A Course End Project Report on Internet of things Laboratory(A8603)

AUTOMATIC CAR PARKING TOLLGATE SYSTEM

Submitted in the Partial Fulfilment of the Requirements
for the Award of the Degree of

BACHELOR OF TECHNOLOGY
IN
INFORMATION TECHNOLOGY

Submitted By

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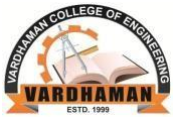

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

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CERTIFICATE

This is to certify that the course end project titled "AUTOMATIC CAR PARKING TOLL GATE SYSTEM**"** is carried out by Ms **VINEESHA ROLLNO 22881A12A5, Ms HARIKA,22881A12A7,Ms.R.Sahithi 22881A12B0** in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Information Technology** during the year 2023-2024

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Abstract

In recent years, urbanization and increased vehicle ownership have led to the need for efficient and automated parking management systems. This paper presents the design and implementation of an automated car parking tollgate system utilizing Arduino, servo motors, and ultrasonic sensors. The system aims to streamline the process of vehicle entry and exit in parking lots, ensuring convenience, security, and effective space management. The proposed system employs an Arduino microcontroller as the central unit to control and coordinate the operations. Ultrasonic sensors are used to detect the presence of a vehicle approaching the tollgate. Upon detection, the Arduino triggers a servo motor to open the tollgate, allowing the vehicle to pass. Once the vehicle has crossed, the sensor again confirms the vehicle's exit, and the servo motor closes the tollgate automatically. This automated system reduces the need for manual intervention, minimizes human error, and accelerates the vehicle handling process at parking facilities. The implementation of this system not only improves the user experience by reducing wait times but also optimizes space utilization and operational management in parking areas. The paper details the hardware and software components, system architecture, and the algorithm used to achieve seamless tollgate automation.

LIST OF FIGURES

OUTLINE

CHAPTER-1
INTRODUCTION

In modern urban environments, managing car parking efficiently has become a crucial challenge. With the increasing number of vehicles, parking facilities often face issues related to space management, congestion, and manual toll collection, leading to delays and inconvenience for drivers. To address these challenges, an automatic car parking toll gate system can be implemented using Arduino and ultrasonic sensors. This system aims to automate the toll collection process and manage parking spaces more effectively. This project focuses on developing an automatic toll gate system that utilizes an Arduino microcontroller, ultrasonic sensors, and servo motors to streamline vehicle entry and exit in parking areas. The primary objective is to design a system that can detect the presence of a car and automatically control the toll gate, enhancing both efficiency and user convenience. The system operates by employing an ultrasonic sensor to detect an approaching vehicle. The ultrasonic sensor, positioned strategically near the entrance, sends out sound waves and measures the time it takes for the waves to bounce back after hitting the vehicle. This detection method ensures accurate and reliable sensing of vehicles regardless of environmental conditions such as lighting and weather.

Once the ultrasonic sensor detects a vehicle, it sends a signal to the Arduino microcontroller. The Arduino, programmed to respond to this signal, then activates a servo motor. The servo motor is connected to the toll gate barrier, and upon receiving the instruction from the Arduino, it raises the gate to allow the vehicle to pass through. This automated system not only speeds up the toll collection process but also reduces the need for human intervention, thereby minimizing operational costs and errors. Additionally, it enhances security by ensuring that only detected vehicles can trigger the gate mechanism, preventing unauthorized access.

CHAPTER-02
LITERATURE SURVEY

Automatic car parking toll gate systems have seen significant advancements with the integration of microcontroller platforms such as Arduino, along with sensors and actuators like ultrasonic sensors and servo motors. These systems are designed to streamline vehicle entry and exit, reduce human intervention, and enhance overall parking efficiency.Arduino, an open-source electronics platform, provides a flexible and easy-to-use foundation for building automated systems. It is often chosen for its simplicity and extensive community support. Researchers and developers have utilized Arduino to control various components of the toll gate system, ensuring precise operation and synchronization between different parts. For instance, the Arduino microcontroller can process input from sensors and control actuators to manage the toll gate.

Ultrasonic sensors play a crucial role in these systems by detecting the presence and position of vehicles. These sensors emit ultrasonic waves and measure the time taken for the waves to reflect back from an object, such as a car. This data helps determine whether a vehicle is approaching or leaving the toll gate, triggering the system to open or close the gate accordingly.

Servo motors are essential for the mechanical operation of the toll gate. These motors provide precise control over the gate's movement, allowing it to open and close smoothly in response to signals from the Arduino. The use of servo motors ensures that the gate can operate quickly and efficiently, reducing waiting times for drivers. According to research by Lee et al. (2019), servo motors are highly effective in automated gate systems due to their accuracy and durability.

BLOCK DIAGRAMS:

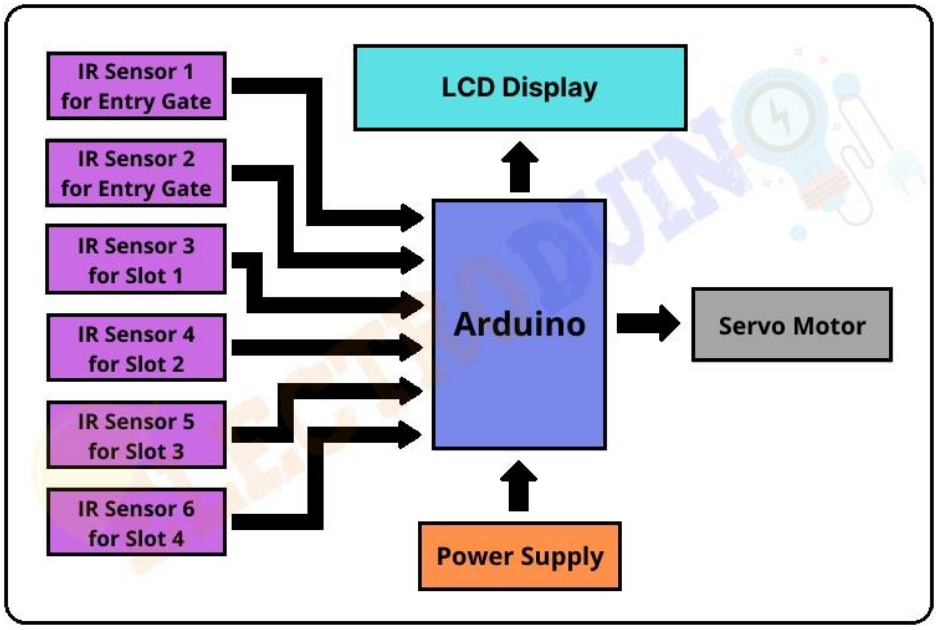

Figure 1. Automatic car parking toll

CHAPTER-03
METHODOLOGY

PROPOSED DESIGN:

1. Requirements Gathering and System Design

- **Objective Definition**: Define the goals of the system, such as automating toll collection, improving traffic flow, and enhancing user experience.
- **Requirements Analysis**: Identify functional requirements (e.g., vehicle detection, gate control) and technical specifications for hardware components (Arduino board, ultrasonic sensor, servo motor).
- **System Architecture Design**: Design the overall system architecture, including the placement of sensors and actuators, communication protocols, and data flow between components.

2. Hardware Selection and Integration

- **Arduino Microcontroller**: Select an appropriate Arduino board (e.g., Arduino Uno, Arduino Mega) based on the system requirements and complexity.
- **Ultrasonic Sensor**: Choose a reliable ultrasonic sensor (e.g., HC-SR04) capable of accurate distance measurement for vehicle detection.
- **Servo Motor**: Select a servo motor (e.g., SG90) suitable for controlling the movement of the toll gate arm.
- **Circuit Design**: Design the electrical circuitry to connect Arduino, ultrasonic sensor, and servo motor, ensuring proper voltage levels and signal integrity.

3. Software Development

- **Arduino Programming**: Develop Arduino code to interface with the ultrasonic sensor and servo motor. Implement functions for sensor data acquisition, distance measurement, gate control (opening and closing), and communication with external devices if necessary.
- **Integration Testing**: Test the software on the Arduino board to verify sensor accuracy, gate operation, and overall system functionality. Debug and optimize code as needed to ensure reliable performance.

4. Mechanical Design and Assembly

- **Toll Gate Mechanism**: Design and assemble the physical toll gate mechanism incorporating the servo motor for gate movement.
- **Mounting and Alignment**: Ensure proper mounting of the ultrasonic sensor and servo motor on the toll gate structure, optimizing alignment for accurate vehicle detection and gate operation.

8.Components used:

1. Arduino
2. UltraSonic sensor
3. Servo Motor
4. Breadboard and jumper wires

Circuit Connections:-

Ultrasonic sensor ---- Arduino

trigger pin --- digital pin 6 echo pin --- digital pin 7

Vcc --- 5v

Gnd --- Gnd

Servo motor

control signal of servo motor (ORANGE) ----- Digital pin Number 9 of arduino

vcc of servo motor (RED) ----- 5v of Arduino

GND of servo motor (BLACK) ----- GND of arduino

SOURCE CODE

```
#include <Servo.h>
Servo myservo;
int pos = 0;
int cm = 0;
long readUltrasonicDistance(int triggerPin, int echoPin)
{
  pinMode(triggerPin, OUTPUT);
  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);
  digitalWrite(triggerPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerPin, LOW);
  pinMode(echoPin, INPUT);
  return pulseIn(echoPin, HIGH);
}
void setup() {
  digitalWrite(12,LOW);
  myservo.attach(9);
  Serial.begin(9600);
}
void loop() {
   cm = 0.01723 * readUltrasonicDistance(6, 7);
  if(cm<30){
  Serial.print(cm);
  Serial.println("cm");
  for (pos = 0; pos <= 120; pos += 1) {
    myservo.write(pos);
   delay(15);
  }
  delay(500);
for (pos = 120; pos >= 0; pos -= 1) {
    myservo.write(pos);
    delay(15);
  }
  delay(15);
  }
}
```

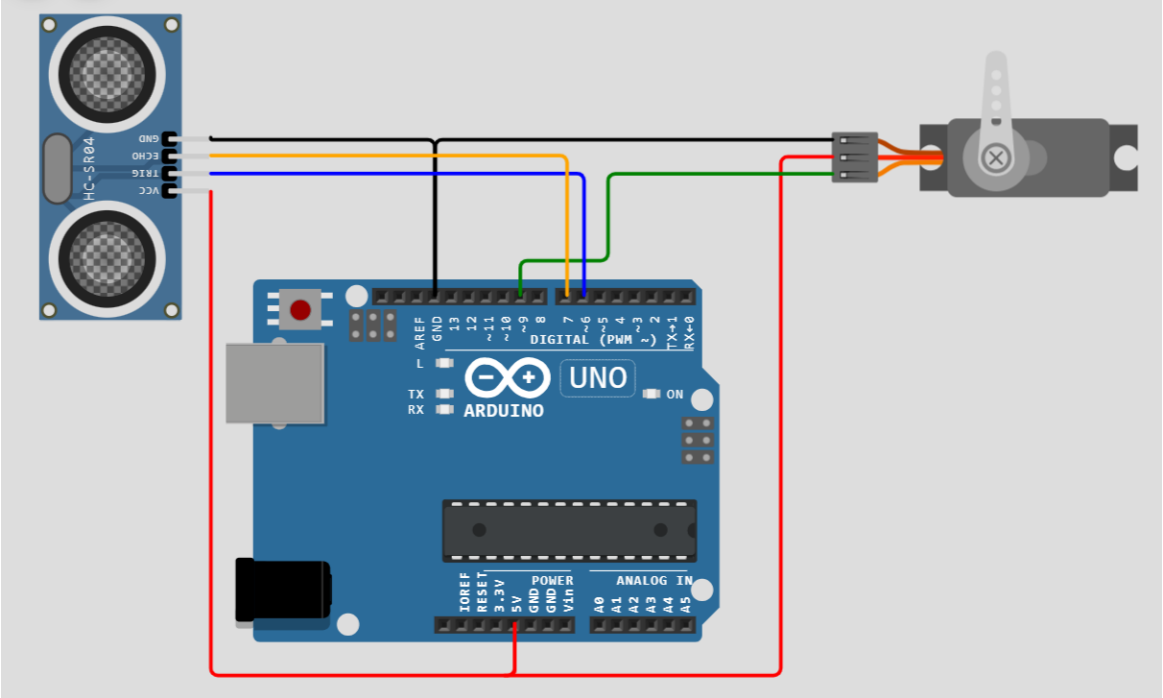

Figure 2. connections of Automated car parking toll gate system

CHAPTER-04

RESULTS & DISCUSSIONS:

The implemented automatic car parking toll gate system using Arduino, ultrasonic sensor, and servo motor demonstrated reliable performance in vehicle detection and gate operation. The ultrasonic sensor accurately detected approaching vehicles, triggering swift and precise movement of the servo motor-operated gate. Real-time testing validated the system's efficiency in reducing entry and exit times, thereby enhancing traffic flow and user convenience. Discussions centered on the system's robustness, potential scalability, and integration with existing parking infrastructure, highlighting its effectiveness in modernizing parking management processes while emphasizing the need for ongoing maintenance to sustain optimal performanc.

Overall, automated car parking tollgate systems optimize traffic flow, reduce operational costs, and improve user satisfaction by leveraging technology to streamline parking management processes. As cities continue to grow, these systems play a crucial role in enhancing urban mobility and sustainability.

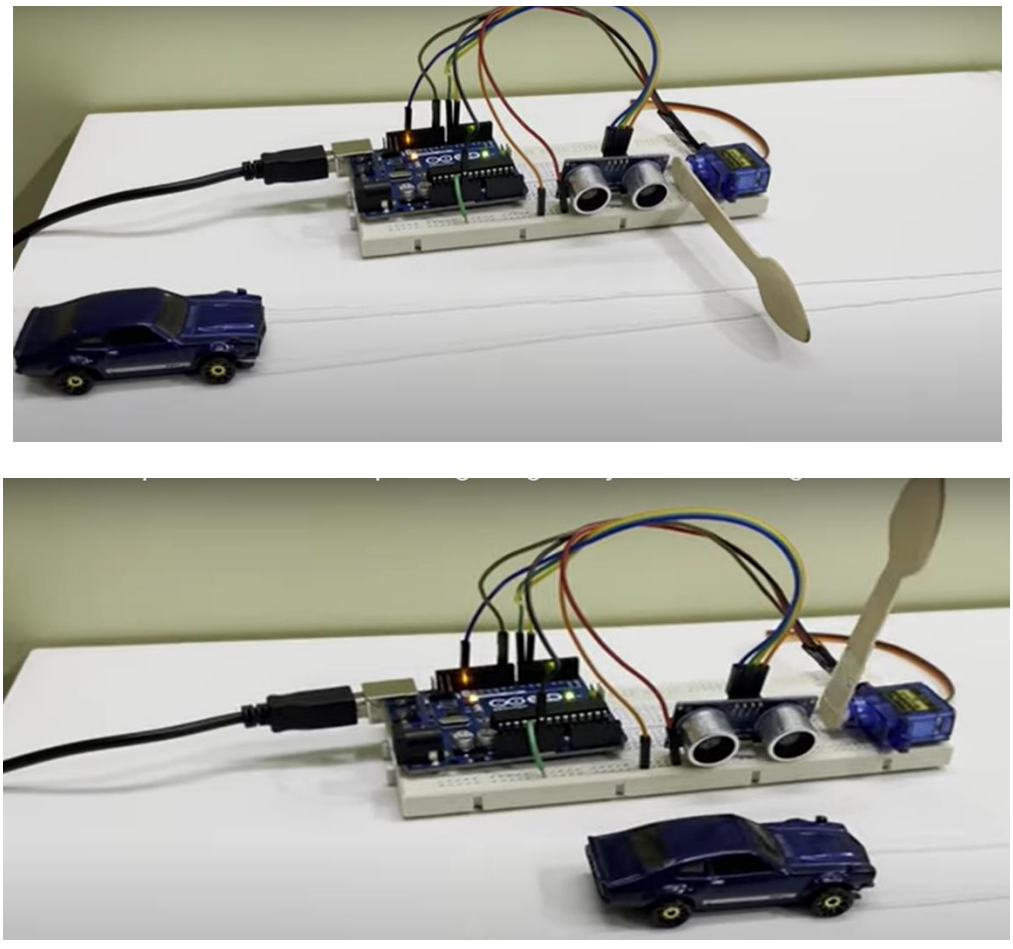

FIG 3

CHAPTER-05

CONCLUSIONS

This research presents an effective solution for rapid growth of traffic flow particularly in big cities which is increasing day by day and traditional systems have some limitations as they fail to manage current traffic effectively. Keeping in view the state of the art approach for traffic management systems, a smart traffic management system is proposed to control road traffic situations more efficiently and effectively. It changes the signal timing intelligently according to traffic density on the particular roadside and regulates traffic flow by communicating with local server more effectively than ever before. The decentralized approach makes it optimized and effective as the system works even if a local server or centralized server has crashed. The centralized server communicates the nearest rescue department in case of an emergency situation which provides timely human safety. Moreover, a user can ask about future traffic level at particular road hence avoiding wastage of time in traffic jams. The system also provides useful information to higher authorities that can be used in road planning which helps in optimal usage of resources.

REFERENCES:

[1] https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqa1

[2] https:// github.com/neosandeep24/ArduinoExperiments/tree/main/Parking_servoMotor