulse turns the servo to the center (90°) position, while shorter or longer pulses move it to the left or right.



**Figure 5. Servo motor**

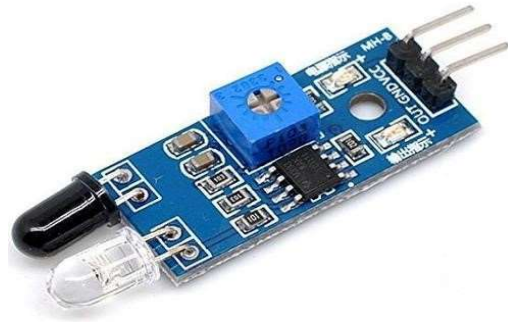
### 5.5. Ir sensor

An infrared (ir) sensor as shown in figure 6. Is an electronic device that detects objects or motion using infrared light. Every object around us emits a small amount of infrared radiation, which cannot be seen by human eyes but can be sensed by an ir sensor. The sensor mainly consists of two parts — an emitter and a detector.

The emitter is an ir led (light emitting diode) which emits infrared light and the detector is an ir photodiode which absorbs this light. When an object is presented in front of the sensor, the light emitted reflects off to the photodiode. This alters resistance and output voltage and this is interpreted by the arduino as a signal.

This smart car parking system employs ir sensors to detect a car in a parking slot or not. When a car is identified, the arduino receives the signal and

displays lcd or drives the servo motor.

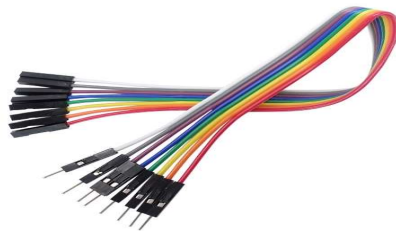


**Figure 6. Ir sensor**

## 5.6. Connecting wires

Figure 7 illustrates. Connecting wires are crucial elements that are used to connect various electronic components within a circuit. They enable electric current and signals to flow between the arduino board, ir sensors, servo motor, and lcd display. They are typically copper wires; copper is a good conductor of electricity and minimizes energy loss.

In the smart parking system, all modules are connected by wires that form the appropriate electrical connections. Jumper wires are often used on a breadboard, either male-to-male, female-to-female or male-to-female, depending on the pin type. Wiring done properly so that its communication and operation are smooth.



**Figure 7. Connecting wires**

## 5.7. Battery

The lithium battery illustrated in figure 8. Is a high-energy, small rechargeable power source that is commonly used in electronic and embedded systems. It offers a constant dc voltage output, typically, 3.7v, and is therefore applicable in

applications related to driving sensors, arduino boards and small modules. The density of lithium batteries is high, i.e., it can hold more energy in a small space and, they have longer life cycles than other types of batteries.

There is the possibility of using a lithium battery in the smart car parking system to provide backup power, such that the ir sensors, servo motor and arduino do not stop functioning in the event of power loss.

Its constant output ensures the correct sensor data and proper operation of the entire system.



**Figure 8. Battery**

## 6. Result and conclusion

The intelligent car parking system that has been invented in this project is effective in identifying vacant parking spaces and assisting motorists to locate free parking spaces, even in new locations. It effectively lowers the mean waiting and searching time to find a parking space, enhances convenience and minimizes unnecessary vehicle movement. This decreases the usage of fuel and reduces traffic congestion.

The principles behind the system are the concept of the internet of things (iot), relying on infrared sensors to precisely identify the presence or absence of vehicles. The smart car parking management system is an iot-based system designed to monitor

parking availability in real time using the arduino and sensors to create a prototype. The ir sensors sense the presence of vehicles and the information is immediately shown on the lcd display. The system also stores sensor data in a database and constantly updates information on parking so that it may be properly monitored.

Although the prototype was designed for a single parking area, the concept can be extended to managing multiple parking zones. An additional management interface can record the vehicle's entry and exit time for administrative purposes. According to the results, this system can be implemented in various public and private parking areas to help drivers easily locate available slots, saving time, energy, and fuel. A user acceptance test showed that most users found the system effective and practical. In the future, the system can be enhanced with a mobile application for booking and tracking parking spaces online.

## References

- [1] das, s., & basu, t. "urban parking management challenges: a modern review." *International journal of urban studies*, 2020.
- [2] lin, t., et al. "modern smart parking systems: a comprehensive survey." *Sensors*, 2021.
- [3] shaikh, f., & pathan, a. "a review of smart parking models in developing cities." *Ijca*, 2020.
- [4] Kumar, R. (2025, October). Smart healthcare systems: A comprehensive review of smart health and well-being paradigms based on the Internet of Things and Big Data frameworks. *International Journal of Advanced Research Publications (IJARP)*, 1(1), 1–15. <https://www.ijarp.com>
- [5] patel, a., & karamta, m. "ir sensor-based slot monitoring system." *Irjet*, 2021.
- [6] kim, j., & lee, s. "lcd-based parking space indicator system." *Ijee*, 2022.
- [7] Kumar, R. (2025, August). IoT powered smart agriculture: Innovation in precision farming and sustainability. *International Journal of Engineering in Computer Science*, 7(2), 38–44. <https://doi.org/10.33545/26633582.2025.v7.i2a.197>
- [8] gupta, r., sharma, p., & tiwari, s. (2018). Arduino-based ultrasonic smart parking system.
- [9] patel, m., & kaur, h. (2019). Ir sensor-based vehicle detection for smart parking.
- [10] raut, s., & kale, p. (2019). Gsm-based parking availability notification system.
- [11] rahman, a., hussain, n., & sheikh, m. (2020). Iot-enabled parking system using arduino and wi-fi modules.
- [12] banerjee, a., & iqbal, m. (2020). Energy-efficient sensor networks for smart parking applications.
- [13] thomas, j., & varghese, l. (2022). Survey on urban smart parking models.
- [14] Kumar, R. (2025, July–August). Smart system, smarter world: A review of ML and DL innovation since 2018. *International Journal for Multidisciplinary Research*, 7(4). <https://doi.org/g9vpwt>
- [15] sinha, r., & mehta, a. (2021). Automated gate control using arduino.
- [16] choudhary, s., nair, r., & prasad, v. (2021). Rfid-enabled secure smart parking system.
- [17] fernandes, l., & pinto, d. (2022). Machine-learning-based slot occupancy prediction.
- [18] khan, a., & singh, r. (2020). Real-time slot monitoring in smart parking.