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Human Following Robot

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Abstract: *Humanoid robotics is an emerging research field that received significant attention in the last few years and remains to be one of the key contributors in robotics research and numerous applications in the 21st century and beyond. In this fast-paced world, a robot like "A Human Following Robot" is needed that can share space and interact with them. Due to its human following potential, These robots can work as assistants for humans in various situations, and it can also acquire or monitor some kind of information associated with the human subject. In this paper, we present a prototype that uses Arduino Uno along with some basic sensors such as an ultrasonic and an IR sensor. All the processing is carried out. It is done by the microprocessor whereas the control of the motors is done by the controller. This robot can be further modified by using many technologies such as Bluetooth, PixyCamera etc..*

Keywords: Human following, Ultrasonic Sensor, IR Sensor, Arduino Micro Controller

I. INTRODUCTION

Robotic technology has increased remarkably in the last few years. So, this was teched in the brain of some people only a few years back, huh? Nevertheless, in this rapidly changing world, there is a need for a robot like "A Human Following Robot" which can interact and live together with humans as they do. The evolution of robot technology has been increasingly augmented by the industrial, medical, and military applications. In several fields with extreme environments such as underground mining, war zones, medical, construction, space exploration etc, the work done by one is a very high risk. The situations of the workers are also even endangered. The things that human beings do are still of low performance in various ways. To overcome the limitations of a human being in vision, speed, consistency, flexibility, quality, etc. we need to utilize robots. The robots need a human recognition skill as the major skill before interaction using long signals or non-tech-methods. The major purpose of this dissertation is to produce a robot that can assist humans in the completion of different tasks.

This paper shows a prototype of a human following robot which uses Arduino Uno and different sensors for detecting and following an object. The Robot must follow the following objectives:

- The robot must be able to precisely follow a person.
- It must be able to take a variety of turns.
- The robot must be the non-sensitive one to environmental factors like noise.
- The robot should have the ability to evade collision.

II. SYSTEM CIRCUIT DIAGRAM AND COMPONENTS

2.1 Circuit Diagram

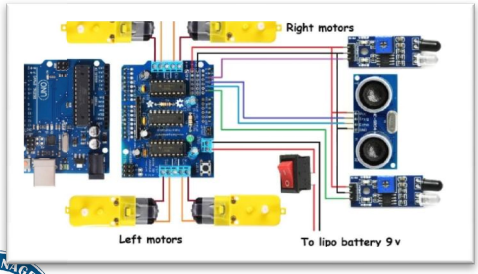

Figure 1: Human Following Robot Circuit

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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 by operated by the human behavior . And it also give feedback to the other components and human. So that it can be the 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

III. WORKING

Our system consists of a four wheel robotic vehicle attached to a different microprocessor and control unit as well as different sensors and modules i.e. ultrasonic sensor, infrared sensors that allow them to move relative to humans and objects in their environment. The above sensors are paired with each other and assist the robot with its function and to reach its destination by avoiding the obstacles and keeping a certain distance from the object. We employed ultrasonic sensor for the hindrance removal and for the distance maintenance as well. The ultrasonic sensor is of high performance in the distance of 4 meters; it works well.

3.1 Ultrasonic and IR Sensor Principle

An ultrasonic sensor is fitted into the top of the robot, and a pair of IR sensors is mounted on either side of the ultrasonic

sensor. We used ultrasonic sensors for obstacle avoidance and to maintain a specified separation distance from the object. The working range of ultrasonic sensors goes up to 4m. Ultrasonic sensors estimate the time intervals between the emitting and reflecting signals. The infrared sensors sense the distance of the object with respect to infrared emissions. When the beam from the transmitter detects the object, it returns to the receiver offset at an angle after reflection. A triangulation rule is also involved. This triangulation method used to calculate the distance traveled by the robot was further refined to minimize errors in robotic movement due to displacement.The IR sensor controls motor movements while ultrasonic sensors detect obstacles and stop the motors.

IV. RESULTS

Numerous experiments were conducted and tests were done for performance on the human-following robot. This was performed under ultrasonic and infrared sensors. It was clear that the sensor was performing accurately with an effective range of 4 meters. Then we checked if the robot maintains a specific distance from the target object. Next, the serial communication between Arduino, the motor shield, and various motors was assessed. On the basis of the results obtained from these tests and experiments, we made the necessary changes in the processing and control algorithm. After completion, we noted a clutter of awe results. The robot was doing well in following the person wherever he or she goes. Thus the objective for implementing a good Human-Robot interaction was achieved.

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Figure 2: Human Following Robot

V. APPLICATIONS

Upon their deliberation on environment and surrounding, they were able to come up with a great thought to design a robot that will assist humanity by serving the purpose of being a helping hand. Such type of robots can be adapted for numerous purposes, and with a little engineering, it may strive to even work as a companion. These types of robots could perform limitless jobs that include load assistance to people in hospitals, libraries, airports, and others.

VI. FUTURE WORK

This research opens several exciting applications in various fields such as military and medical. Wireless communication features may be added on to provide the robots with increased versatility to enable remote operations. The operational skill of this robot may also find application in military areas. Equipped with a real-time video recorder to be placed on top of the camera, a view over the place becomes feasible while sitting comfortably in the safety of a room. Other modifications are possible, either programmed or structural, to frame for similar purposes. The same would assist the civilian in a shopping mall, whereby it will work as a luggage carrier; thus, there is no need to carry heavy loads or pull it. Likewise, ample amounts of modifications could be introduced to the prototype for various applications.

VII. 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 co operate, communicate, and expand understanding of electronics, mechanical systems, and their integration with programming.

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