MPCA MINI PROJECT

Human-Following Robot

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Introduction

This project focuses on building an Arduino-based robot designed to follow a human target while navigating its environment. By integrating multiple sensors, the robot can detect obstacles, follow lines or IR cues, and maintain safe operation. The design leverages a Motor Driver Shield and TT gear motors for movement, while sensors provide the data needed for autonomous navigation. The structure is built using an acrylic chassis, and power is supplied via 18650 Li-ion batteries. The project not only demonstrates key concepts in robotics and embedded systems but also serves as a versatile platform for further enhancements and experiments.

Sensors Used & Their Details

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To ensure robust sensing for autonomous navigation and target tracking, the project employs the following sensor units:

1. **Ultrasonic Sensor (HC-SR04)**
    - **Purpose:** Measures distance to obstacles using ultrasonic waves, providing real-time data for collision avoidance and safe navigation.
    - **Key Features:**
        - Emits and receives ultrasonic pulses to calculate distance
        - Offers reliable short-range measurements
        - Critical for dynamic obstacle detection
2. **Infrared Sensor (IR Sensor) – Two Units**
    - **Purpose:** These sensors can be used for tasks such as line following, edge detection, or sensing IR signals (if an IR emitter is used by the target).
    - **Key Features:**
        - Each sensor detects infrared light intensity
        - When deployed in a pair (left and right), they help the robot maintain alignment and detect surface variations
        - Enhance the robot's ability to interpret environmental cues

Collectively, these three sensor units (one ultrasonic + two infrared) meet the minimum requirement while providing complementary data to guide the robot's movements.

Estimated Cost of the Project

Below is an approximate cost breakdown based on the provided parts list (sourced from Banggood, Amazon.in, and Flyrobo.in):

Component	Estimated Cost (₹)
Arduino Uno	600

Motor Driver Shield	250
Wheels (4×)	200
TT Gear Motors (4×)	400
Servo Motor	200
Ultrasonic Sensor (HC-SR04)	150
Infrared Sensors (2×)	100 (₹50 each)
18650 Li-ion Batteries (2×)	200
18650 Battery Holder	50
Male & Female Jumper Wires	50
Acrylic Sheet (for chassis)	100
DC Power Switch	50
Total Estimated Cost	**~₹2350**

Applications:

The Arduino Human-Following Robot can offer several practical applications in everyday settings:

1. **Personal Assistance and Mobility Support**

- **Assistance for the Elderly or Disabled:** The robot can help by following a person around the home, carrying small items or providing reminders, making daily tasks easier.
- **Hands-Free Convenience:** It can transport essentials like groceries or personal belongings, reducing the need for repetitive trips around the house.

2. **Home Security and Surveillance**

   - **Mobile Patrol:** The robot can serve as an autonomous security unit, following the designated path and monitoring the environment for unusual activities or intrusions.
   - **Real-Time Alerts:** By integrating with simple sensors, it can alert homeowners to obstacles or unexpected movements, enhancing overall home safety.

3. **Interactive Companion**

   - **Smart Home Integration:** Acting as a mobile assistant, the robot can interact with smart devices, help with navigation through the house, and even provide information or entertainment upon command.
   - **Educational Tool:** It serves as a hands-on platform for teaching robotics and programming concepts to students, inspiring innovation and practical learning.

4. **Retail and Service Applications**

   - **Customer Assistance:** In small retail environments, the robot can guide customers to specific sections or help transport products from storage to the sales area.
   - **Service Delivery:** For tasks like serving food or carrying light loads in cafes and small offices, this robot can enhance operational efficiency and customer experience.