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Short Range Motion Detector Droid

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***Abstract*—The paper presents the design and development of a short range motion detector based droid. In this digital and automotive day and age, robotics, and IoT produce an impact on human life. One can't just rely on the traditional mode of work in this era. One has to adapt the robotics and keep digging in it, as it's the near future for humans. So to do this there are many aspects to implement automotive in day-to-day life. One such event is to study a robot that follows humans that means which can detect human movement and react as per this movement. The study shows that there are many researchers, scientists, engineers who have worked and still working to improve this human movement detection in robotics. This paper has studied some of the previous work and gave a comparative analysis of the same. The work presented in this paper is the mini-project work of the under-graduate students of the engineering college guided by their supervisors.**

***Index Terms*— Human follower robot, hand follower robo, Arduino, DC gear motor, Infrared sensor, Microcontroller, Ultrasonic sensor, safe distance.**

I. INTRODUCTION

In this high technology era, the rise of robotics plays an important role for human beings. Robots proved us to be always a very helpful thing as a more intelligent robot are able to cooperate with human for supporting the human. In order to support the human's works, a robot must be able to detect and follow the human. A robot that able to detect and follow human is called human following robot. A human following robot needs interaction between itself and human in order to give aid / assistance. For example, an intelligent cargo transportation robot helps by carrying luggage in an airport, the development of mobile cleaning robot to detect and track the sound source by using three microphones. Besides, one of the domestic applications for a following robot is that it can carry stuffs along with human in shopping malls, home, office or golf courses.

There are a variety of advantages of this robot for human beings as it can also be used in civil application and industrial area. However, the robot itself cannot track and detect an object. So, the robot needs a mechanism which can make decision for it to take action accordingly so that the task can be performed correctly. The involved mechanism is sensor that can detect obstacles or object around the robot itself. A lot of sensors can be utilized like laser, radio frequency, cameras and others, that able to follow the human in a constant distance with the mobile robot itself. In this project, ultrasonic sensor is used. Ultrasonic sensor is a device that able to

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measure the distance to an obstacle by using sound waves. The sound wave is travelled out at a specific frequency and returned when its sense a thing to measure distance in real time. It has its faults and this could be an issue for the sensor to recognize an object because the sensor works based on specular basis which mean it is not a narrow range scanning angle. Hence, a precision and accuracy work need to be implemented in order to track an object.

The ultrasonic sensor is low cost device that able to operate in any environment with low visibility where vision or laser systems are not really efficient. The ultrasonic sensor is able to measure distance from itself to the certain object by using pulse-echo in real time. Unlike other sensors, ultrasonic sensor provides data about object existence in front of the sensor. Fig. 1 gives the idea about the slowly following the human based droid & a quickly following droid. Only few researches used ultrasonic sensor in human following system even though it is a very superior sensor in maneuvering and scanning application in various fields and environment conditions. Here, the system utilizes IR sensor for legs recognition. The position and number of sensor was designed to recognize both human's leg at the same time and follow the human. Two IR sensors were used to detect both human's left and right leg and their interception is used to differentiate left leg and right leg. Each IR sensor data is evaluated by using probability and the algorithm that can detect and track human legs is developed. From here, the robot able to follow as it could recognize both human's leg. The performance of human following robot was then analyzed.

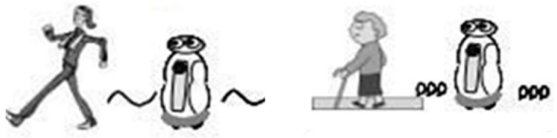

Fig. 1 : Slowly following the human based droid & a quickly following droid

II. Research Objectives

This paper addresses the three important research objectives, viz., firstly, to develop a Short Range Motion Detector robot to aid the humans to carry loads, secondly, to develop a robot that must be able to detect the change in direction of the moving object and follow accordingly & finally to develop the current robot that can help medical and military services

III. Literature Survey

The AVR microcontroller will perform the operation on the received command from android device through Bluetooth module HC-05. The DC motor driver IC-L293D is connected to port C of AVR microcontroller, which drives the DC motor as per command and controls the wheels of robot. The Port D of microcontroller are used for future use for wired communication by using MAX 232 IC for serial communication and Port B remaining pins are used for the ULN2803 IC for connected the in future the devices like Buzzer, LED etc. In Microcontroller Atmega32 the Port A has 8-bit ADC are inbuilt. The ADC are used for to convert the signals from analog to digital form. These digital signals are used for further processing by the digital processor. ADC is operated on 5 v power supply. We used HC-SR04 three ultrasonic sensors, which transmit & receive signals by emitting sound waves. Ultrasonic sensor has four pins V_{cc}, Echo, Trigger, Gnd three ultrasonic sensor are used to connect the right, left and front side of the robot for calculating the distance between person and robot. 5 v supply are required for each ultrasonic sensor and common ground will be connected. The first and second Ultrasonic Sensor are motor4 connect to 7 and 8 of the motor drivers pins. Connected to Port B B0,B1,B2,B3 pins and third Ultrasonic Sensor is connected to the Port A A0,A1 pins. The AVR Microcontroller Port C, C0 to C3 pins are connected to the Driver IC L293D as a input and the four pins of Driver IC's two DC Motors are connected as a output of driver Ic. It required 5V power supply. The 4.7k pull- up resistors connected between the microcontroller and Driver We have used two 60 rpm DC motors for forward and reverse direction according to the microcontroller instruction. For the DC Motors we have used directly supply from charging and discharging lead acidic battery 12V, 1.3A/hrs.

IV. Methodology

Ultrasonic sensor is used to maintain the ideal distance between the object and the robot. We have set the safe distance as 5 cm based on the capacity of the sensor. 2 IR sensors is used to track the path in which the object or

human is moving. With the aid of such data, robots can be instructed and operate accordingly to avoid losing the target object. The combination of these two sensors will send the command to the Arduino motor driver which then limits the speed and the direction of the robot. The Fig. 2 gives the working model of the droid robot which is following the human beings.

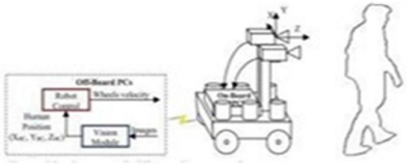

Fig 2. Working of the droid of our project

V. Hardware Development of the Project

First, we have to build a frame or chassis as per the requirement now arrange the component in chassis 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 of Arduino. 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 shield. And now, similarly motor2 is connected to 3 and 4 pins of the motor driver shield, and now motor3 connects to 5 and 6 pins of the motor driver and the last one being the motor controlled aspects. The Fig. 3 gives the internal structure of the developed robot.

VI. 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 hard ware 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 senses all the data and provide it to the microcontroller chip. Microcontroller part software take all data from the whole 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. The Fig. 4 gives the external structure of the developed robot.

VII. Results and Discussions

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 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.

VIII. Conclusion

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 used 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,

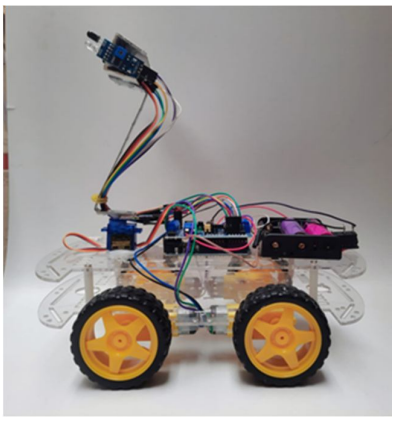

Fig 3. Internal structure of the developed system

Fig 4. External structure of the developed system

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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