

Multi-Way Controlled Robotic Vehicle

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ABSTRACT

In the modern world, the Robots play a vital role in replacing manual works especially in assisting handicapped people. When we take so many robots the drawback present in it is that it will operate only in single mode but in this work the Multi-Controlled Robot can be operated under hand gesture mode, mobile and voice controlled modes. The purpose of this work is to implement a wheel chair for disabled people to navigate themselves using different modes of operation. In Hand Gesture Control mode, robot can be controlled by simple gestures. And also the robot can be controlled by means of Voice and mobile application using Bluetooth. The microcontroller used here are Arduino Nano (ATmega328) for hand glove and Arduino Mega (ATmega2560) for receiver section.

Keyword—Arduino based wheel chair, smart robot, robot for disabled, robot, gesture controlled, multi control.

I. INTRODUCTION

Gesture recognition technologies are much younger in the world of today. At this time there is much active research in the field and little in the way of publicly available implementations. Several approaches have been developed for sensing gestures and controlling robots. Glove based technique is a well-known means of recognizing hand gestures. It utilizes a sensor attached to a glove that directly measures hand movements.

There are over 21 million persons with disability in India [1], which constitutes more than 2% of the population. Nowadays most of us were able to see people who were unable to move from one place to another.

Though there are technologies available for overcoming the above difficulties, they have certain drawbacks. The existing models with drawbacks are,

- Wheelchairs operated using eyeball movement[2], which lags in accuracy and control when comparing with hand gesture control
- Joystick interfaced wheelchairs(wired or wireless)[3], Remote controlled robot[4], can be operated in only one way whereas our project can be operated in multi-ways

- In Steering operated robot[5], the user will feel difficult to operate while multi-way robot has simple gesture and voice command operation

In this project the robot can be controlled in multiple ways and can be used for several purposes unlike the existing model which limits the user to use it only for single operation.

While considering the eyeball gesture wheel chairs the controlling and accuracy will not be in expected level for the user because there are chances for the direction of the robot to go on the wrong track. This fault can be rectified by using appropriate hand gestures and voice.

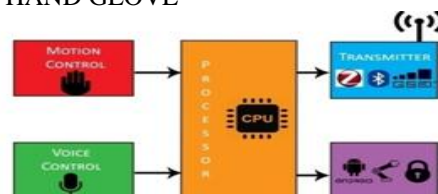
A Gesture Controlled robot is a kind of robot which can be controlled by hand gestures and not the old fashioned way by using buttons. The user just needs to wear a small transmitting device on his hand which includes a sensor which is an accelerometer in our case. Movement of the hand in a specific direction will transmit a command to the robot which will then move in a specific direction. The transmitting device includes an accelerometer which is used to sense tilting and then it will be transmitted by an RF Transmitter module. At the receiving end an RF Receiver module will receive the data. This data is then processed by a microcontroller and passed onto a motor driver to rotate the motors in a special configuration to make the robot move in the same direction as that of the hand.

II. PROPOSED MODEL

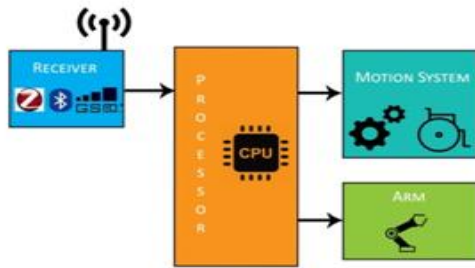
The main objective of this project is to make a simple easy way controlled robotic vehicle which can help the disabled persons and also which can be used for commercial and defence purposes. There is no remote or Joystick needed to control the Robot.

A. BLOCK DIAGRAM

a) HAND GLOVE



b) RECEIVER



B. HAND GESTURE MODE:

a) Working Description

The user has to wear the hand glove for controlling through hand gesture mode and the movements of the person will be recorded by the accelerometer sensor based on the dimensions of x,y axes with respect to angle of tilt. The output of the sensor is transmitted through the RF transmitter with the help of Arduinonano microcontroller. The wheel chair can be navigated by Arduino mega controller based on signal received through the RF receiver.

b) 3-AXIS ACCELEROMETER

3-Axis accelerometer senses acceleration and gives an analog data while moving in X,Y,Z direction or may be X,Y direction only depending on the type of the sensor[6]. It is a mechanical or electromechanical apparatus, for measuring acceleration or deceleration - that is, the rate of increase or decrease in the velocity of a moving object. The measurement of acceleration or one of its derivative properties such as vibration, shock, or tilt.

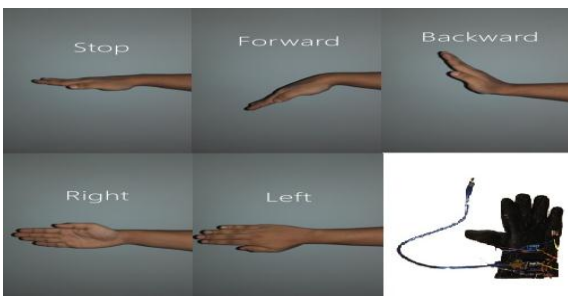
c) RF TRANSMITTER AND RECEIVER MODULE

RF stands for radio frequency;[7] It is available in different operating frequencies and with different operating range. We have used 433 MHz RF Tx/Rx module. It can transmit the signal up to 500 ft. of range at rate of 1 Kbps to 10 Kbps.

Transmitter receives serial data and transmits RF signal wirelessly to the receiver through this antenna. The length of the antenna is determined according to the frequency range of RF module.

d) Hand glove operation

If the user is choosing hand gesture mode he has to change mode switch to OFF and then user has to move his hand by wearing the hand glove. If the user wants the robot to move left for which he has to move his hand leftwards and if the user wants to move the robot forward he has to move his hand forward vice versa. If the robot has to be stopped then user has to keep his hand idle without any movement.

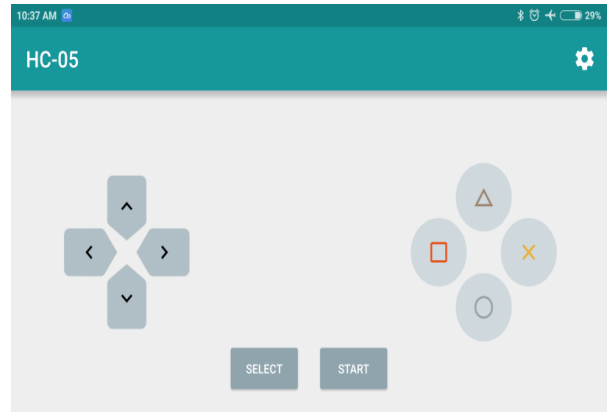


C. MOBILE CONTROLLED MODE:

If the user is opting mobile controlled mode he has to change mode switch to ON. Then he has to open blue term app and press menu button and click connect. Blue Term is an android application which can connect with any serial device using a Bluetooth serial adapter. Here the adaptor HC-05 is connected with the Arduino mega microcontroller. Now the mobile phone will be paired with Bluetooth module HC-05 by clicking connect in the application. After a successful pairing user can be able to control the Robot by opening the keyboard and pressing the following buttons

Button	Action
Up	Forward
Down	Reverse
Left	Left
Right	Right
Box	Stop

HC-05 gets the data from the mobile Bluetooth and communicates with the microcontroller, which is programmed to enable and disable the wheel motor rotation based on data received in the adapter HC-05.



E. BLUETOOTH MODULE

Bluetooth is a technology for wireless communication; it is designed to replace short-range cable connections.

HC-05 Module is a Bluetooth spp (Serial port protocol) module, designed for transparent wireless serial connection setup. It is a serial port Bluetooth, which replaces wired serial connections. Serial module's operation doesn't need drive, and can communicate with the other Bluetooth device that has the serial [8].

F. VOICE CONTROLLED MODE

If the user wishes to control Robot via Voice then the user has to open BT Voicer application. BT Voicer uses android mobiles internal voice recognition to pass voice commands to the Bluetooth serial modules and sends in the recognized voice as a string. After opening, the user has to speak the command (Forward/Reverse/Left/Right/ Stop or F/B/L/R/S) as per the microcontroller coding.



G. MOTOR AND DRIVER PART

a) DC MOTOR

A dc motor converts electrical energy to mechanical energy, through the interaction of magnetic fields and current-carrying conductors[9].

To move the wheel chair, two 12V DC motors are coupled to the shafts attached with the wheels. And the movement of the two motors either forward/backward or stop can be determined by the motor driver which receives the control signals from the microcontroller.

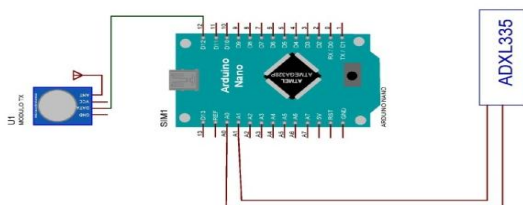
b) MOTOR DRIVER

Motor driver L293D[10] aims the motors to run at either directions with the usage of 4 output pins and 4 input pins which reads the control commands from the microcontroller. It uses H-Bridge which is typically an electrical circuit that enables a voltage to be applied across the motor in either direction as an output. And it just results in reversing the direction of current to rotate the motor in reverse direction.

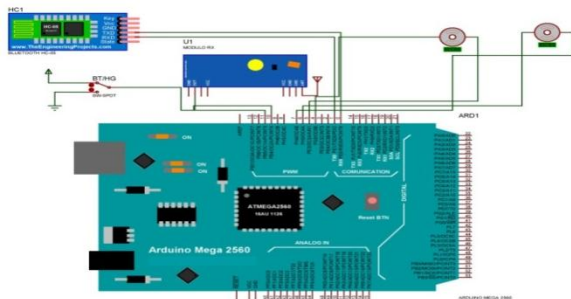
H. HARDWARE IMPLEMENTATION

a) SIMULATION DIAGRAM:

i. HAND GLOVE

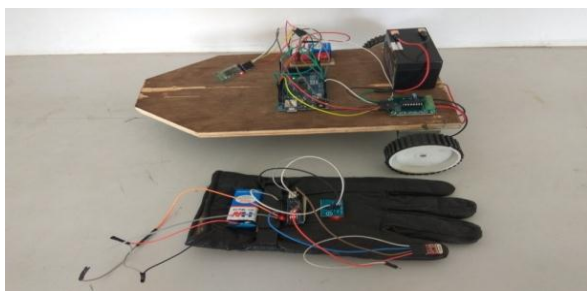


ii. RECEIVER



The user has to intimate whether the robot has to operate in hand gesture mode or voice controlled mode or mobile controlled mode.

b) DEVELOPED PROTOTYPE



III. CONCLUSION & FUTURE SCOPE

It can be used by all types of disabled people (Leg – hand gesture, Hand – Voice etc.). Operation is also simple

This project enables the physically disabled persons to return to their normal life. Gesture controlling mode and other controlling modes as an amalgam in the same robot will be very helpful for handicapped and physically disabled people to achieve certain tasks, such as driving a vehicle. And it can also be used for defusing bombs in military, scavenging wastes etc.

The device must be designed as based on its applications and usage. For example if it is used for military purposes design it should be fully bullet proof.

This could be extended for detection of obstacles for the blind people and it can be used as small pick and place robot for physically disabled persons

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