RC–CAR

Exploring the Dynamics and Innovations of Remote-Controlled Vehicles

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Introduction

What is a RC-CAR?

The RC-Car Embedded System Project is a small-scale remote-controlled car utilizing the ATmega32 microcontroller. This project integrates essential principles of electronics, programming, and mechanical design to create a functional prototype capable of wireless operation via a mobile app. The car incorporates core components such as DC motors, a motor driver, a Bluetooth module (HC-05), an ultrasonic sensor for obstacle detection, and a power supply to facilitate controlled movement and communication.

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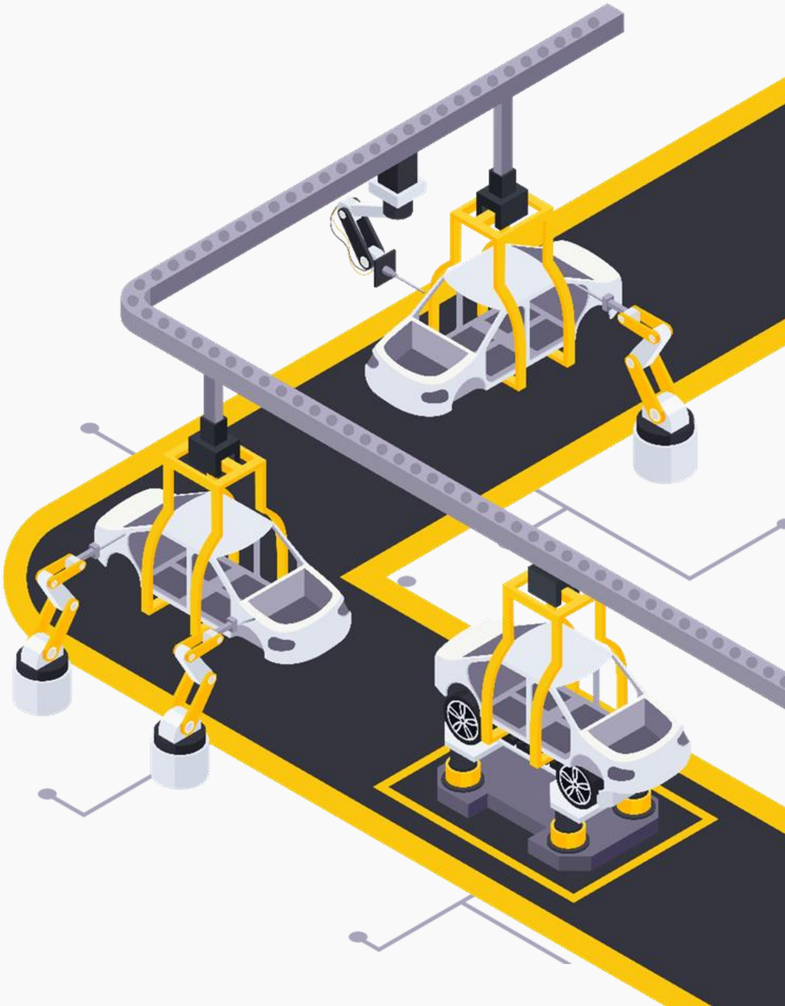
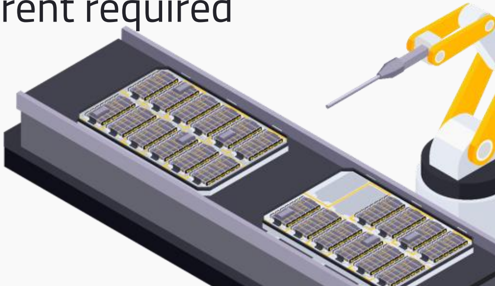
System Architecture



System Architecture

- ❑ **ATmega32 Microcontroller:** The core of the RC-Car system, responsible for processing inputs and controlling outputs. It handles the commands received via Bluetooth and drives the motors accordingly.
- ❑ **Motors and Car Body:** Two DC motors are used to drive the car, providing the necessary motion and speed control. A lightweight and sturdy chassis that houses all the components, ensuring stability and maneuverability.
- ❑ **Motor Driver (L298N):** An H-bridge motor driver used to control the direction and speed of the two motors. It acts as an interface between the ATmega32 and the motors, allowing the microcontroller to handle the high current required by the motors.



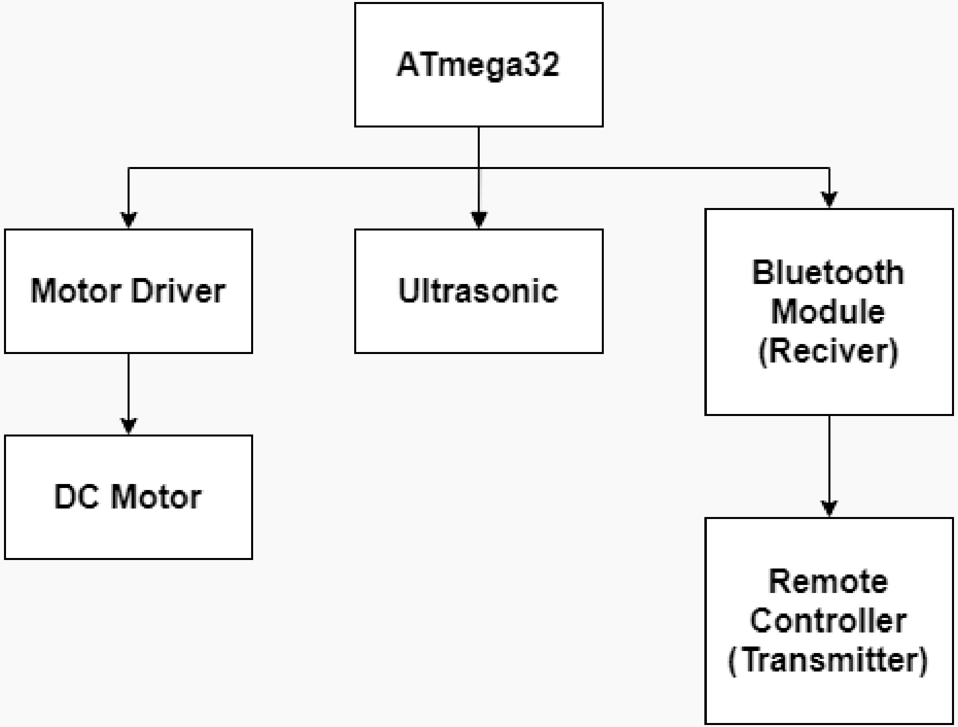
System Architecture

- **Bluetooth Module (HC-06):** A Bluetooth module that facilitates wireless communication between the microcontroller and a mobile app. It receives control commands from the mobile app and sends them to the ATmega32.
- **Mobile App:** An application on a smartphone used to send commands to the HC-06 Bluetooth module. The app provides a user-friendly interface to control the car’s movements remotely.

System Architecture

- ❑ **Ultrasonic Sensor:** Detects obstacles in the car's path and provides distance measurements to the microcontroller. Utilizes Timer1 as an Input Capture Unit (ICU) for precise measurement of echo signals, enabling accurate obstacle detection and avoidance.
- ❑ **Power Supply:** A suitable power source that supplies the required voltage and current to all components, ensuring stable operation of the microcontroller, motors, and other peripherals.

System Architecture



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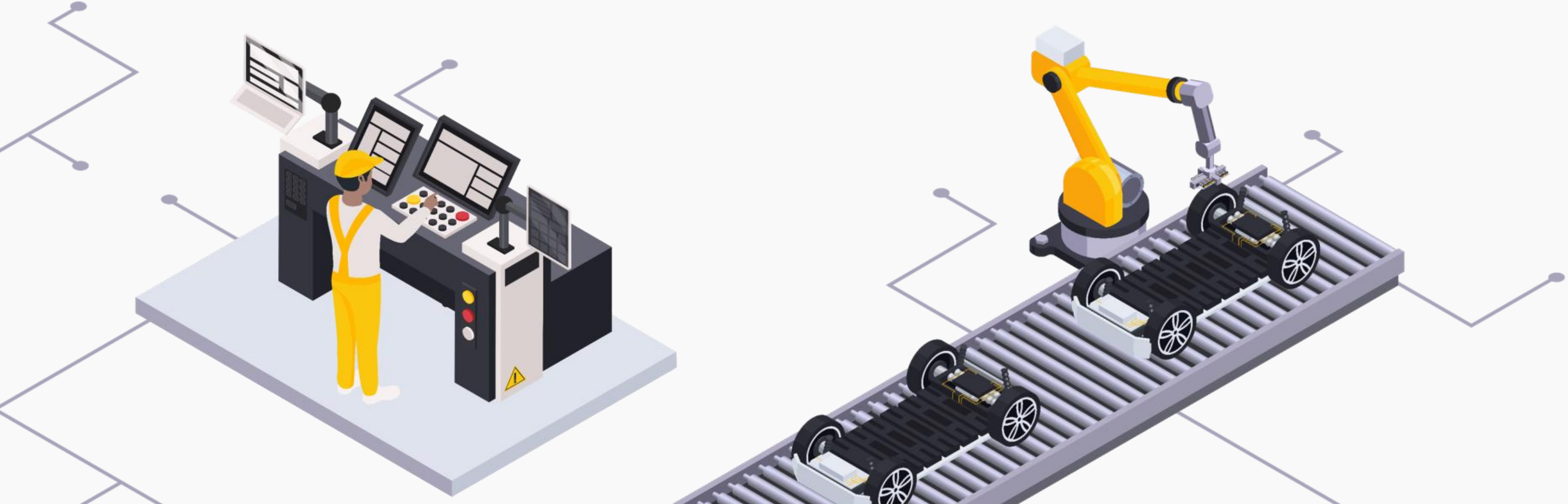
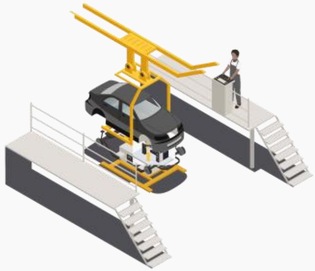
Design and Development



Design and Development

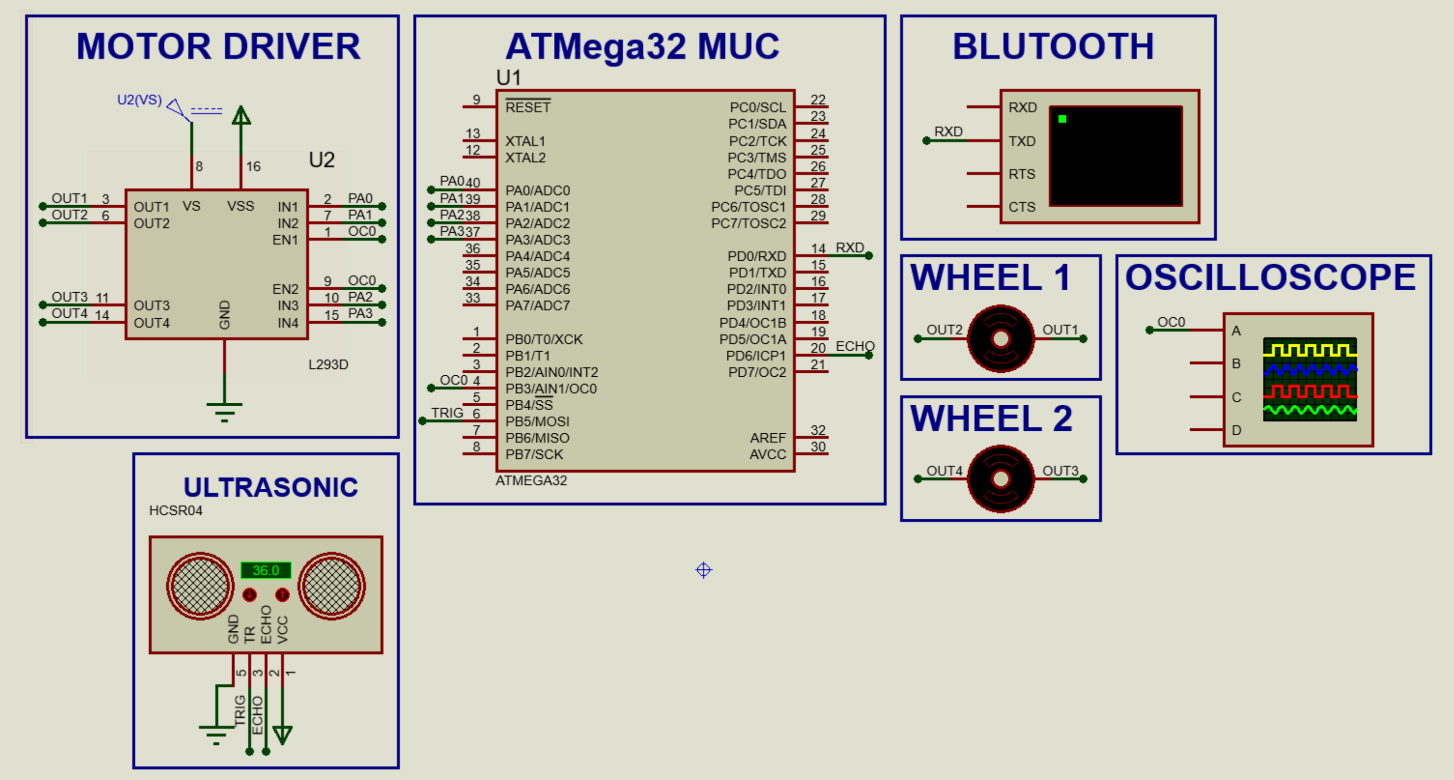


- **Microcontroller Connections:** The ATmega32 microcontroller is connected to the HC-06 Bluetooth module, L298N motor driver, and power supply. Specific pins are used for communication and control:
  - Bluetooth Module (HC-06): Connected via UART pins (TX and RX) on the ATmega32.
  - Motor Driver (L298N): Connected via digital output pins to control the motors' speed and direction.
  - Power Supply: Proper voltage regulation is ensured for the microcontroller and peripherals.
  - Ultrasonic (HC_SR04): Connected via ICU pins (ICP1) and Trigger pin on the ATmega32.

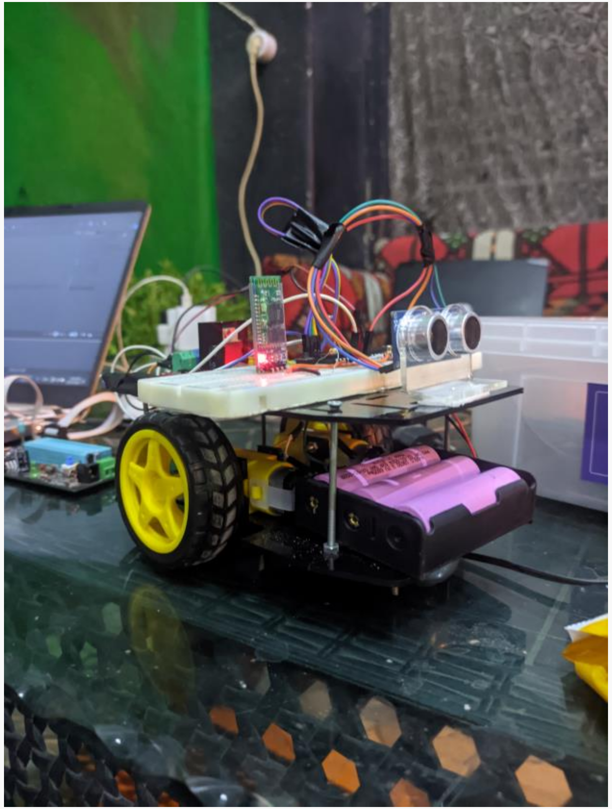
Design and Development

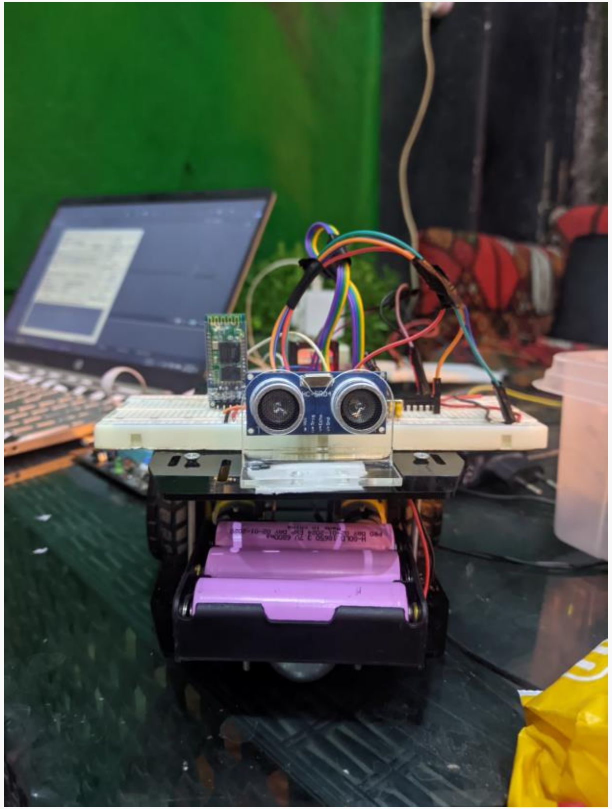
- ❑ **Motor Connections:** The motors are connected to the L298N motor driver, which in turn is connected to the ATmega32 for control signals and the power supply for driving power.
- ❑ **Circuit Diagram:** A detailed circuit diagram shows the connections between the microcontroller, motor driver, Bluetooth module, motors, and power supply. This diagram includes all necessary resistors, capacitors, and other passive components for stable operation.

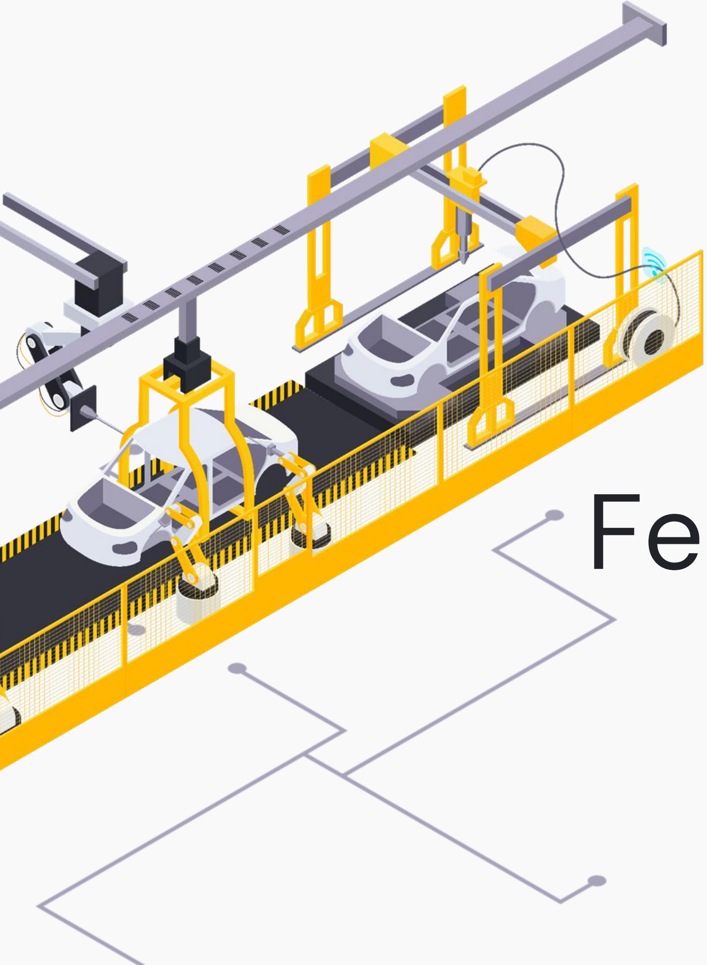
Circuit Diagram



Hardware Circuit







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Features and Functionality

Features and Functionality

Remote Control Mechanism (Bluetooth Communication)

- ❑ The RC car is controlled remotely via a mobile app using the HC-06 Bluetooth module. The app sends commands to the Bluetooth module, which are then relayed to the ATmega32 microcontroller.
- ❑ Control Interface: The mobile app provides an intuitive interface, typically including buttons, allowing the user to send commands for forward, backward, left, right, stop movements and speed control.

Features and Functionality

Motor Control (Speed and Direction Control)

- The ATmega32 microcontroller sends signals to the L298N motor driver based on the received commands. The motor driver then adjusts the speed and direction of the two DC motors.
- PWM (Pulse-Width Modulation): PWM is used to precisely control the speed of the motors. By adjusting the duty cycle of the PWM signal, the microcontroller can increase or decrease the motor speed as needed.

Features and Functionality

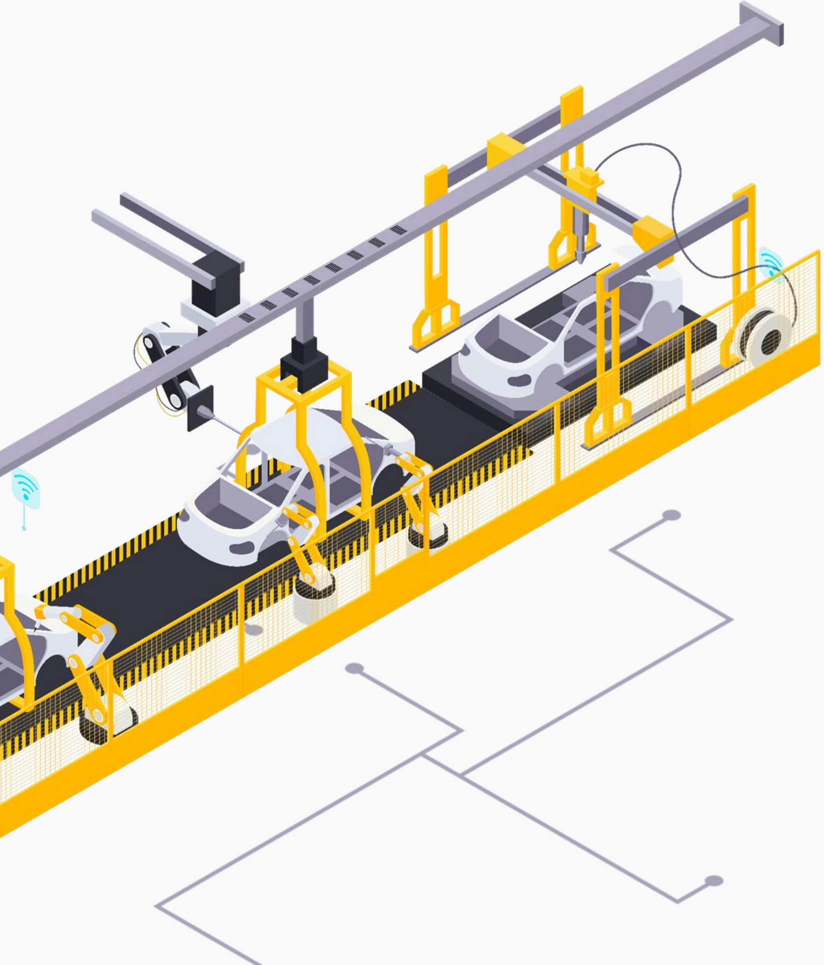
Basic Automation (Obstacle Detection)

- ❑ The ATmega32 microcontroller sends signals to the L298N motor driver based on the received commands. The motor driver then adjusts the speed and direction of the two DC motors.
- ❑ PWM (Pulse-Width Modulation): PWM is used to precisely control the speed of the motors. By adjusting the duty cycle of the PWM signal, the microcontroller can increase or decrease the motor speed as needed.

Features and Functionality

Communication Protocols (UART Communication)

- ❑ Basic sensors (ultrasonic sensors) can be integrated to enable simple obstacle detection. When an obstacle is detected, the microcontroller can override user commands to prevent collisions.
- ❑ Avoidance Mechanism: The microcontroller processes sensor data to make decisions, such as stopping or changing direction when an obstacle is detected..



Thanks!

Do you have any questions?