GE 107

SMART REVERSE PARKING ASSISTANT

WITH ULTRASONIC AND INFRARED SENSOR INTEGRATION

INTRODUCTION :

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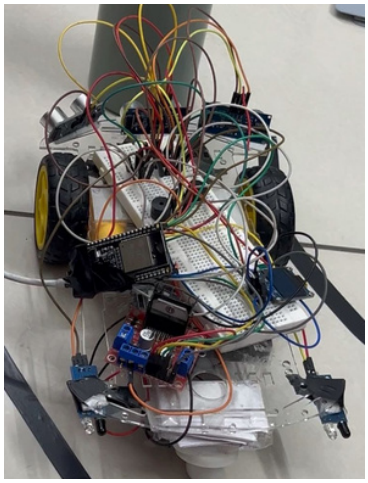


As cities grow and the number of vehicles continues to rise, finding a safe and convenient parking spot is becoming increasingly difficult. To help address this everyday challenge, we've developed a **Smart Car Parking Assistant System** — a compact, intelligent solution that helps guide vehicles during parking and avoids collisions.

Our system is powered by an **ESP32 WROOM microcontroller** and combines multiple sensors and components to make parking smoother and safer. It uses:

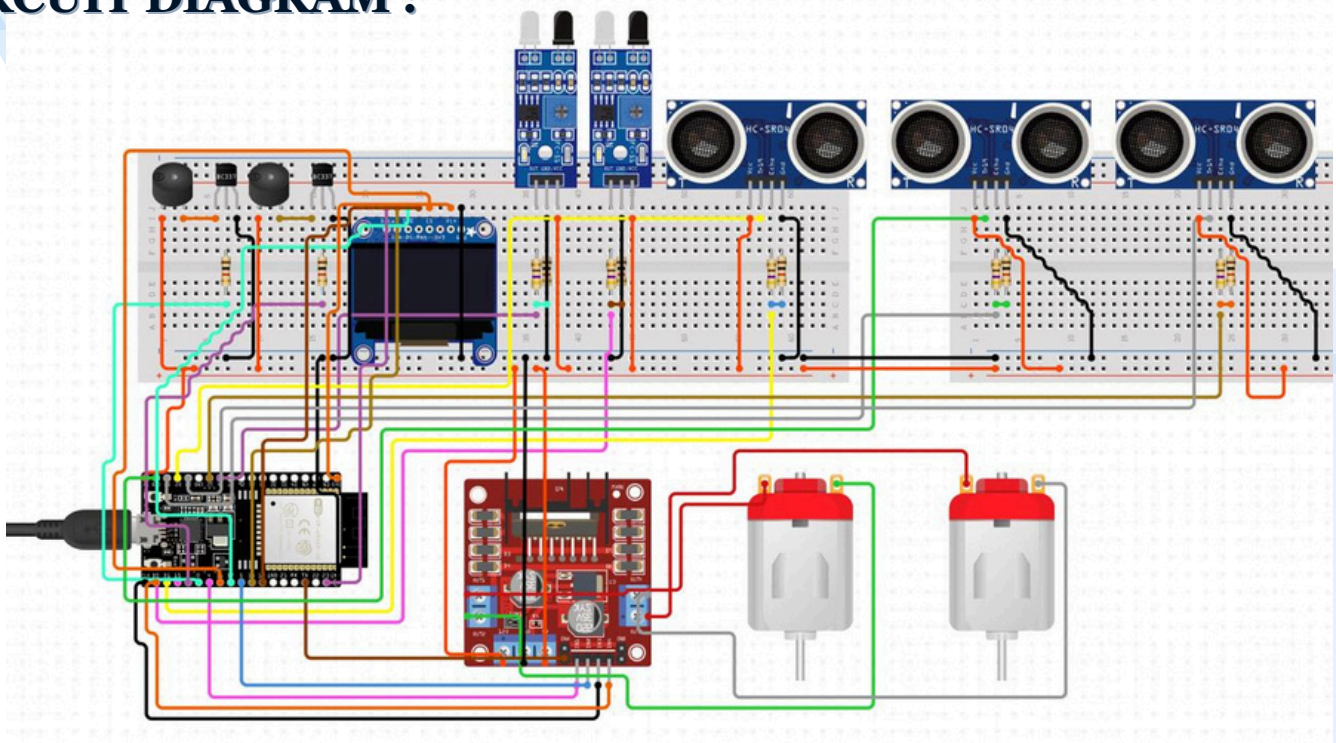
- **Three ultrasonic sensors** (HC-SR04) to measure distances from nearby objects,
- **Two IR sensors** to detect obstacles,
- An **L298N motor driver** to control BO motors for simulating vehicle movement,
- An **OLED display** to show real-time distance readings,
- And a **buzzer** that gives alerts when the car gets too close to something.

With this setup, the system continuously scans the surroundings and provides helpful visual and audio feedback, making parking more precise and less stressful. It's a simple step toward smarter urban mobility.

COMPONENTS USED:

Component	Quantity	Description
ESP32 WROOM Microcontroller	1	Central control unit with Wi-Fi/Bluetooth capabilities
HC-SR04 Ultrasonic Sensor	3	For front, left, and right distance measurements
IR Sensor Module	2	Detects presence of car in the parking zone
L298N Motor Driver	1	Controls the BO motors
BO Motors with Wheels	2	Simulates car movement
OLED Display (SPI)	1	Displays distances and parking feedback
Buzzer	1	Sound alert for obstacle proximity
Resistors (1kΩ and others)	As required	Used with sensors and buzzer
Breadboard/PCB	1	For prototyping and assembling components

CIRCUIT DIAGRAM :



CHALLENGES FACED :

- **ESP32 Pin Conflicts:**
  - Issue: The ESP32 has limited usable GPIOs, many of which are reserved or have special functions. With multiple components like ultrasonic sensors, IR sensors, motors, OLED, and buzzer, available pins run out quickly.
  - Solution: We used the breadboard effectively to combine functionality of multiple sensors together and then connected it to the ESP32.
- **Wiring Complexity**
  - Issue*:* Tangled circuit with risk of miswiring.
  - Solution: Carefully handled the wires and each connection was made one at a time to make sure they were correct and accurate.
- **Sensors not Working**
  - Issue: Since we used 5 sensors (3 ultrasonic and 2 infrared) and an OLED screen, there were multiple components that were not in working condition.
  - Solution: Each component was tested individually using the ESP32 to check if they were in working condition and we got them changed in case they were not.
- **Use of IR Sensor:**
  - Issue: Due to the sudden blackout situation, we couldn't implement the IR-based parking system as planned.
  - Solution: We used the IR sensors for a basic line-following feature to demonstrate the robot’s functionality.

CONCLUSION :

This project presents a reverse car parking system assistant that utilizes three ultrasonic sensors, two IR sensors, an OLED display, and a buzzer to assist drivers in parking. The system effectively detects obstacles and provides real-time feedback.

By integrating these components with the ESP32 microcontroller, the project demonstrates a practical application of sensor fusion and basic automation. It serves as a valuable learning experience in embedded systems, sensor integration, and user interface design.

Future improvements, such as wireless control or more advanced sensors, could further enhance the system’s capabilities and user experience. Overall, this project showcases a cost-effective solution with significant potential for real-world applications in vehicle parking assistance.