

Design and Analysis of Gesture Controlled Wheelchair

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ABSTRACT

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 wheelchair. 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

A Gesture Controlled wheelchair is a kind of wheelchair 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 wheelchair which will then move in a specific direction. The transmitting device includes a Comparator IC for assigning proper levels to the input voltages from the accelerometer and an Encoder IC which is used to encode the four bit data and then it will be transmitted by an RF Transmitter module.

At the receiving end an RF Receiver module will receive the encoded data and decode it by using a decoder IC. 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 wheelchair move in the same direction as that of the hand.

Keyword: A Gesture Controlled wheelchair, accelerometer, transmitter and receiver arrangement.

1. INTRODUCTION

Recently, strong efforts have been carried out to develop intelligent and natural interfaces between users and computer based systems based on human gestures. Gestures provide an intuitive interface to both human and computer. Thus, such gesture-based interfaces can not only substitute the common interface devices, but can also be exploited to extend their functionality. A wheelchair, often abbreviated to just "chair", is a chair with wheels, used when walking is difficult or impossible due to illness, injury, or disability. Wheelchairs come in a wide variety of formats to meet the specific needs of their users. They may include specialized seating adaptations, individualized controls, and may be specific to particular activities, as seen with sports wheelchairs and beach wheelchairs. The most widely recognised distinction is between powered wheelchairs ("powerchairs"), where propulsion is provided by batteries and electric motors, and manually propelled wheelchairs, where the propulsive force is provided either by the wheelchair user/occupant pushing the wheelchair by hand ("self-propelled"), or by an attendant pushing from the rear ("attendant propelled").

2. LITERATURE REVIEW

The literature towards the design methodologies proposed by different authors is collected and presented in the subsequent paragraphs.

Dr.Shaik Meeravali

Development of a Hand-glove controlled wheel chair based on MEMS. This paper purpose of life in the lives of disabled people based on MEMS, The aim at incorporating the modern ways of wheel chair dynamics and control and at the same time making it cost effective, so that it is affordable to the common masses. The goal of this research is to develop a wheelchair system which controls its movement by the merely bending of a person's fingers. In this research a prototype of an affordable and technologically advanced wheelchair is to be designed and developed. The proposed prototype will be communicating wirelessly between the controller and the plant and it will also replace the traditional joystick by the implementation of user hand glove control based on MEMS. The MEMS sensors inside the glove can sense the movement of fingers. The controller sends the signals to the receiver section which is placed under the wheelchair through a wireless technology. In The receiver section get the signals from the transmitter according to the signals the motor is running which changes the wheel movement. The technologies presented in this paper suggest a wide domain of possibilities to a wide variety of users. In addition, it also aims at making a hi-tech wheelchairs are made and so that control the security problem with Alarm and cost effective by people Disabilities.

Amruta S. Magar¹, M.R.Bachute

This paper, presents hand gesture controlled wheelchair using image processing through web camera. This proposed system is totally depend on the raspberry pi board that contains the Arm11 controller that should controls the movements of the wheelchair with help of web camera and dc motor. This system not only recognizes hand gesture but also control the wheelchair according to the hand movement i.e. wheelchair will perform according to the number of finger. The fingers will be recognized and the wheelchair movement will be done in 360°. This System approaches the vision based methodology exposed hand motion. This system mainly used for handicapped person having those persons could not move anywhere. This system mainly controls the wheelchair thought detection of number of fingers. This system has using the HSV color space technique to detection of hand gesture through image processing..

D. Sharath Babu Rao

Wheelchair is a device designed for moving physically challenged people, shifting patients from one place to another. Generally wheel chairs are driven manually with the help of another person or by means of self – propelling. To reduce the complexities for those who don't have strength to move their chairs by themselves the wheelchairs are automated. Depending on the human instructions in the form of audio, hand gestures, or head gestures automation is done. In this wheel chair is automated using hand and head gestures. The mems sensor which is connected to head is accelerometer. Touch pad is used for hand gestures. In this project there are two modes based on the gestures from head or hand. 1. Based on the head gestures 2. Based on the hand gestures. By using a switch the mode of operation is selected by user. Accelerometer senses the angular movement of the head. Based on the data from either the accelerometer or touchpad the movement of the wheelchair is controlled. Battery is used to provide power supply to move the wheels.

Deepak Kumar Lodhi

This paper describes the design of a smart, motorized, voice controlled wheelchair using embedded system. Proposed design supports voice activation system for physically differently abled persons incorporating manual operation. This paper represents the "Voice-controlled Wheel chair" for the physically differently abled person where the voice command controls the movements of the wheelchair. The voice command is given through a cellular device having Bluetooth and the command is transferred and converted to string by the BT Voice Control for Arduino and is transferred to the Bluetooth Module SR-04connected to the Arduino board for the control of the Wheelchair. For example, when the user says „Go" then chair will move in forward direction and when he says „Back" then the chair will move in backward direction and similarly „Left", „Right" for rotating it in left and right directions respectively and „Stop" for making it stop. This system was designed and developed to save cost, time and energy of the patient. Ultrasonic sensor is also made a part of the design and it helps to detect obstacles lying ahead in the way of the wheelchair that can hinder the passage of the wheelchair

Fahad Wallam and Muhammad Asif

many disable persons are able to operate a joystick to control the electric wheelchair but on the other hand, many people do not have the legerdemain necessary to operate a joystick. Moreover, many of them face difficulty to avoid obstacles. The aim of this paper is to implement a multi-control system to control the movement of the

wheelchair by integrating finger movement tracking system, a small vocabulary speaker dependent based word recognition system and a group of monitoring sensors in order to avoid obstacles. Moreover, a joystick control system is also implemented in order to facilitate the patients that are able to use the joystick. The theme is accomplished by using a micro-controller with digital signal processor for isolated word recognition and sets of sensors. The results are also given at the end of the paper.

Kohei Arai

Eyes base Electric Wheel Chair Control: EBEWC is proposed. The proposed EBEWC is controlled by human eyes only. Therefore disabled person can control the EBEWC by themselves. Most of the computer input system with human eyes only consider in specific condition and does not work in a real time basis. Moreover, it is not robust against various user races, illumination conditions, EWC vibration, and user's movement. Though experiments, it is found that the proposed EBEWC is robust against the aforementioned influencing factors. Moreover, it is confirmed that the proposed EBEWC can be controlled by human eyes only accurately and safely.

Shahid Hussain Wani¹

The motivation behind VOICE CONTROLLED WHEELCHAIR USING ANDROID TECHNOLOGY project is to build an automated wheelchair that helps the physically disabled peoples to locomote from one place to another. As we know that many wheelchairs are available with different running technologies, but the cost is very high and it is not much effective. Mostly, the idea of building VOICE CONTROLLED WHEELCHAIR is to overcome some disadvantages of the existing systems. The wheelchair is controlled with the help of an android mobile application. The purpose of selecting the Android platform is that nowadays Android mobile phones are commonly used. The user has to first get connected with the wheelchair with the help of the application. The user then has the GUI to control the wheelchair. This system allows the user to robustly interact with the wheelchair at different levels of the control (turn left, turn right, go ahead, go back and stop) and sensing. This project uses Arduino kit Microcontroller circuit and DC motors to create the movement of the wheelchair and Ultrasonic Sensors to detect the hurdles in between wheelchair and the way of direction.

3. COMPONENTS USED

3.1 ACCELEROMETER (ADXL335)

An Accelerometer is an electromechanical device that measures acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic caused by moving or vibrating the accelerometer. It is a kind of sensor which record 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.

| PIN NO | SYMBOL FUNCTION |
|--------|---------------------------------------|
| 1 | Z Records analog data for Z direction |
| 2 | Y Records analog data for Y direction |
| 3 | X Records analog data for X direction |
| 4 | GND Connected to ground for biasing |
| 5 | VCC +3.3 volt is applied |

3.2 GENERAL PURPOSE PCB

It is the type of printed circuit board with less cost. This is very compact for project makers. It provides space to solder easily the components to make circuit. It does not need chemicals to remove coatings, because there is no coating. It is best suitable for the beginners.

3.3 ENCODER IC (HT12E)

HT12E is a remote control encoder paired with HT12D utilizing CMOS technology. It encodes data and address pins into serial coded waveform suitable for RF or IR modulation. HT12E has a maximum of 12 bits of tri-state address pins providing up to 312 address codes; thereby, drastically reducing any code collision and unauthorized code scanning possibilities. The pin description is shown below. It has 4 input while 1 output pin. The address pins can also be utilized as data pins.

3.4 RF MODULE (Rx/Tx)

Radio frequency (RF) is a rate of oscillation in the range of about 3 KHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals.

Although radio frequency is a rate of oscillation, the term "radio frequency" or its abbreviation "RF" is also used as a synonym for radio – i.e. to describe the use of wireless communication, as opposed to communication via electric wires

The RF module is working on the frequency of 433 MHz and has a range of 50-80 meters.

3.5 DECODER IC (HT12D)

HT12D is a remote control decoder paired with HT12E utilizing CMOS Technology. It has 12 bits of tri-state address pins providing a maximum of 312 address codes; thereby, drastically reducing any code collision and unauthorized code scanning possibilities. The input data is decoded when no error or are found. It has 1 input while 4 output pins. The address pins can also be utilized as data pins.

3.6 MICROCONTROLLER (Ardiuno UNOR3)

The processing is the most important part of the robot. Till now we get the data from the decoder. Based on that data decisions have to be made. So here the role of microcontroller comes up. We used a microcontroller for our robot to give it a decision capability. Our microcontroller is made up by Atmega138 and the product name is ardiuno UNOR3

3.7 MOTOR DRIVER IC (L293D)

It is also known as H-Bridge or Actuator IC. Actuators are those devices which actually gives the movement to do a task like that of a motor. In the real world there are different types of motors available which work on different voltages. So we need a motor driver for running them through the controller.

The output from the microcontroller is a low current signal. The motor driver amplifies that current which can control and drive a motor. This IC can able to rotate the motors in both clockwise and anticlockwise direction.

3.8 DC MOTORS

A machine that converts DC power into mechanical power is known as a DC motor. Its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force.

DC motors have a revolving armature winding but non-revolving armature magnetic field and a stationary field winding or permanent magnet. Different connections of the field and armature winding provide different speed/torque regulation features. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current.

3.8.1 DC GEAR MOTOR

A geared DC Motor has a gear assembly devoted to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and dropping the speed. Using the correct arrangement of gears in a gear motor, its speed can be reduced to any required figure. This concept of reducing the speed with the help of gears and increasing the torque is known as gear reduction.

Reducing the speed put out by the motor while increasing the quantity of applied torque is a important feature of the reduction gear trains found in a gear motor. The decrease in speed is inversely relative to the increase in torque. This association means that, in this sort of device.

3.9 SUSPENSION

suspension is the system, or systems, used to suspend the rider and bicycle in order to insulate them from the roughness of the terrain. Bicycle suspension is used in our project.

4. DESIGN OF CIRCUIT

Transmitter circuit consist of few components .They are

1. RF Transmitter
2. Accelerometer(ADXL335)

3. Encoder (HT12E)
4. Arduino or Lily pad arduino
5. Battery (9v)
6. Resistor (750kohm).

The receiver circuit consists of few components. They are

1. RF Receiver
2. Voltage regulator(IC7805)
3. Resistor(33kohm)
4. Decoder(HT12D)
5. Motor Driver(L293D)
6. DC geared motor(150rpm)
7. Battery (9v) and (12v).

5. WORKING PRINCIPLE

In our experiments, Accelerometer based gesture controlled wheelchair moves according to the movement of hand as we place the accelerometer on your hand. When we tilt hand with an accelerometer in front, then the wheelchair starts moving forward until the next movement is given. When we tilt hand in backward direction, then the wheelchair changes its direction and state. Then it starts moving in backward direction until the next signal is given. When we tilt hand on left side, then the wheelchair moves into left side until the next signal is given. In the same way, when we tilt hand in right side, then the wheelchair moves right side.

Receiver circuit section of our project

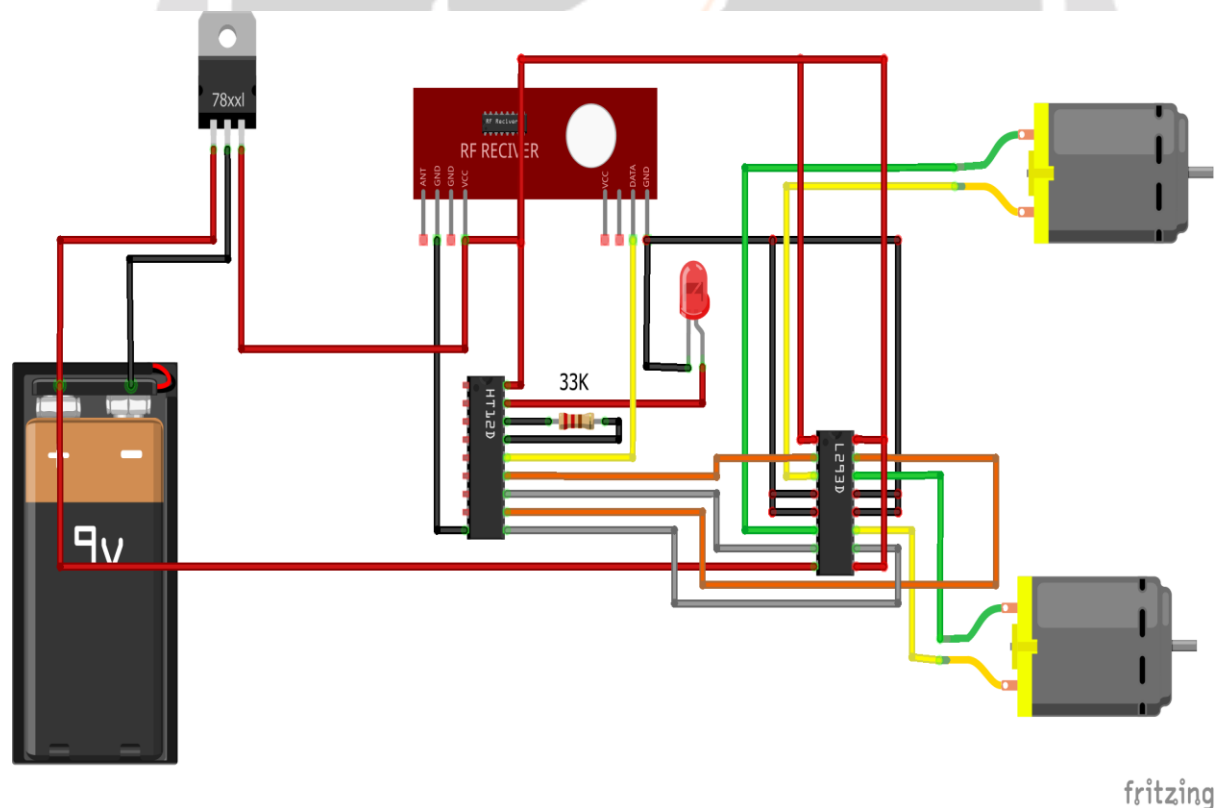


Fig-4.1: Receiver circuit

Transmitter circuit section of our project

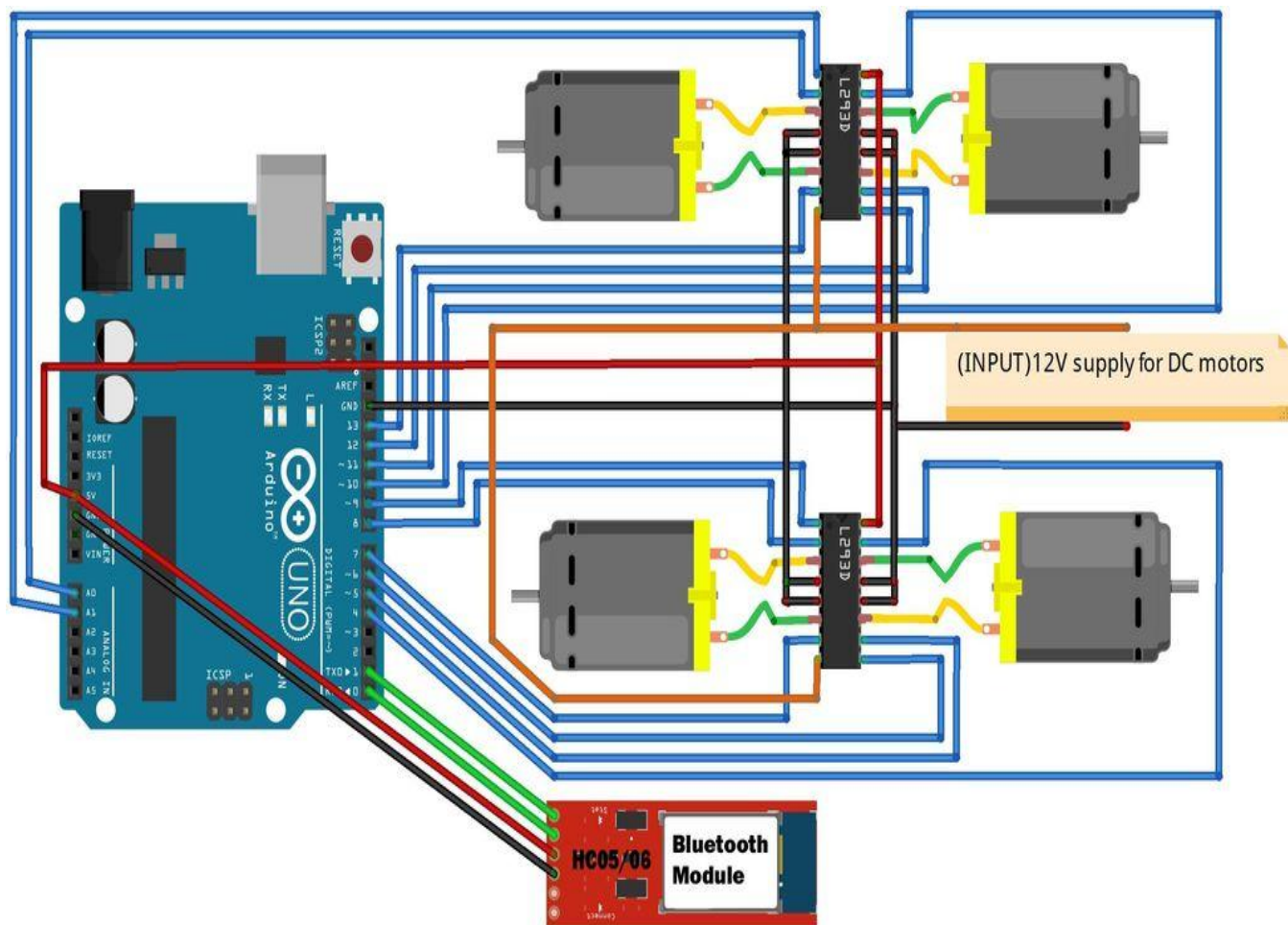


Fig-4.2: Transmitter circuit

5. CONCLUSION

Automated wheel chair can be used to help handicapped people, especially those who are not able to move. The system was successfully implemented to move the wheel chair Left, Right, Forward, Backward or Stay in the same position.

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