



# HUMAN FOLLOWING ROBOT

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- Abstract:** Human-following robots have been researched and developed actively these decades due to its plentiful applications in daily life and manufacturing. A human-following robot requires several techniques such as human's target detection, robot control algorithm and obstacles avoidance. Various approaches of following robots have been proposed such as using ultrasonic sensors, voice recognition sensors, laser range sensors, charge-coupled device (CCD) camera and so on. These technologies detect the relative position between a mobile robot and a human.

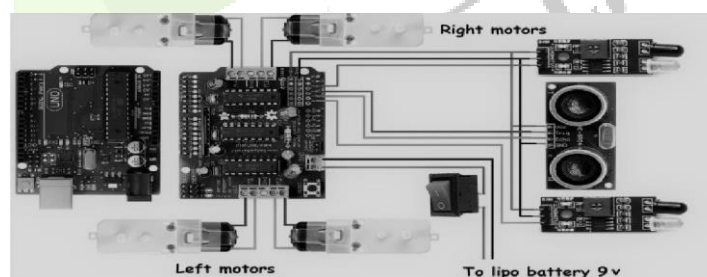
**Keywords:** Artificial Intelligence, Human following, Human tracking, Ultrasonic Sensor, IR Sensor, Arduino Micro Controller, Bluetooth Module HC-05.

## I. INTRODUCTION

Robotic technology has increased appreciably in past couple of years. Such innovations were only a dream for some people a couple of years back. But in this rapid moving world, now there is a need of robot such as "A Human Following Robot" that can interact and co-exist with them. To perform this task accurately, robot needs a mechanism that enables it to visualize the person and act accordingly. The robot must be intelligent enough to follow a person in the crowded areas, vivid environment and in indoors and outdoors places.

## II. SYSTEM CIRCUIT DIAGRAM AND COMPONENTS

### 2.1 CIRCUIT DIAGRAM



**Figure 1:** Human Following Robot Circuit

### 2.2 SYSTEM COMPONENTS

#### 2.2.1 ArduinoUno

It is the brain of our project. It can give all the command to their sub ordinate components which should be operated by the human behavior. And it also give feedback to the other components and human. So that it can be used as a medium of communication between human and robots & vice versa. It has specification of 8 bit CPU, 16 MHZ clock speed, 2 KB SRAM 32 KB flash Memory, 1 KB EEPROM.

#### 2.2.2 DC MOTORS

DC Motor is a device that converts any form of energy into mechanical energy or imparts motion. In constructing a robot, motor usually plays an important role by giving movement to the robot. Here 4 DC motor are used to drive the robot.

### 2.2.3 MOTOR SHIELD

The Motor Shield is a driver module for motors that allows you to use Arduino to control the working speed and direction of the motor. . The Motor Shield can either be powered by Arduino directly or by an external 6V~15V power supply via the terminal input. Here Motor Driver Board is designed to Work with L293D IC.

### 2.2.4 ULTRASONIC SENSOR

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. The working principle of this module is simple, it sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.

### 2.2.5 IR SENSOR

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode.

### 2.2.6 Bluetooth Module HC-05

Bluetooth is a one of the great example for wireless connectivity. It is used in many fields. Bluetooth consumes very small amount of energy. Do you know about Smartphone controlled robot or car. Commonly one of these two wireless technology is used in Smartphone controlled robot. One is WIFI and other is Bluetooth. And another commonly used wireless technology for controlling Robot car is RF. Which is the same remote and receiver used in drones. Here we are going to interface a Bluetooth Module (HC-05) with Arduino Uno. And describe each line of code. Then we control the builtin LED of Arduino Uno from smartphone via Bluetooth.

## III. WORKING

Our system consists of a four wheel robotic vehicle mounted with a separate microprocessor and control unit along with different sensors and modules i.e. ultrasonic sensor, infrared sensors which helps them to move with respect to people and objects in their surroundings. The above sensors work in unison with each other and helps the robot in its operation and to navigate its path by avoiding the obstacles and maintaining a specific distance from the object. We used ultrasonic sensor for obstacle avoidance and to maintain a specific distance for the object. The ultrasonic sensor works accurately works accurately within a range of 4 meters.

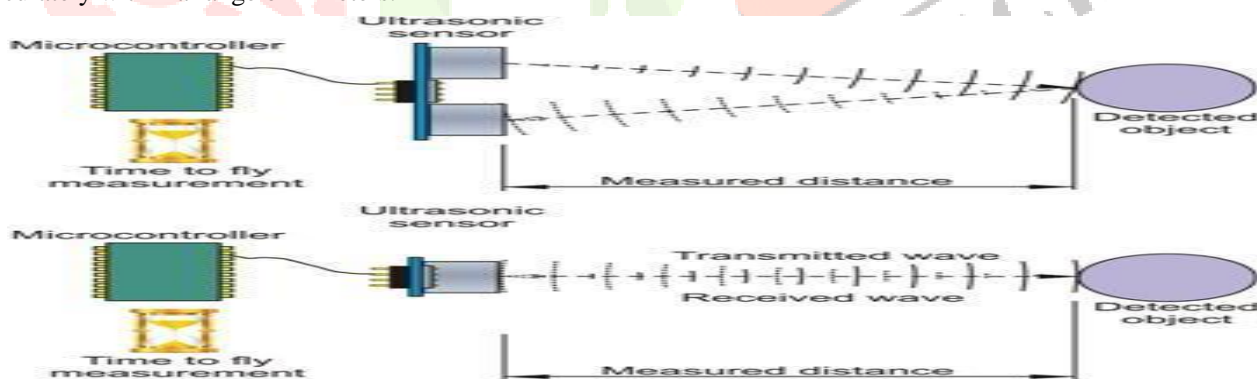


Figure 2: Ultrasonic Sensor Principle

### 3.1 ULTRASONIC AND IR SENSOR PRINCIPLE

This ultrasonic sensor is placed at the top of robot and pair of IR sensors are attached on either side of the ultrasonic sensor. We used ultrasonic sensor for obstacle avoidance and to maintain a specific distance for the object. The ultrasonic sensor works accurately works accurately within a range of 4 meters. Ultrasonic sensors operate by calculating the times differences. Infrared sensors detect the object's distance with infrared radiations when the beam from transmitter detects an object it returns to the receiver with an angle after reflection also known as method of triangulation this also helps in calculation of distance travelled by robot and eliminate any further error in the robotic movement due to displacement. IR sensor controls the movement of motors and ultrasonic sensor detects the obstacle and stops the motors

#### IV. RESULTS

Different experiments were conducted and the performance of the human following robot was tested. Test was performed on the ultrasonic and infrared sensor. It was noted that the sensor was working accurately within a range of 4 meters. Then we performed the test to check whether the robot maintains a specific distance with the target object. Then we checked the serial communication between Arduino, motor shield and various motors. On the basis of results obtained from these tests and experiments, we made the necessary changes in the processing and control algorithm. After the completion, we observed that the results produced were very satisfying the robot was perfectly following the person wherever it goes. Hence the objective of implementing a good Human-Robot interaction was achieved.

#### V. FUTURE SCOPE:

There are many interesting applications of this research in different fields whether military or medical. A wireless communication functionality can be added in the robot to make it more versatile and control it from a large distance. This capability of a robot could also be used for military purposes. By mounting a real time video recorder on top of the camera, we can monitor the surroundings by just sitting in our rooms. We can also add some modifications in the algorithm and the structure as well to fit it for any other purpose. E-g a vehicle follower. Similarly it can assist the public in shopping malls. So there it can act as a luggage carrier, hence no need to carry up the weights or to pull that. Using this algorithm the robot will automatically follow that person.

#### VI. CONCLUSION:

A successful implementation of a person follower robot is illustrated in this research. This robot does not only have the detection capability but also the tracking and following ability as well. The tracking is basically performed on the tag and the human is followed on the basis of that detection. It was also kept in mind that the „following“ capability of the robot should be as efficient as possible. The tests were performed on the different conditions to pin point the mistakes in the algorithm and correct them. The different sensors that were integrated with the robot added an additional advantage.

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