

## SMART VEHICLE PARKING TECHNOLOGY

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### ABSTRACT

Effective vehicle parking solutions are increasingly important in today's urban environments. This project introduces a Smart Vehicle Parking Technology that uses Arduino Uno, Infrared (IR) sensors, and an LCD display to monitor and show real-time parking availability. Designed as an affordable and scalable option, the system targets small to mid-sized parking facilities, avoiding reliance on high-end technologies like AI or IoT. Each parking slot includes a sensor that detects vehicle presence and sends the data to the Arduino Uno microcontroller. This data is then shown on a 20x4 LCD screen, allowing users to identify available parking slots instantly. The system aims to streamline parking access, reduce traffic congestion, save time, and improve urban parking efficiency. Additionally, it supports the vision of smarter cities and urban mobility by offering potential upgrades like multi-level parking integration and security-based access features for a complete smart infrastructure solution.

**Keywords:** Arduino Uno, IR sensors, LCD module, Urban infrastructure, Smart city.

### NOMENCLATURE

Symbol / Term	Description
IR	Infrared Sensor used for vehicle detection
LCD	Liquid Crystal Display used for real-time slot display
UNO	Arduino Uno microcontroller
I2C	Communication protocol for serial data transfer
HIGH	Sensor output indicating empty parking slot
LOW	Sensor output indicating occupied slot

### 1. INTRODUCTION

The rapid increase in vehicle ownership has placed significant pressure on existing parking infrastructure, especially in urban and semi-urban regions. Drivers often spend considerable time searching for vacant parking spaces, which not only leads to fuel wastage but also contributes to localized congestion and reduced roadway efficiency. Traditional parking systems, which rely on manual monitoring or visual inspection, are unable to provide real-time information and therefore fail to support efficient traffic flow within parking areas.

Advancements in embedded systems and low-cost sensors have opened new possibilities for automated parking management solutions. Integrating microcontrollers with proximity sensors and display modules enables continuous monitoring of slot occupancy and offers users immediate access to availability data. Such systems not only improve utilization of limited parking resources but also reduce the workload on human operators.

In this context, the present work aims to design and implement a smart vehicle parking system using IR sensors, an Arduino Uno microcontroller, and an LCD interface. The developed system focuses on reliability, low power consumption, and simplicity of installation, making it suitable for educational institutions, residential complexes, and small commercial facilities. By delivering accurate slot-status