# Chapter One: Introduction

## Introduction

In today's fast-paced world, finding a parking spot can be a significant challenge. With the increasing number of vehicles on the road, efficient parking management systems have become essential in urban areas and commercial complexes. The integration of computer technology and automated systems in parking management not only enhances convenience for users but also optimizes the utilization of available parking space.

This project focuses on developing an automated parking management system using Arduino boards and ultrasonic sensors. The system will detect the presence of cars in parking spots and display the status of these spots on an LCD screen. The use of microcontrollers like Arduino for such applications demonstrates the practical importance of computer technology in everyday life.

## Problem to be Solved

The system aims to address the following problems:

Difficulty in finding available parking spots quickly.

Inefficient utilization of parking spaces.

Lack of real-time information about parking spot availability.

Manual monitoring of parking lots, which is labor-intensive and prone to errors.

## Project Goals

The main objectives of this project are:

To automate the process of monitoring parking spot availability.

To provide real-time information on the occupancy status of parking spots.

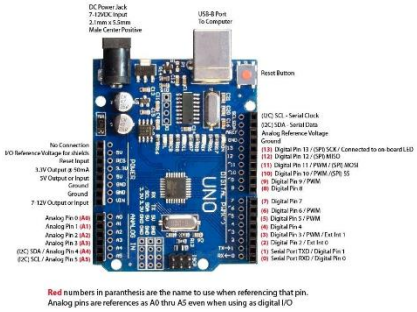
To reduce the time spent by drivers in searching for available parking spots.

To improve the efficiency of parking space utilization.

## Tools Used in the Project

The tools and components used in this project include:

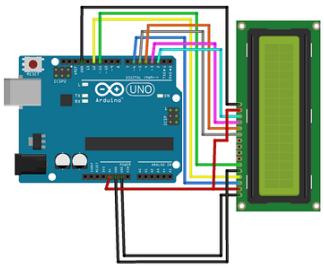
Arduino Uno Board




Jumper Wires Premium and Jumper Wires

LCD Screen

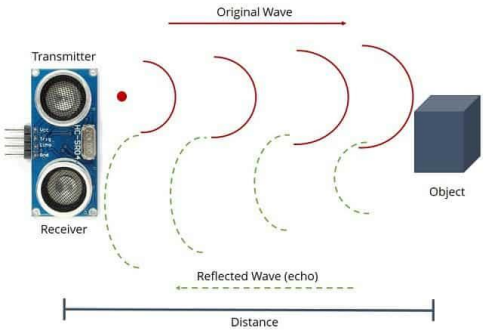
| LCD pins | Arduino uno pins |
|---|---|
| Vss | Gnd |
| Vdd | 5v |
| Vo | Digital pin 6 |
| Rs | Digital pin 12 |
| Rw | Gnd |
| E | Digital pin 11 |
| D4 | Digital pin 5 |
| D5 | Digital pin 4 |
| D6 | Digital pin 3 |
| D7 | Digital pin 2 |
| A | 5v |
| K | Gnd |



Rotary Potentiometer 250KΩ

Test Board Mini (Breadboard)

Ultrasonic Sensor HCSR04




The Arduino platform was chosen due to its widespread use, extensive support community, and ease of integration with various sensors and components.

# Chapter Two: Introductory and Detailed Studies

## Theoretical Background

The existing system for parking management in many areas is manual, where parking attendants monitor and direct vehicles to available spots. This system is inefficient and cannot provide real-time data on the availability of parking spaces. Automated systems using sensors and microcontrollers offer a more efficient and scalable solution.

## System Problems

The current manual system faces several issues:

Inaccuracy in detecting available spots.

High labor costs and potential for human error.

Delays in finding parking spots, leading to increased fuel consumption and emissions.

## Objectives of the New System

The new system aims to:

Accurately detect the presence of vehicles in parking spots.

Provide real-time updates on the status of parking spots.

Reduce the need for manual monitoring.

Enhance the overall efficiency of parking management.

## Feasibility Study and System Construction Plan

The feasibility study includes analyzing the cost, technical requirements, and potential benefits of implementing the system. The construction plan involves:

Designing the circuit and layout for the sensors and LCD.

Programming the Arduino boards for sensor data collection and communication.

Testing and refining the system to ensure reliability and accuracy.

# Chapter Three: Designing the System or Application

## System Architecture

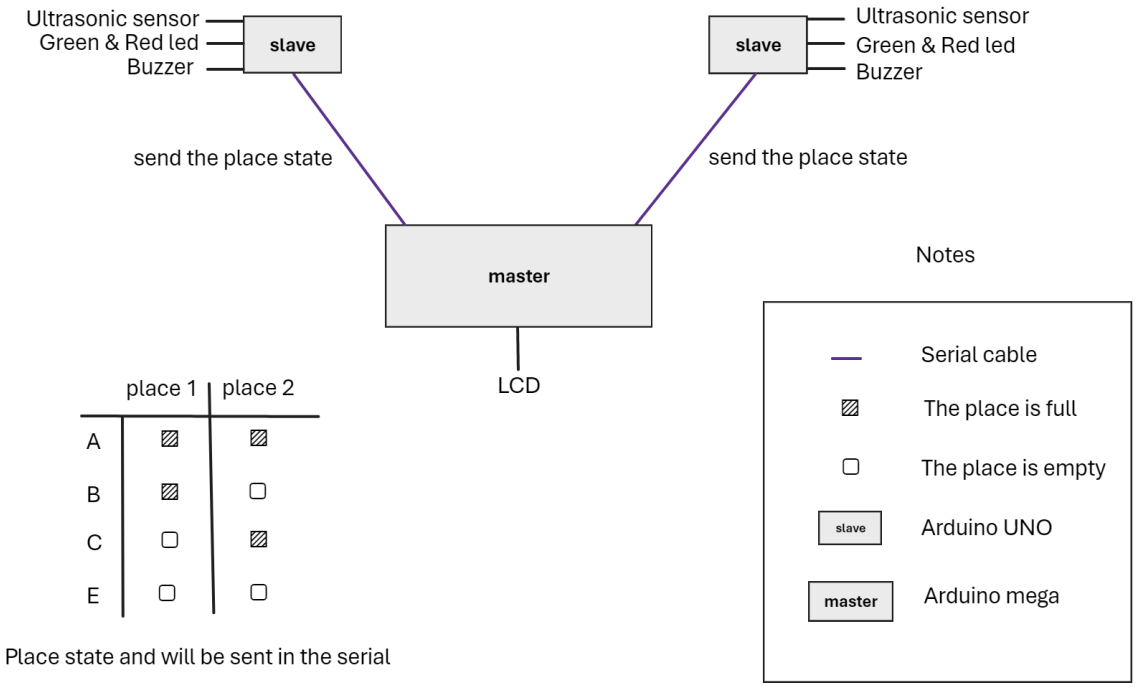
The system consists of three Arduino boards:

Master Arduino: Connected to the LCD to display parking status.

Slave Arduino 1: Connected to an ultrasonic sensor to monitor the first parking spot.

Slave Arduino 2: Connected to another ultrasonic sensor to monitor the second parking spot.

The master Arduino communicates with the slave Arduinos to receive data about the status of each parking spot and displays this information on the LCD.




## Designing Tables (Project Files)

The project files include the Arduino sketches (programs) for each board:

Master Arduino Sketch: Handles communication with slaves and updates the LCD.

Slave Arduino Sketches: Handle sensor data collection and communication with the master.

Design Procedures, Algorithms, and Schemes

## Procedures

Sensor Data Collection: Ultrasonic sensors measure the distance to detect the presence of a car.

Data Communication: Slave Arduinos send the status of their respective parking spots to the master Arduino.

Display Update: The master Arduino updates the LCD based on the received data.

Algorithms

Distance Measurement: Calculate the distance using the HCSR04 sensor and determine if a spot is occupied based on predefined thresholds.

Serial Communication: Send and receive data between master and slave Arduinos.

## Data Dictionary

distance: The measured distance from the ultrasonic sensor.

status: Boolean variable indicating if a parking spot is occupied (true) or empty (false).

message: The character sent from slaves to master representing the status of parking spots.

# Chapter Four: Implementing the System or Application

## System Configuration Settings

Connect the ultrasonic sensors to the respective slave Arduinos.

Connect the LCD to the master Arduino.

Configure the serial communication baud rate.

## System Screens

LCD Display

Screen Layout: The LCD displays a message indicating the status of the parking spots (A, B, C, E).

## System Reports

Real-time Status Report: Shows the status of all monitored parking spots.

Inquiries

Check Spot Status: Query the system to get the status of a specific parking spot.

# Chapter Five: Conclusions and Future Work

## Conclusions

The project successfully demonstrated an automated parking management system using Arduino and ultrasonic sensors.

Real-time monitoring and display of parking spot status were achieved, reducing the time needed for drivers to find available spots.

## Pros and Cons of the System

Pros:

- Accurate and real-time detection of parking spot status.
- Reduction in manual monitoring and associated labor costs.
- Easy to set up and scalable.

Cons:

- Limited to a small number of parking spots in the current setup.
- Reliant on sensor accuracy and proper placement.

Future Works:

- Expand the system to monitor more parking spots.
- Integrate with a mobile application for remote monitoring.