A Project Based Learning Report

on

"HUMAN FOLLOWING ROBOT"

Submitted Towards The

Partial Fulfillment of The Requirements of

B.Tech Robotics and Automation Sem IV

For the Subject

Manufacturing Technology- II

Academic Year: 2022-23

Bharati Vidyapeeth's

(Deemed to be University)

College of Engineering, Pune 411043

Acredited with "A+" grade by NAAC"

Submitted by-

NAME	ROLL NO.	PRN
GAURI KADBANE	11	2014111275
ROHIT PATIL	24	2014111289
ANAND K. PATIL	25	2014111290
SHIVANI SHINDE	30	2014111295

Faculty Supervisor
Dr. P.V. Jadhav

I

Bharati Vidyapeeth
(Deemed to be University)
College of Engineering, Pune 411043
Accredited with "A⁺" grade by NAAC"

CERTIFICATE

This is to certify that the project entitled "Human Following Robot " is a bonafide work carried out by the following students and it is submitted to the Bharati Vidyapeeth Deemed to be University College of Engineering, Pune for the partial fulfillment of the requirement for the of Semester IV Robotics and Automation Bachelor's of Technology Degree for the subject Manufacturing Technology- II Project Based Learning (PBL) in the of Semester IV Robotics and Automation Engineering .

NAME	PRN
GAURI KADBANE	2014111275
ROHIT PATIL	2014111289
ANAND K. PATIL	2014111290
SHIVANI SHINDE	2014111295

Dr. P.V. Jadhav
(Faculty Supervisor)

Dr.K.B.Sutar
(Head of Department)

DECLARATION

We, here by declare that the project titled "HUMAN FLLOWING ROBOT" Being submitted by us towards the partial fulfilment of Bachelor of Technology ,is a project based learning work carried by us is our own work.

Date:

NAME	PRN	Signature
GAURI KADBANE	2014111275	
ROHIT PATIL	2014111289	
ANAND K. PATIL	2014111290	
SHIVANI SHINDE	2014111295	

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Last but not least we are heavily indebted to our beloved **PARENTS** for their continuous source of encouragement.

Abstract:

Human Following robots have been investigated and actively developed throughout the decades in current contemporary age because to their numerous uses in everyday life and manufacturing. The human robot must use a variety of strategies, including a robot control algorithm, human target identification, and obstacle avoidance. Ultrasonic sensors, infrared sensors, voice recognition sensors, laser range sensors, camera charging-coupled devices (CCD), and other human-following robotic processes have been proposed. These innovations can distinguish between a versatile robot and a person in the general region. We provide another method for identifying the location of a human robot using an ultrasonic and infrared camera in this study, which is an important step in the robot's human evolution. In our undertaking, the robot is outfitted with a ultrasonic sensor which catches and identifies a person. A basic application carried out progressively utilizing a PI regulator shows benefits of the proposed technique.

Introduction:

Many people think of robot as machine that imitates a human. However much these robots capture our imagination, such robots still only inhabit Science Fiction. People still have not been able to give a robot enough 'common sense' to reliably interact with a dynamic world. The types of robots that you will encounter most frequently are robots that do work that is too dangerous, boring, onerous, or just plain nasty. Most of the robots in the world are of this type. They can be found in auto, medical, manufacturing and space industries. In fact, there are overa million of these types of robots working for us today. Some robots like the Mars Rover Sojourner and the upcoming Mars Exploration Rover, or the underwater robot Caribou help us learn about places that are too dangerous for us to go. Simply put, a robot can be described as a system that contains sensors, control systems, manipulators, power supplies and software all working together to perform a task. Designing, building, programming and testing a robot is a combination of physics, mechanical engineering, electrical engineering, structural engineering, mathematics and computing. The human following robot uses 2 IR sensors and an ultrasonic sensor. IR sensors are used to follow the human or object and ultrasonic sensor is used to move back the robot.

The human following robot can use in the defense sector also to carry weapons for the soldiers. This type of robot can sense obstacles and humans automatically and it can use in the future in our cars. An human following robot can be modified in the future with more developed components and can make it more advance. This robot can be enhanced by structure by adding more components like camara, tracking device and make it more beautiful and workable . This robot will be more trend in our future.

Objectives:

1) A human following robot requires several techniques such as human target detection.
2) Robot control algorithm and obstacle avoidance. Various approaches of following robots have been proposed such as ultrasonic sensors.

Working Principle:

Ir sensor works on infrared light which can also detect the object near to it. so there is two IR sensor one is at the left side of ultrasonic sensor and other is at the right side of the ultrasonic sensor. when anything comes near to the left sensor Arduino got the information that there is something is near to the left sensors and according to the code, the robot will turn to the left. And the same process for the right sensor. So this is how the human following robot works.

This Arduino robot having a sensor that can detect any object near it and can follow this object. If you come in front of the robot it will start following you. This robot consists ultrasonic sensor and IR sensor which help to follow the object.

When you come near to the robot starts to follow you. there are 4 wheels in the robot. and 4 motors attached to the chassis. now there are three sensors on the robot one is an ultrasonic sensor and two IR sensor which arranges like two sensors left and right to the ultrasonic sensor. and when you put your hand near to the ultrasonic sensor the robot will start forward.

If you turn your hand to the left side the Arduino robot moves on the left side, and if you put your hand in the right the robot will move in the right direction. so, how the whole system works we will talk about this.

When you put your hand in from of the ultrasonic sensor then the sensor detects you and sends this information to the Arduino. there is some distance prefix in the Arduino so if your hand is away from the sensor it will not read that. and if your hand is near to the sensor it will read it.
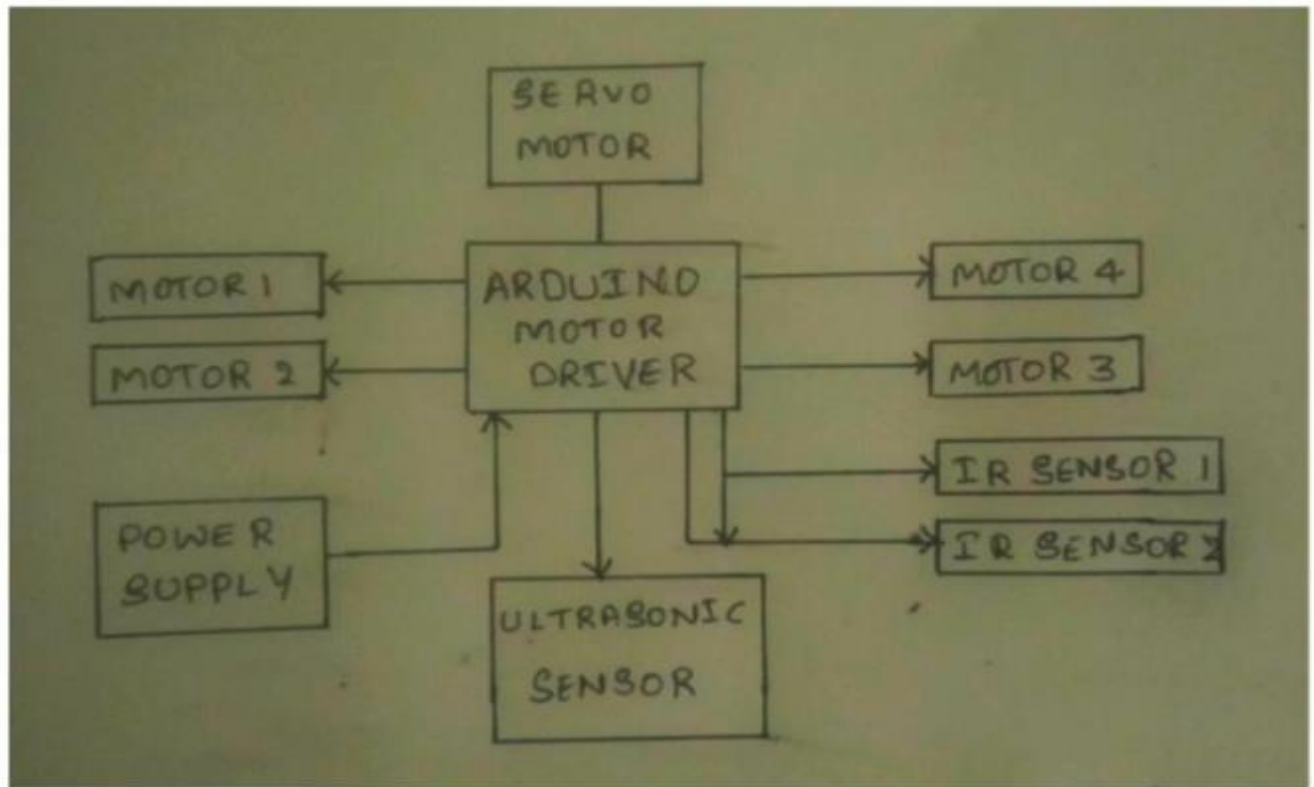
Methodology :

Figure- Block diagram of human following robot

Hardware

First, we have to build a frame or chassis as per the requirement now arrange the component in chasis as per the circuit diagram. Now connect trigger pin to A2 number pin in Arduino, now connect Echo pin to A1 of the Arduino. Likewise left IR sensor is connected to the A3 pin of the arduino board, the servo motor is connected to PIN10 ofArduino.

 Likewise, the motor driver(L293D) has 16 pins, first, 1,8,9 and 16 pins of the motor driver are connected to +5 volt pin and 4,5,10 and 11 pins of the motor driver are connected to the ground pin. Similarly,PIN 2 of the motor driver is connected to the PIN 4 of Arduino, and PIN 7 of Arduino is connected to PIN 10 of the motor

driver, and now PIN 8 of Arduino is connected to the PIN 15 of the motor driver pin. Likewise in motor, motor1 is connected to the 1 and 2 pins of the motor drive shild. And now, similarly motor2 is connected to 3 and 4 pins of the motor driver shild , and now motor3 connects to 5 and 6 pins of the motor driver. And last one motor4 connect to 7 and 8 of the motor driver pins

Software

To make the hardware parts work or run, it should be programmed through the required software like Arduino IDE . Since the microcontroller at first will not be having any program, if we also build up the hardware it will not have the capability to work or run due to lack of instructions which is provided by a program. Therefore we need a software to upload the program on any microcontroller.

To implement the task all three section are taking and giving information. Sensor module parts it sense data and provide it to the microcontroller chip. Microcontroller part software take all data from the all sensor and saving to the corrected path. According to the data input the microcontroller parts giving the necessary input for the motor control section to guiding and run the motor for working. Since we are using Arduino microcontroller we have to use Arduino IDE software to write and upload program in microcontroller.

Components Required:-

- Arduino Uno
- Arduino Motor Driver shield
- Jumper wires
- 4 BO motors
- Hook up wires
- 9V battery
- 4 wheel
- Chassis
- Ultrasonic sensor
- 2 IR Sensor
- on-off switch
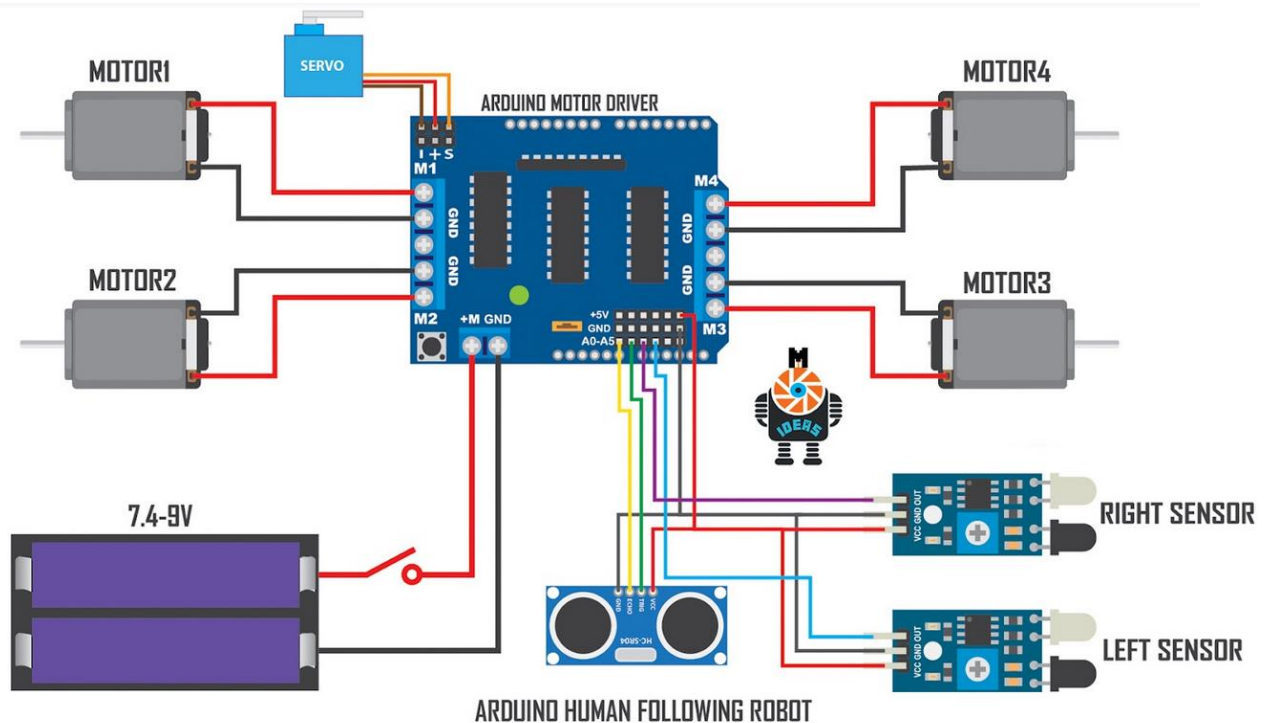- servo motor
- Ultrasonic sensor holder
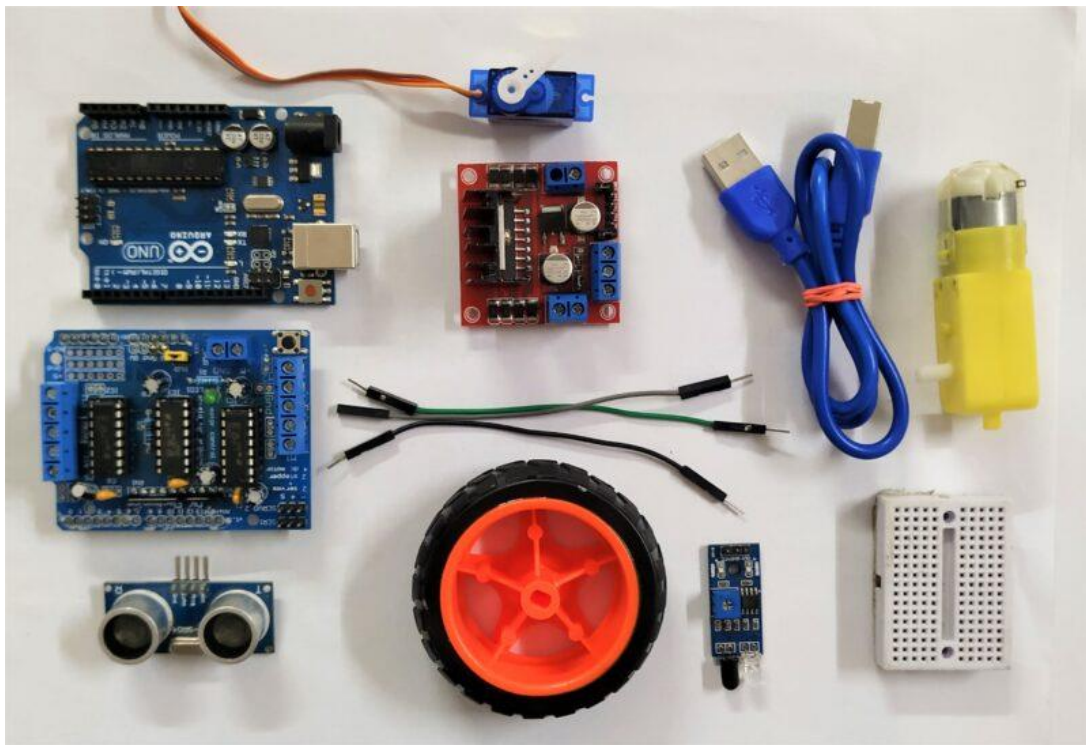
Tools Needed:-

Some tools names are given below:

- Soldering Iron
- Glue gun
- Cutter
- Knife
- Screwdriver
- Tweezer
- Wire Strippers
- Needle nose Pliers

Circuit diagram:

SPECIFICATIONS:

Arduino UNO:

- Microcontroller: ATmega328P
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Inout Voltage (limit): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins: 6
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB (ATmega328P) of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328P)
- EEPROM: 1 KB (ATmega328P)
- Clock Speed: 16 MHz
- LED_BUILTIN: 13
- Length: 68.6 mm
- Width: 58.4 mm
- Weight: 25 g
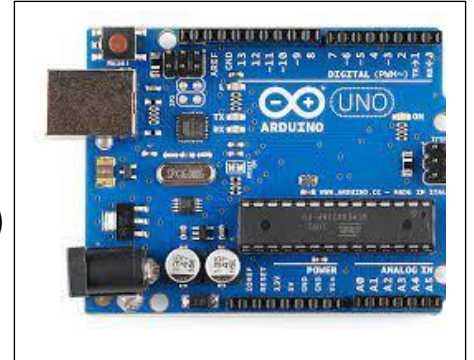
Arduino uno is a microcontroller board based on ATmega 328. 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

L293D Motor Driver Shield

- Wide Supply-Voltage Range: 4.5 V to 36 V
- Separate Input-Logic Supply
- Internal ESD Protection
- High-Noise-Immunity Inputs
- Output Current: 600 mA Per Channel
- Peak Output Current: 1.2 A Per Channel
- Output Clamp Diodes for Inductive Transient Suppression
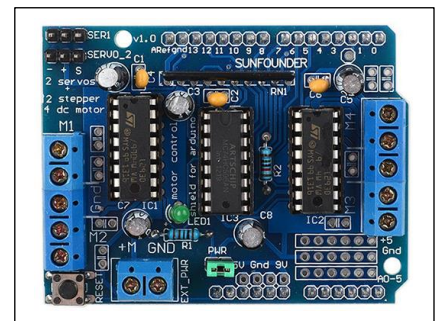
- Operation Temperature: 0°C to 70°C.
- Automatic thermal shutdown is available

This Arduino compatible motor Driver shield is a full-featured product that it can be used to drive 4 DC motor or two 4-wire steppers and two 5v servos. It drives the DC motor and stepper with the L293D, and it drives the servo with Arduino pin9 and pin10.

BO Motor:

- Volt:DC 3-9V
- No Load:60RPM
- Torque:0.5Kg-cm
- Current:0.01A (NL)
- Protect Feature:Enclosed
- Speed:Constant Speed
- Function:Control

A small shaft with matching wheels gives an optimized design for your application or robot. Mounting holes on the body & lightweight makes it suitable for in-circuit placement. This motor can be used with 69mm Diameter Wheel for Plastic Gear Motors and 87mm Diameter Multipurpose Wheel for Plastic Gear Motors.

IR sensor:

- operating voltage: 5VDC
- I/O pins – 3.3V & 5V
- range: 20 centimeters
- supply current:20Ma

Proximity sensor is used to detect objects and obstacles in front of sensor. Digital low output is produced on detecting the objects in front.

Ultrasonic sensor:

- Working Voltage:5V (DC)
- Static Current: Less than 2mA
- Output Signal:5V
- Sensor Angle: Less than 15 Degrees
- Detection Distance: 2 cm to 450 cm
- High Precision: Up to 2 mm
- Input Trigger Signal: 10µs TTL impulse
-

An ultrasonic sensor measures a distance of the target object by emmiting ultrasonic sound waves. For ultrasonic sensor the range is 40-70kHz.

Servo motor:

- 3 pole ferrite, all nylon gear
- Top ball bearing
- Operating Voltage: 4.8V~6.0V
- Operating speed: 0.12sec/60 degree
- Output torque: 1.6kg/cm 4.8V
- Dimension: 21.5 x 11.8 x 22.7mm
- Weight: 9g

Micro servo motor is a tiny and light weight servo motor with high output power. Servo can rotate approximately 180 degree.

Lithium-Ion battery:

- Capacity (mAh) : 3000
- Discharge Rate : 5C
- Length (mm) : 65
- Width (mm) : 18
- Life Cycle   : 800
- Nominal Voltage (V) : 3.7
- Weight (gm) : 45gm

- Height (mm) : 65mm
- Diameter (mm) : 18mm

This Samsung 18650 30Q Li-ion Battery is a single cell compact and powerful battery cell with 3000mAh capacity. It is very convenient to install in your project where 3.7 Volt with high capacity is needed.

Model Design :

(Using Solid Works Software)
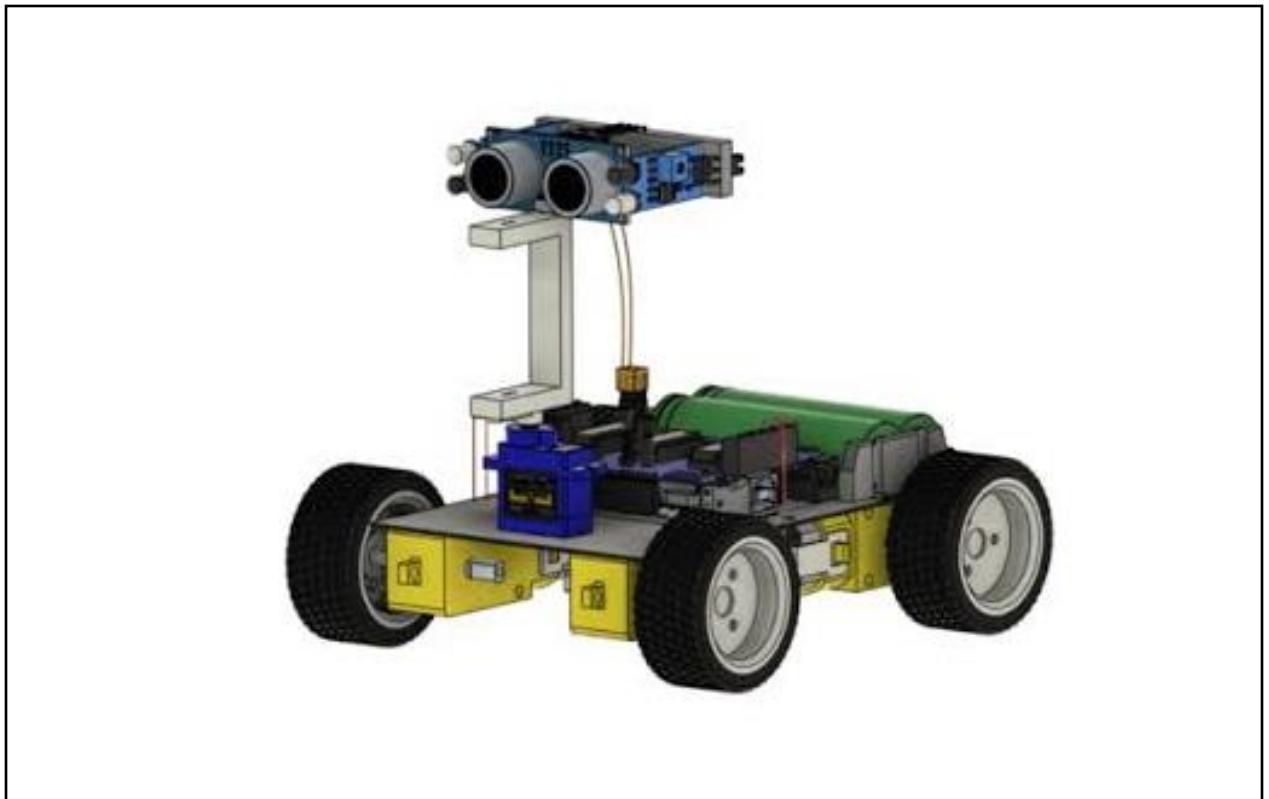
Applications:

Such a robot can be used for many purposes. With a few changings, the robot can act as a human companion as well. Some other applications of this robot are

- Can assist in carrying loads for people working in hospitals, libraries, airports, etc.
- Can service people at shopping centers or public areas.
- Can assist elderly people, special children and babies.
- Can follow a particular Vehicle.
- Human following robot can be used for home for floor cleaning.
- In hotels they are being used for the transfer of things from one place to another following straight path.

Future scope:

The human following robot can use in the defense sector also to carry weapons for the soldiers. This type of robot can sense obstacles and humans automatically and it can use in the future in our cars. An human following robot can be modified in the future with more developed components and can make it more advance. This robot can be enhanced by structure by adding more components like camara , tracking device and make it more beautiful and workable . This robot will be more trend in our future.

Result:

We have successfully made the human following robot which is used to follow objects as well humans. This robot uses ultrasonic range sensors and Infrared sensors. The test was performed with the both ultrasonic sensor and infrared sensor that the sensor was working accurately within the range of 10 cm. An ultrasonic sensor is used to move the robot forward and backward. Infrared sensors are used to move the robot in the left or right direction accordingly. Then we test the serial communication of Arduino, motor shield various motors . This robot took a lot of time to complete this project. We were faced lots of problems regarding the program code, as there was huge numbers of error in the code which was further rectified it and lastly it works. Motors drivers connections got interchanged which was rectified and our robot works perfectly fine. Finally, after the lots of effort and time our objective was achieved which was to implement a good Human-Robot interaction.

I have set it in such a way that if I put hand in front of one sensor it moves backward and another sensor moves forward.

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.

In the world the robotics generation is coming. In this Object Following Robot, we can add a GSM module that will give us the location of the robot, or we can add wireless remote controls to our robot to work as a remote controller or to work as an automatic object following the robot. My project can be use in many areas like hospitals for more accuracy and fast work in any emergency cases , in shopping malls to carry items , we can attach various sensors and cameras to get more features. This project challenged the group to co-operate, communicate, and expand understanding of electronics, mechanical systems, and integration with programming . In this way, we completed this project by believe that our project will be helpful in future and it will help human to do any kind of works & hence my purpose will be successful.

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