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Human Following Robot using Arduino

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Abstract: *Humanoid robotics is an emerging research field that has received significant attention during the past years and will continue to play an important role in robotics research and many applications of the 21st century and beyond. In this rapid moving world, there is a need of robot such "A Human Following Robot" that can interact and co-exist with them. Because of its human following capability, these robots can work as assistants for humans in various situations and it can also acquire or monitor certain information associated with the human subject. In this paper we present a prototype that uses Arduino Uno along with basic sensors such as ultrasonic and IR sensor. All the processing is carried out by the microprocessor while the control of the motors is carried out by the controller. This robot can further be modified by using many technologies such as Bluetooth, Pixy Camera, etc.*

Keywords: Robot, Ultrasonic Sensor, Bluetooth module, Neural network

I. INTRODUCTION

Robotics technology has increased appreciably is past couple of years. Such innovations were only a dream for some people couple of years back. but in this rapid moving world now there is a need of robots such as "A Human Following Robot "that can interact and co-exist with them. The development of robot technology had increase significantly due to industrial, medical and military application. In various fields with harsh
environment such has underground mining, war -zones, medical, construction, space exploration etc. the work done by one is extremely dangerous. life of individual assisting is also put at risk. tasks performed by humans have its own limitation in many ways .in order to perceive beyond the human limitation in vision, speed, consistency, flexibility, quality, etc. we should make use of robot. A key requirement for these robots is the ability to detect humans and to interact with the min non -technical way. The main objective of this
dissertation is to make a robot that can help humans with various tasks. In this paper, we present a prototype of a human following robot that uses Arduino Uno and different sensors for detection and following an object.
In this high technology, a robot must be able to detect and follow humans. A robot that can detect and follow human or obstacle within a specific range is called 'Human Following Robot'. Robots are used to change people's lives and make people's life luxurious. A robot that can use in shopping time which carries items, and follow human without any remote more useful. A robot that can use in the hospital to bringing medicine with more accuracy and fast. The human following robot has many works like work as trolley, structure in hospital, and a small basket with a car and so on. Now in this changing world, people are started to lives with robot-like humans following robots for their luxurious life. This project named called human following robot because it can follow humans with the help of IR sensors and can co-exist with humans and help humans in any kind of work with more accuracy and in lesser time. The human following robot can use in the Défense sector also to carry weapons for the soldiers. This type of

II. LITERATURE REVIEW

In the below – mentioned project, the users (human) were given a tag which emits radiation which was received by the multiple sensors on the robot and using the triangulation method, the face and magnitude will be determined and hence the location of the emitter (tag). The techniques used to calculate the relative positions of the emitter and receiver use PIR and RF localization system. Combining the PIR and antenna data requires a lot of time, and the use of triangulation method may produce inaccurate results.

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So far, a lot of research has been done on the kinds of robot that fall into the category of the "Assisting Robots". People have used different logics and alog‟s to implement their design. All of their primary focus has entirely been on the design of robots that follows the target.

Laser sensor is used by Burgard in his tour guide robot for human tracking. LRF was incorporated by D. Schulz to perform the „following‟. Using the above-mentioned process, they performed the information linking for the detection. Nicola, Husing used a technique for pointing out the different styles of movement by using LRF. This information was fused with the information obtained by the camera.

Depth imaging was used by Songmin Jia to carry out the detection. The model of a person was determined using the depth imaging. The particular style of clothing was used by Mehrez Kristou. He used a multidirectional camera. LRF was also incorporated by him in the design. Research was conducted by Wilhelm with the focus on the color of the particular person‟s skin. Information from different sensors was also used by him in the research.

Some other research work was also conducted in this regard, Depth imaging was used by Calisi and the target was persued by designing a special algorithm. Ess and Leibe carried out the same work. They did a lot of work on object tracking and detection. The biggest advantage of their method was that their algorithm worked in complex environments as well. Stereo vision was also carried out by Y. Salih in order to perform the detection

III. PROJECT METHODOLOGY

3.1 Arduino IDE

Generally, Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs-light on a sensor, a finger on a button, or a Twitter message – and turn it into an output- activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.to do so you use the Arduino programming language (based on wiring), and the Arduino Software (IDE), based on processing.

The Arduino Software (IDE) rub=ns on windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to windows.

The Arduino software is published as open-source tools available for extension by experienced programmers. the language can be expanded through C++, libraries and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which its base. similarly, you can add AVR-C code directly into your Arduino programs if you want to.

3.2 Working Principle

Our system consists of a four-wheel robotic vehicle mounted with a separate microprocessor and control unit along with different sensors and modules. ultrasonic sensor infrared sensor which helps them to move with respect to people and object in their surroundings the above sensor 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 work accurately within a range of 4 meters.

3.3 Methodology for Installation Section:

As mentioned above the knowledge of neural network and machine learning is not mandatory for using this API as we are mostly going to use the files provided in the API. All we need is some knowledge of python and passion for completing this project. Also, I assume anaconda is already installed in your PC. So, let us start by downloading soma files:

3.4 Download Source Code From Git Hub

There are two ways of doing this, one is by using git and another by manually downloading it:

1. **Using git:** This is the easier way of downloading the source code of robotic arm from the repository but you need to have git installed in the system. Open the command prompt and the type this command.
2. **Downloading manually :** To manually download the code, go to the link and click on the code button (in green

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colour). You can see the download zip option; click on that you will have a compressed file. Now you need to extract the files.

IV. HUMAN FOLLOWING ROBOTIC CODE

```
#include <New Ping. h>
#define ULTRASONIC_SENSOR_TRIG 11
#define ULTRASONIC_SENSOR_ECHO 12
#define MAX_FORWARD_MOTOR_SPEED 75
#define MAX_MOTOR_TURN_SPEED_ADJUSTMENT 50
#define MIN_DISTANCE 10
#define MAX_DISTANCE 3
#define IR_SENSOR_RIGHT 2
#define IR_SENSOR_LEFT 3

//Right motor
int enable Right Motor=5; int rightMotorPin3=7;
int rightMotorPin4=8;

//Left motor
int enable Left Motor=6; int leftMotorPin1=9;
int leftMotorPin2=10;

New Ping my Sensor (ULTRASONIC_SENSOR_TRIG, ULTRASONIC_SENSOR_ECHO, 400);
void setup ()
{
// put your setup code here, to run once: Pin Mode (enable Right Motor, OUTPUT); pin Mode (rightMotorPin3, OUTPUT);
pin Mode (rightMotorPin4, OUTPUT);
pin Mode (enable Left Motor, OUTPUT); pin Mode (leftMotorPin1, OUTPUT);
pin Mode(leftMotorPin2, OUTPUT);
pin Mode(IR_SENSOR_RIGHT, INPUT); pin Mode(IR_SENSOR_LEFT, INPUT);
rotate Motor(0,0);
}
void loop()
{
int distance = my Sensor. ping_ cm();
int right IR Sensor Value = digital Read(IR_SENSOR_RIGHT); int left IR Sensor Value = digital Read(IR_SENSOR_LEFT);
//NOTE: If IR sensor detects the hand then its value will be LOW else the value will be HIGH
//If right sensor detects hand, then turn right. We increase left motor speed and decrease the right motor speed to turn towards right
if (right IR Sensor Value == LOW && left IR Sensor Value == HIGH )
{
Rotate Motor(MAX_FORWARD_MOTOR_SPEED - MAX_MOTOR_TURN_SPEED_ADJUSTMENT, MAX_FORWARD_MOTOR_SPEED + MAX_MOTOR_TURN_SPEED_ADJUSTMENT );
}
//If left sensor detects hand, then turn left. We increase right motor speed and decrease the left motor speed to turn towards left else if (right IR Sensor Value == HIGH && left IR Sensor Value == LOW )
{
```

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```
Rotate Motor(MAX_FORWARD_MOTOR_SPEED + MAX_MOTOR_TURN_SPEED_ADJUSTMENT,
MAX_FORWARD_MOTOR_SPEED - MAX_MOTOR_TURN_SPEED_ADJUSTMENT);
}
//If distance is between min and max then go straight
else if (distance >= MIN_DISTANCE && distance <= MAX_DISTANCE)
{
Rotate Motor(MAX_FORWARD_MOTOR_SPEED, MAX_FORWARD_MOTOR_SPEED);
}
//stop the motors else
{
Rotate Motor(0, 0);
}
}
void rotate Motor(int right Motor Speed, int left Motor Speed)
{
if (right Motor Speed < 0)
{
Digital Write(rightMotorPin3,LOW); Digital Write(rightMotorPin4,HIGH);
}
else if (right Motor Speed > 0)
{
Digital Write(rightMotorPin3,HIGH); Digital Write(rightMotorPin4,LOW);
}
else
{
Digital Write(rightMotorPin3,LOW); Digital Write(rightMotorPin4,LOW);
}
if (left Motor Speed < 0)
{
Digital Write(leftMotorPin1,LOW); Digital Write(leftMotorPin2,HIGH);
}
else if (left Motor Speed > 0)
{
Digital Write(leftMotorPin1,HIGH); Digital Write(leftMotorPin2,LOW);
}
else
{
Digital Write(leftMotorPin1,LOW); Digital Write(leftMotorPin2,LOW);
}
Analog Write(enable Right Motor, abs(right Motor Speed)); Analog Write(enable Left Motor, abs(left Motor Speed));
}
```

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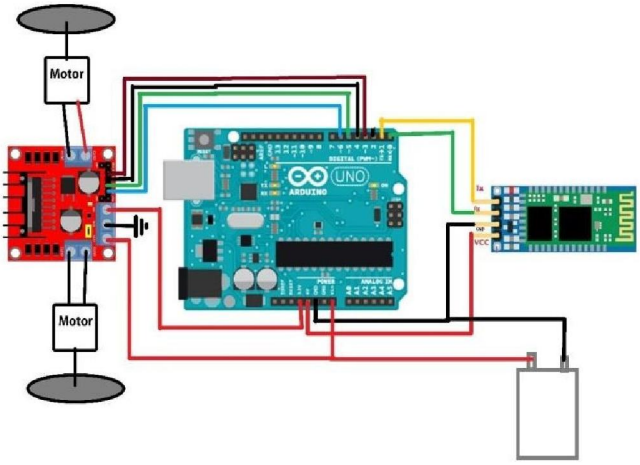
V. FUNCTIONS OF VOICE CONTROLLED CAR.

Users Command	Arduino O/P Digital Pins (2,3,4,5)	L293D Input Pins (2, 7, 10, 15)	L293D Output Pins (3, 6, 11, 14)
Forward	H L H L	H L H L	H L H L
Backward	L H L H	L H L H	L H L H
Left	- H L L L for 1s, then H L H L if previous Command was Forward - H L L L for 1s, then L H L H if previous Command was Backward		
Right	- L L H L for 1s, then H L H L if previous Command was Forward - L L H L for 1s, then L H L H if previous Command was Backward		
Stop	L L L L	L L L L	L L L L

VI. METHODOLOGY FOR ELECTRONIC SECTION:

Over all circuit diagram of human following robot:



VII. MODEL IN REAL LIFE

Final photos of Voice Controlled Car after

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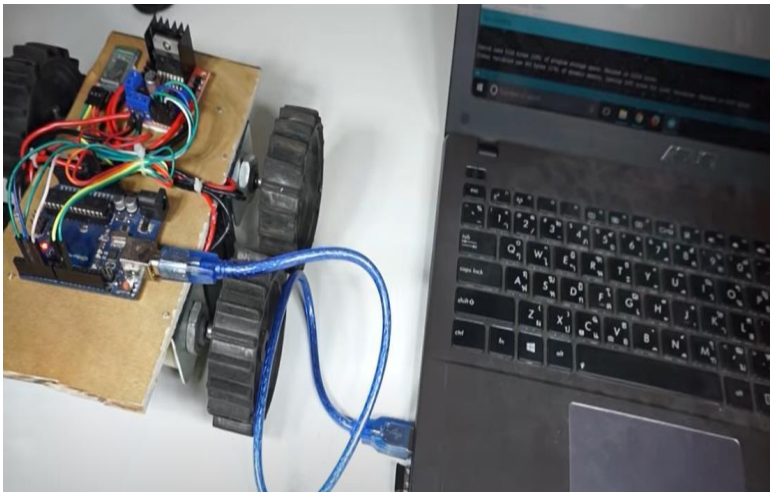
Installation of parts and uploading of code–



VIII. CONCLUSION

A successful implementation of a prototype of human following robot is illustrated in this paper. This robot does not only have the detection capability but also the following ability as well. While making this prototype it was also kept in mind that the functioning of the robot should be as efficient as possible. Tests were performed on the different conditions to pin point the mistakes in the algorithm and to correct them. The different sensors that were integrated with the robot provided an additional advantage. The human following robot is an automobile system that has ability to recognize obstacle, move and change the robot's position toward the subject in the best way to remain on its track. This project uses Arduino, motors different types of sensors to achieve its goal. This project challenged the group to cooperate, communicate, and expand understanding of electronics, mechanical systems, and their integration with programming.

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