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Gesture Controlled Robot with Obstacle Avoidance using Arduino and Android

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Abstract - *A Gesture Controlled robot can be controlled by simple human gestures. The user just needs to wear a gesture device in which a sensor is included. The sensor will record the movement of hand in a specific direction which will result in the motion of the robot in the respective directions. The robot and the Gesture instrument are connected wirelessly through radio waves. User can interact with the robot in a more friendly way due to the wireless communication. We can control the car using accelerometer sensors in a Android mobile. The radio frequency sensors are intended to replace the remote control that is generally used t run the robot. It will allow user to control the forward, backward, leftward and rightward movements.*

One among such application is obstacle avoidance robot. We are integrating obstacle avoiding system in this robot which will use a sonar sensor to identify the distance of the upcoming obstacle and automatically override the user instructions to prevent the robot form collision. Only the motion in the direction of obstacle is stopped and the user can navigate in other directions.

Key Words: **Arduino, Accelerometer, Ultrasonic sensor, Motor driver, Bluetooth module, Android application, Power supply.**

1. INTRODUCTION

A gesture control robot is an Accelerometer based robotic device (or) vehicle which is capable to detect the tilt of hand and move according to it. There are several ways to recognize a human gesture that a machine would be able to understand. The gesture can be captured using a CCD camera, or a data glove. Gestures can also be captured via Bluetooth or IR waves, Acoustic, Tactile, optical or motion technological means. The embedded systems designed for specific control functions can be optimized to reduce the size and cost of the device, and increase the reliability and performance. With the invention of Smartphone and other modern technologies, operating machines have become more flexible. The Smartphone are equipped with in-built accelerometer which may be used for gesture recognition. Moreover, the Android OS is gaining significant popularity in the world of Smartphone due to its open architecture. Android platform is being used in the development of numerous applications for cell-phones.

There are various modes of communication between the microcontroller of the robot and the Smartphone. However, the popularly used means of communication is done via RF, Bluetooth or Wi-Fi. In this project an android operated phone is incorporated as an accelerometer, a Bluetooth module is incorporated in the robot that serves as the means of receiving the data from the Smartphone which is processed in the Arduino to detect the direction of movement of the users hand and move the robot accordingly.

An Obstacle Avoidance Robot is an intelligent robot, which can automatically sense and overcome obstacles on its path. It contains of a Microcontroller to process the data, and Ultrasonic (sonar) sensors to detect the obstacles on its path

1.1 Objective

The main objective of this project is to interface two robotic system i.e.; gesture controlled robot and obstacle avoidance robot. In addition to that, the objective of this project is to help in military operations, physically challenged people, material handling and transferring equipments.

1.2 Literature review

Prajwal Ashwin Jawalekar, in the "Robot control by using human hand gesture using hand gestures". The gesture controlled robot can be controlled by normal hand gestures. The accelerometer controls the movement of the car.

Premangshu Chandra, Pallab kanti Mukherjee, in the "Gesture controlled robot using arduino and android" The theme of this project wireless controlled robot using arduino ATmega32 processor and an android operated application to control the gestures via Bluetooth module. The android operated phone is incorporated as an accelerometer.

Manisha Kukde, Sanchita Nagpurka, Akshay Dhakulkar, Akshay Amdare, in the "Automatic and manual vaccum cleaning robot" The project is to design and develop robotic floor with obstacle avoidance. RF modules have been used for wireless communication between remote and robot having range 50m.

Amrutha S Raibagi, Surabhi Anand B, Swetha R in the

"Ultrasonic anti crashing system for automobiles" attempted to develop an anti-crash warning system combined with ultrasonic ranging technology and sensor technology for automobiles. It mainly focuses on potholes in the road and its detection and hence automatic or manual reduction in the speed of the vehicle in order to avoid crashing.

1.3 Block diagram

The fig 1 shows the block diagram of the Gesture Controlled Robot with Obstacle Avoidance using Arduino and Android.

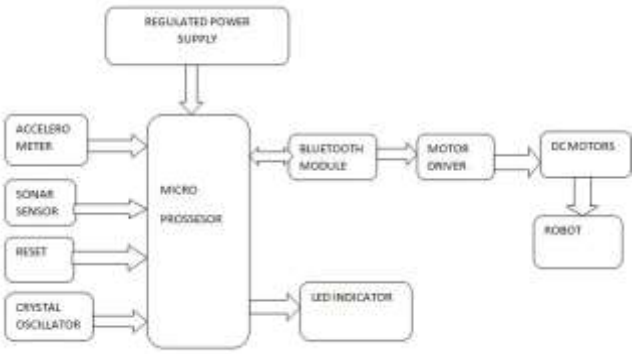


Fig 1 Block diagram

1.4 Proposed work

The gesture controlled robot is a wireless operated robot and has two parts: Transmitter and Receiver. When the power of 9V is supplied to robot, the transmitter part, which consists of Arduino, Accelerometer and RF Transmitter will continuously monitor the ultrasonic sensor.

This data is captured by the Arduino, which then transmits a corresponding data to the Encoder, based on the orientation of the Accelerometer of the android mobile phone through an android application 'ArduinoRC'. The parallel data received by the encoder is converted into serial data and this serial data is transmitted by the RF Transmitter.

At the receiver section, the RF Receiver i.e. Bluetooth module(HC 05) receives the serial data and transmits it to the Decoder IC. The Decoder will convert the serial data to parallel data and this parallel data is given to the motor driver IC. Based on the data, the movement of the motor driver, IC motors and hence the movement of the robot is defined. The robot moves forward, backward, right and left when there is tilt in the mobile phone holded in the palm of user in forward, backward, right and left respectively.

2. HARDWARE DESCRIPTION

2.1 Arduino Nano

Arduino nano is a small, compatible, flexible and breadboard friendly Microcontroller board, based on ATmega328p (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x). Arduino Nano Pin out contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins. Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage. This board doesn't use standard USB for connection with a computer, instead, it comes with Mini USB support.

2.2 Accelerometer

An accelerometer is an electromechanical device used to measure acceleration forces. Such forces may be static, like the continuous force of gravity or, as is the case with many mobile devices, dynamic to sense movement or vibrations.

2.3 Ultrasonic sensor

The HCSR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent noncontact range detection with high accuracy and stable readings in an easy to use package.

2.4 Bluetooth Module (HC 05)

The **HC-05** is a very cool module which can add two-way (full-duplex) wireless functionality to your projects. You can use this module to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. There are many android applications that are already available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any microcontroller that supports USART.

2.5 Motor Driver

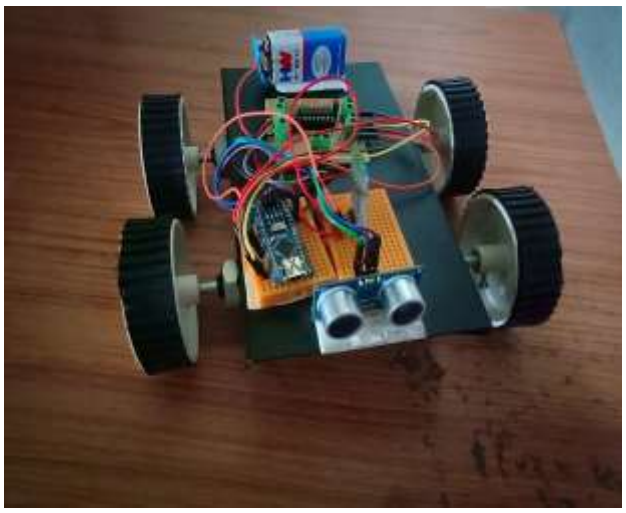
A motor driver IC is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver ICs act as an interface between microprocessors in robots and the motors in the robot. The most commonly used motor driver IC's are from the L293 series such as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously.

2.6 DC Motor

DC motor is used for the conversion of direct current into mechanical motion. The mechanical motion could be rotary or linear. A magnetic field is produced as the current passes through the wire, or coil of wires. This magnetic field opposes against the permanent magnet set the right beside the coil thus resulting in a force going up or down depends on the right hands rule.

2.7 Battery

The Hi Watt 9V battery is an affordable, reliable, dedicated low-power solution to provide sufficient energy to your circuit. Ideally used in circuits with low power consumption so that it can work for longer durations.



3. CONCLUSION

In this paper, Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested. This kind of robot gives an intelligent approach to help physically challenged people to reach their destination, in military applications, in domestic use, in material handling.

4. FUTURE SCOPE

The Gesture controlled robot designed in this work has many future scopes. In future most of the industries including automation, medical field, gaming, etc will be using gesture technologies, providing a greater revolutionary in surgery and for gamers it brings a new way of gaming experience. For disabled persons it is like a support to them and make feel them secure to reach beyond their limits.

The robot can be used for surveillance. The robot can be applied in a wheelchair where the wheelchair can be driven by the movements of rider's hand. Wi-Fi can be used for communication instead of Bluetooth to access it from a greater distance. Edge sensors can be incorporated to it to prevent the robot from falling from any surface. Some camera can be installed which can record and send data to the nearby computer or cell-phone.

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