A

Study Report

On

“HUMAN FOLLOWING ROBOT”

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Abstract

The Human Following Robot project involves developing a robot capable of autonomously tracking and following a human being. This project uses various hardware components such as the Arduino UNO board, Driver Shield, TT Gear Motors with Tyre, Ultrasonic Sensor for Move Forward and Backward, IR Sensors to turn right or left, and a Servo Motor to help control the direction of the IR Sensor. The robot is designed to move around human beings and obstacles while following a human being, making it suitable for security, surveillance, and entertainment applications. This report provides an overview of the project scope and the hardware components used in its development. The report also acknowledges the contributions of the professor, classmates, and resources that helped in the successful completion of this project.

HUMAN FOLLOWING ROBOT

OVERVIEW

1. Project Background and Description

The Human Following Robot project involves developing a robot capable of autonomously tracking and following a human being. The project aims to develop a robot that can navigate through its environment while avoiding obstacles and following a human being naturally and intuitively. This project is designed to demonstrate the capabilities of robotics technology and its potential applications in various fields such as security, surveillance, and entertainment.

2. Project Scope

The project scope includes the development of a robot that is capable of autonomously tracking and following a human being. The robot should be able to navigate through its environment and avoid obstacles while following the human being naturally and intuitively. The robot should also be able to detect the direction in which it needs to turn using IR sensors and a servo motor, which should help it turn right or left. The robot should be powered by a rechargeable battery and controlled using an Arduino UNO board, a driver shield, and other hardware components.

3. Components Required

The following are the components required for the development of a Human Following Robot:

1. Arduino UNO Board
2. Motor Driver Shield
3. TT Gear Motors with Tyre
4. Ultrasonic Sensor for Move Forward and Backward
5. IR Sensors to turn right or left
6. Servo Motor to help control the direction of the IR Sensor
7. Chassis
8. Battery

4. Implementation

The implementation of the project involves the integration of the various hardware components to build the Human Following Robot. The Arduino UNO board controls the robot's various components, including the motors, sensors, and servo motors. The driver shield is used to control the speed and direction of the motors, and the ultrasonic sensor is used to detect obstacles and avoid them while moving forward or backward. The IR sensors and servo motor are used to detect the direction in which the robot needs to turn. The chassis holds all the components of the robot together, and the battery powers the robot.

5. Budget

Sr. No.	Component Name	No. of pcs Required	Cost (INR)
1	Arduino UNO	1	1081 /-
2	Motor Driver Shield	1	450 /-
3	Servo Motor	1	150 /-
4	Ultrasonic Sensor	1	150 /-
5	I R Sensor	2	180 /-
6	TT-Gear Motor with tyres	4	400/-
7	Li-ion Battery with socket	2	210/-
8	Chassis	1	100/-
9	Jumping wires	10	50/-
	Total		**2771 /-**

Components

1. Arduino UNO

- Arduino is an open-source electronics platform designed for buildingDIY electronics projects and prototyping.
- The platform consists of both hardware and software components that work together to provide a simple and flexible way to build interactiveprojects.
- Arduino Uno can be programmed using the Arduino programminglanguage, which is based on C/C++.

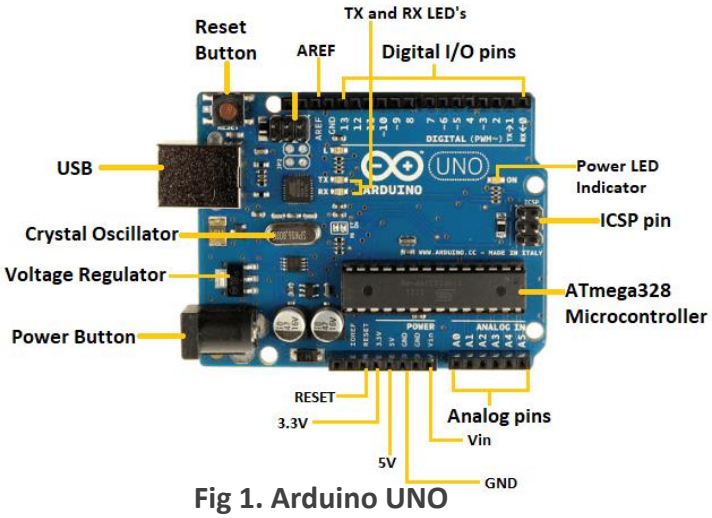


Fig 1. Arduino UNO

2. Motor Driver Shield

- A motor driver shield is specifically designed to control the speed and direction of one or more motors. It acts as an interface between a microcontroller or Arduino board and the motor, providing the necessary signals to control its operation.
- Most motor driver shields use an H-bridge configuration, which allows for bidirectional control of the motor. The H-bridge consists of four switches that can be turned on and off in different combinations to control the motor's rotation direction (forward or reverse) and speed.
- Motor driver shields come in different current and voltage ratings to accommodate different types and sizes of motors.

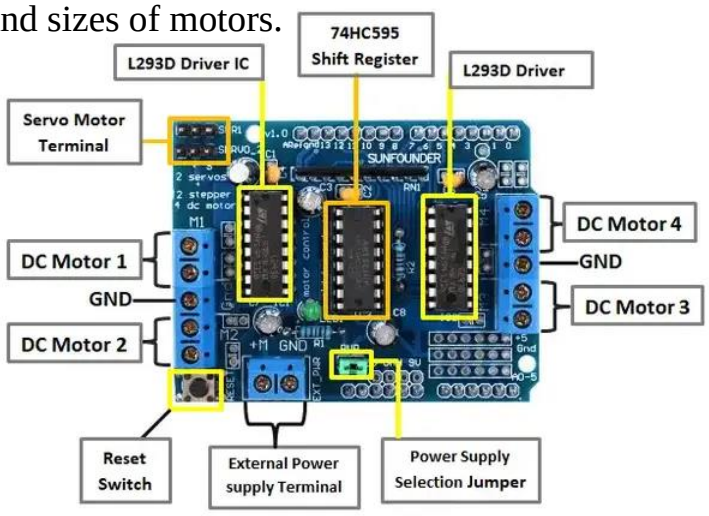


Fig 2. Motor Driver Shield

3. Servo Motor:

- Servo motors are known for their precise control accuracy. They can rotate to specific angles or positions based on the input signals they receive. This makes them suitable for applications that require accurate and controlled movements, such as robotics, automation, and CNC machines.
- Servo motors are commonly controlled using pulse width modulation (PWM) signals. The control signals are typically in the form of a square wave with a varying duty cycle. By varying the duty cycle, you can control the position or speed of the servo motor. The most common PWM signal for servos has a frequency of around 50 Hz.
- The torque output of a servo motor is usually specified in terms of its stall torque, which is the maximum torque it can generate when the rotor is stationary.

Fig 3. Servo Motor

4. Ultrasonic sensor

- The primary function of an ultrasonic sensor is to measure the distance between the sensor and an object. It emits ultrasonic waves and calculates the time it takes for the waves to bounce back after hitting an object. This time measurement is then used to determine the distance between the sensor and the object.
- Ultrasonic sensors operate on a non-contact principle, meaning they do not require physical contact with the object being detected. This feature makes them suitable for applications where contact sensing may not be feasible or desirable, such as in industrial automation, robotics, and object detection systems.

Fig 4. Ultrasonic Sensor

5. Infra-Red Sensor

- IR sensors are designed to detect and measure infrared radiation emitted by objects. Infrared radiation is a form of electromagnetic radiation with wavelengths longer than those of visible light but shorter than radio waves. IR sensors can sense and respond to this radiation, which is commonly generated by heat sources or infrared LEDs.
- IR sensors can operate in different detection modes based on their intended application. The two primary modes are proximity sensing and object detection. Proximity sensing mode detects the presence of an object within a specified range, while object detection mode identifies the characteristics or properties of an object, such as its shape, color, or temperature.

Fig 5. Ultrasonic Sensor

6. TT Gear Motor with tyre

- TT gear motors feature a built-in gearbox that provides gear reduction. The gearbox reduces the output speed of the motor while increasing torque. This gear reduction allows the motor to deliver higher torque output, making it suitable for applications that require strong rotational force.
- TT gear motors typically consist of a DC motor and a gearbox combined in a compact unit. The DC motor provides the rotational power, while the gearbox provides the gear reduction and determines the motor's output speed and torque characteristics. The gearbox is often made of plastic or metal gears, depending on the specific model.

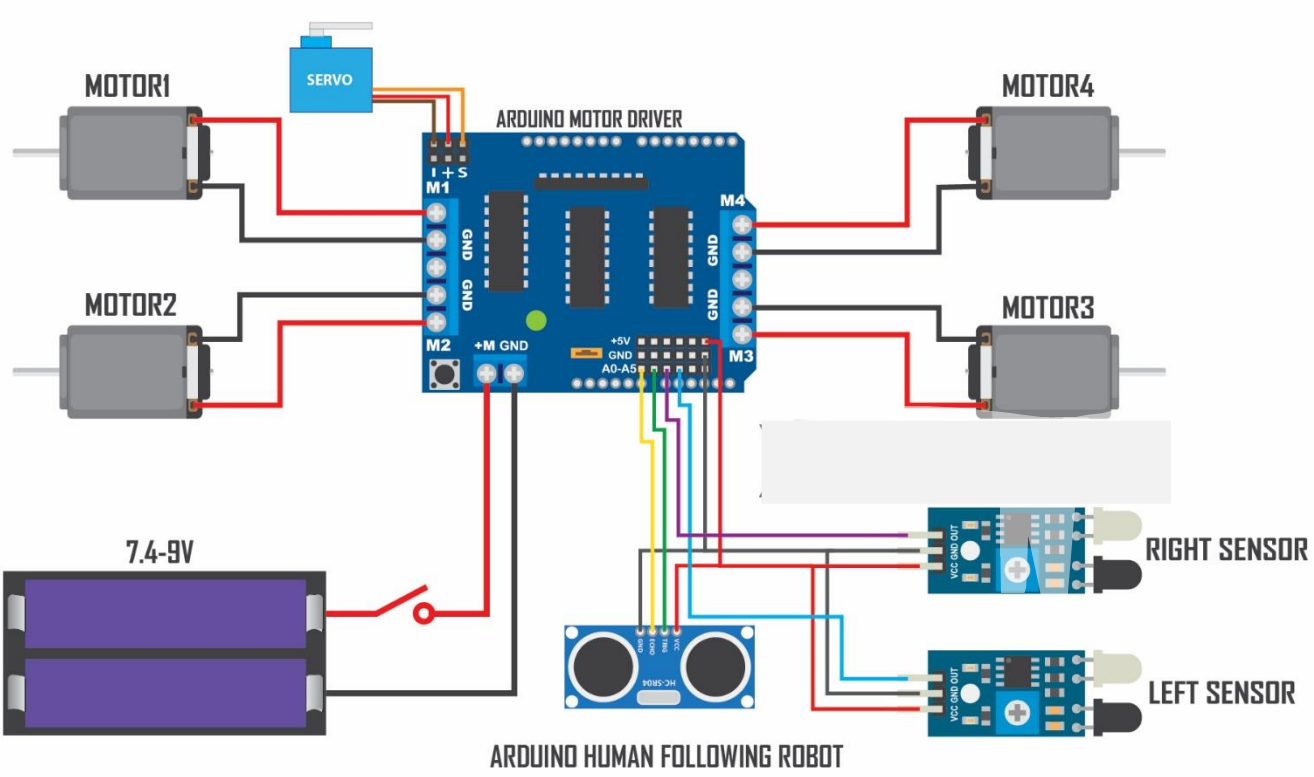
Fig 6. TT Gear Motor with tyre

7. Li-ion battery

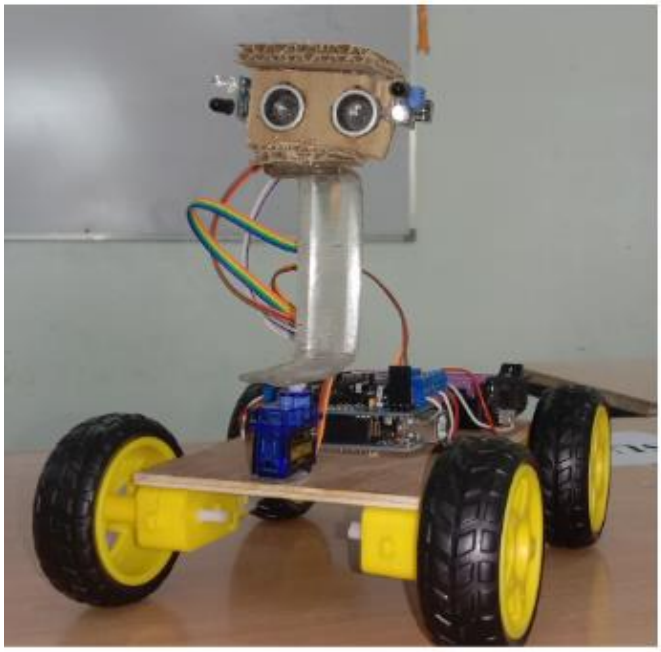
- Li-ion batteries have a high energy density, meaning they can store a large amount of energy relative to their size and weight. This makes them popular for portable electronic devices such as smartphones, laptops, and electric vehicles (EVs) where space and weight are critical considerations.
- Li-ion batteries are rechargeable, allowing them to be used repeatedly. They can undergo hundreds to thousands of charge and discharge cycles, depending on the specific battery chemistry and usage patterns.
- Li-ion batteries do not exhibit a memory effect, unlike some other types of rechargeable batteries. Memory effect refers to a phenomenon where a battery "remembers" a shorter capacity if it is repeatedly charged without being fully discharged.

Fig 7. Li-ion battery

Circuit Diagram



Robot:



HUMAN FOLLOWING ROBOT

Preliminaries

The working of a Human Following Robot involves a combination of hardware components, sensors, and intelligent algorithms to enable the robot to track and follow a human being autonomously. Here is an overview of the working process:

- The robot uses an ultrasonic sensor or any other suitable sensor to detect the presence of a human being within its range. The sensor emits ultrasonic waves or uses other detection methods to identify the human.
- The robot utilizes an ultrasonic sensor to detect obstacles in its path. It sends out ultrasonic waves and measures the time taken for the waves to return after hitting an object. Based on this information, the robot can calculate the distance to the obstacle.
- Once a human is detected and no obstacles are in the immediate path, the robot starts moving toward the human. The driver shield and TT gear motors with tires enable the robot to move in the desired direction.
- The robot uses IR sensors and a servo motor to track the direction in which the human is moving. The IR sensors emit infrared light and receive the reflected light. By analyzing the time taken for the light to return, the robot can determine whether the human is moving to the right or left. The servo motor helps adjust the position of the IR sensors accordingly.
- The robot employs an intelligent follow algorithm to adjust its movement and maintain a suitable distance from the human. The algorithm considers the speed and direction of the human, as well as the robot's own movement capabilities, to ensure smooth tracking and following.
- : If the ultrasonic sensor detects an obstacle in the robot's path, it triggers an obstacle avoidance mechanism. The robot uses the collected distance data to calculate an alternative path or navigate around the obstacle, ensuring safe movement while continuing to track the human.
- The robot continuously repeats the process of human detection, obstacle detection, movement control, direction tracking, and obstacle avoidance to ensure uninterrupted tracking and following of the human.

By combining these elements, the Human Following Robot is capable of autonomously tracking and following a human being, adapting its movement to changes in direction, and avoiding obstacles. The precise implementation and algorithms used may vary based on the specific design and programming of the robot.