Chapter One: Introduction

Introduction

The integration of computer systems in everyday life has revolutionized the way we interact with our environment, making tasks more efficient and convenient. One such application is the development of smart parking systems, which aim to alleviate the common problems associated with parking in urban areas. This project focuses on creating a park assist system using an Arduino Uno board, which leverages sensors and indicators to aid drivers in parking efficiently and safely.

Smart parking systems are essential in modern urban environments where parking spaces are limited, and efficient management is crucial. The system we developed operates in real-world parking scenarios, where it provides real-time feedback to drivers, indicating the availability of parking spaces and alerting them to potential obstacles. This not only improves parking efficiency but also enhances safety and reduces the likelihood of accidents.

Problem to be Solved

The primary problems addressed by our park assist system include:

Difficulty in finding available parking spaces.

Inadequate feedback on the proximity of obstacles while parking.

Increased risk of minor collisions with curbs or other vehicles.

Inefficient use of available parking spaces.

Project Goals

The objectives of the project are as follows:

To develop a system that accurately detects the availability of parking spaces.

To provide real-time feedback to drivers on the distance to nearby obstacles.

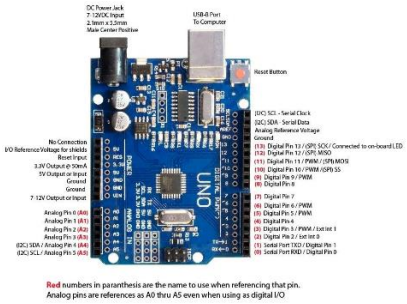
To enhance parking safety by warning drivers of potential collisions.

To utilize cost-effective and easily accessible components in building the system.

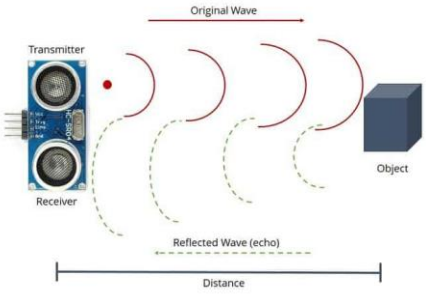
Tools Used in the Project

The tools and components used in this project include:

Arduino Uno Board



Ultrasonic Sensor



Jumper Wires and Resistors

Test Board Mini

Green and Red LEDs

Buzzer

IR Sensor: later replaced due to version limitations.

Chapter Two: Introductory and Detailed Studies

Theoretical Background of the Existing System

Smart parking systems utilize a variety of sensors and indicators to monitor parking spaces and provide feedback to drivers. These systems can range from simple sensor-based solutions to complex integrations with IoT (Internet of Things) platforms. Our project focuses on a sensor-based approach, using ultrasonic sensors to detect the presence and distance of a vehicle in a parking space.

System or Existing Application Problems

Limited accuracy in detecting vehicle presence using older IR sensors.

Ineffective distance measurement due to the analog-to-digital shift in IR sensors.

Insufficient feedback mechanisms for drivers.

High costs associated with advanced smart parking solutions.

Objectives of the New System

To implement a reliable distance measurement system using ultrasonic sensors.

To provide clear visual and auditory feedback to drivers.

To create a cost-effective solution suitable for small-scale implementations.

To enhance the overall user experience by simplifying the parking process.

Feasibility Study and System Construction Plan

Our feasibility study indicated that using ultrasonic sensors in conjunction with an Arduino Uno board would provide accurate distance measurements and allow for effective

feedback mechanisms.

The construction plan involved:

Setting up the Arduino Uno board and connecting the ultrasonic sensor.

Programming the Arduino to interpret sensor data and control the LEDs and buzzer.

Testing the system in various parking scenarios to ensure reliability.

Chapter Three: Designing the System

System Architecture

The system architecture consists of the following components:

Ultrasonic Sensor: Positioned at the front of the parking space to detect the distance to the vehicle.

Arduino Uno Board: Processes the sensor data and controls the LEDs and buzzer.

Green LED: Indicates that the parking space is available.

Red LED: Indicates that the parking space is occupied.

Buzzer: Provides an auditory warning when the vehicle is too close to an obstacle.

Component Function

Ultrasonic Sensor	Measures distance to the vehicle
Arduino Uno	Processes sensor data and controls outputs
Green LED	Indicates availability of the parking space
Red LED	Indicates the parking space is occupied
Buzzer	Warns the driver when too close to an obstacle

Design Procedures, Algorithms, and Schemes

Distance Measurement: The ultrasonic sensor sends out a pulse and measures the time it takes for the echo to return. This time is used to calculate the distance.

Status Indication:

If the distance > 14 cm: Green LED on its mean no car is parking.

If 3 cm < distance ≤ 14 cm: Red LED on and Red LED off, Buzzer on (frequency is 2000) it's means that the car is still parked.

If 2 cm < distance ≤ 3 cm: Red LED on its mean the car is parking.

If the distance <= 2 cm: Red LED on, Buzzer on (frequency is 1000) it's means that the car was about to hit the sidewalk.

Data Dictionary

Arduino Uno: A microcontroller board used for building digital devices and interactive objects.

Ultrasonic Sensor: A device that measures the distance to an object using ultrasonic waves.

LED: Light Emitting Diode, used as an indicator light.

Buzzer: An electronic device that emits a sound for alerts.

Chapter Four: Implementing the System

System Configuration Settings

Arduino Setup: Connect the ultrasonic sensor, LEDs, and buzzer to the Arduino Uno.

Sensor Calibration: Ensure the ultrasonic sensor is correctly positioned and calibrated for accurate measurements.

System Screens

Distance Display: Real-time distance readings from the ultrasonic sensor.

LED Indicators: Visual representation of the parking space status.

Buzzer Alert: Auditory warning when the vehicle is too close to an obstacle.

Chapter Five: Conclusions and Future Work

Conclusions

Our park assist system successfully addresses the key issues associated with parking in urban areas. It provides real-time feedback to drivers, improving both efficiency and safety. The use of ultrasonic sensors proved effective in accurately measuring distances and providing timely alerts.

Pros and Cons of the System

Pros:

Accurate distance measurement.

Clear visual and auditory feedback.

Cost-effective and easy to implement.

Cons:

Limited to small-scale implementations.

Potential sensor interference in crowded environments.

Future Works

Integrate the system with a mobile application for remote monitoring of parking spaces.

Enhance the system to support multiple sensors for more comprehensive coverage.

Explore the use of IoT platforms to create a networked smart parking solution.