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Gesture Controlled Wheelchair

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Abstract

The most difficulty faced by physically challenged people is that they have to depend on others for their movement. We have developed a gesture-controlled wheelchair to make them independent. The user just needs to wear a gesture device in which an accelerometer sensor is included. The sensor will identify the movement of the hand in a specific direction which will result in the motion of the wheelchair in the respective directions. An ultrasonic sensor is also used for detecting obstacles in the path. We present a very useful and integrated approach to real-time detection and control of direction by hand using gestures. Nowadays joystick-controlled wheelchair is available in the market whose cost range between Rs 70,000 to Rs 140,000. We are developing the Hand Gesture Controlled Wheelchair in Rs 35,000. The wheelchair is designed in a cost-effective way but ensures safety, flexibility, and mobility for the users.

Keywords: *Gesture, wheelchair, concept, algorithm*

INTRODUCTION

This project is to develop a wheelchair which is useful to the physically disabled/challenged person using hand movement or by using hand gesture reorganization. With the help of the wheelchair, the physically disabled person can move himself to the desired location with the help of hand gestures that control the movement of the chair. This project aims to provide a feasible solution to those handicapped/disabled people who do not have the ability to move the wheelchair by themselves. These include people with the serious paralytic condition. The percentage of disabled people is getting increased in both rural and urban part of India. The disability may be caused by birth or due to some medical or by accidental reason. Today in India many people are suffering from disabilities, there are people whose lower half of the body is being paralyzed. This Wheelchair increases comfort and makes the life of people bit easier. Around 500000 people are affected by movement disability. Out of total disability maximum people suffers from a disability in movement. Wheelchair automated control systems proved that it is a very versatile tool for many problems in human-computer interface systems. This Wheelchair benefits to people who are:

- Paralytic person.
- Those who crawl.
- Those who walk with the help of aid.
- Those have acute and permanent problems of joints/muscles.
- Those who have stiffness or tightness in movement or have loose, involuntary movements or tremors of the body or have fragile bones.
- Those who have difficulty in motor cell and neurons coordination.
- Those who have lost the sensation in the lower part of the body due to paralysis or other problems.
- Those who have twisted body parts and suffer from any kind of deformity in the body.

LITERATURE REVIEW

When an unfortunate event like leg problems affect the person, it is necessary to use devices like wheelchairs that offer a means of displacement for patients with problems. Tremen-dous modification has been made in the field of wheelchair technology. However, significant advances havent been able to help quadriplegics navigate wheelchair unassisted. Some pa-tients those who cannot operate the wheelchair with their arms due to a lack of force or psychomotor problems in the superior members, request electric wheelchairs, frequently manipulated with joysticks or gesture controlled wheelchairs. However, the joystick manipulation is even not practical and frequently it must be handled with the mouth. Hence wheelchair controlled by an intuitive interface, that is gesture controlled wheelchair where the instructions are given by hand gestures has been developed.

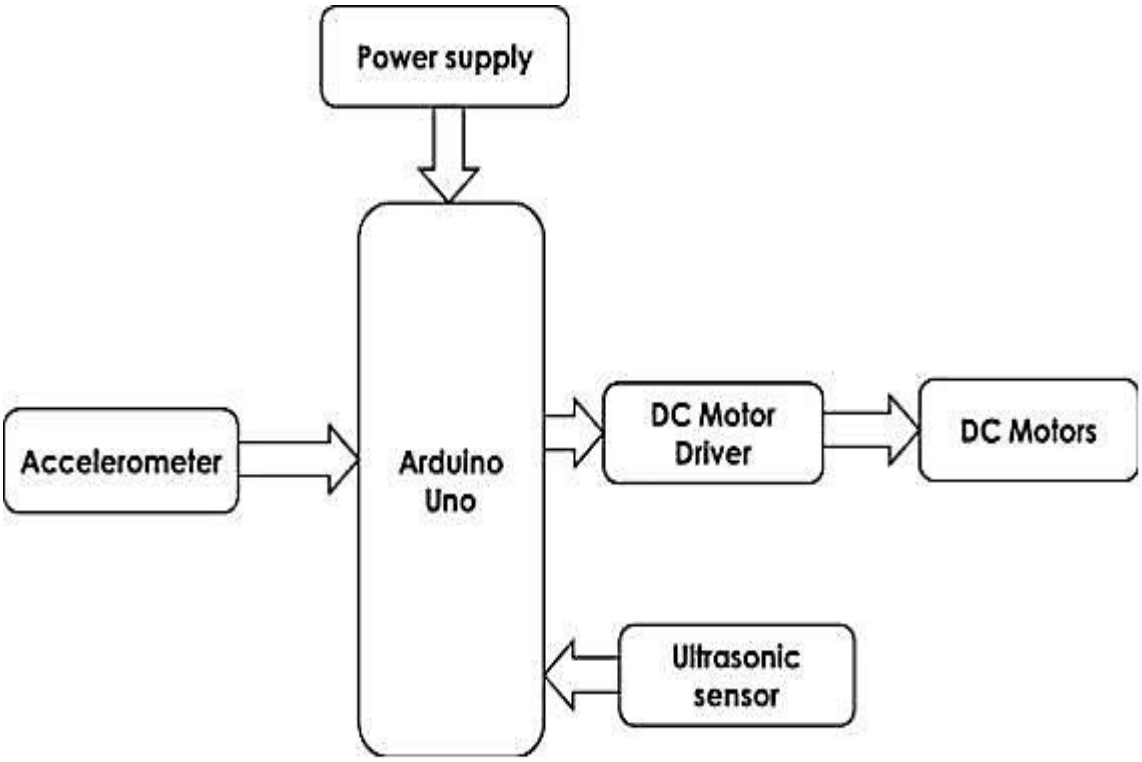

Figure 1: *Block Diagram*

THE CONCEPT

In this project, we propose to a wheelchair user with well preserved arm movements who is able to propel a manual wheelchair and to manipulate objects by hands. It is also assumed that the wheelchair can be driven either manually by the user or by electric motors coupled with the driving wheels. Electromagnetic clutches are used to couple and decouple the motors from the wheels. During indoor and outdoor usage, the wheelchair is propelled by the user by applying forces to the push rims. In that mode, the motors are disconnected from the wheels and the wheelchair performs as a standard manual wheelchair. The wheelchair can also operate in a gesture control mode where the wheelchair is driven by the motors and the wheelchair movement direction is set by the position of the users arms. The gesture control mode allows the user to control the wheelchair by intentional arm movements and to perform at the same time kitchen

tasks which require holding objects with both hands.

WORKING

In this hand gesture controlled wheelchair an ADXL335 accelerometer is used as a sensor which will be giving an analog signal on moving it in X, Y axis respectively. LM324 operational amplifier is used as a comparator to convert the analog signal to the digital signal. Radio frequency transmitter is used to transmit the signal wirelessly. Before sending, the data is encoded with an encoder IC HT12E with a secured address so as to avoid its interference from another device. This will decrease interference and unwanted noise. After that, the signal is sent wirelessly. Now, the receiver receives the signal and then it is processed through decoder so as to decode the signal further is passed through the receiver is being sent to Arduino Uno as an input. On receiving the input the signal the Arduino UNO compares the data which is preinstalled in the controller. If the input data matches the preinstalled data then the signal should be given to L293D IC. On receiving the signal the L293D IC gives the signal to relays and then the wheelchair starts moving. ADXL335 accelerometer is chosen as the sensing device because it records the minute changes. Firstly, calibrate the accelerometer accordingly so that we can control the motion of wheels and for that, we use variable resistors and check the output for different values of voltages which can be changed by using variable resistance. We use comparators to compare the two inputs and give the result accordingly. We also have to adjust the tilting angle as per the motion of the hand.

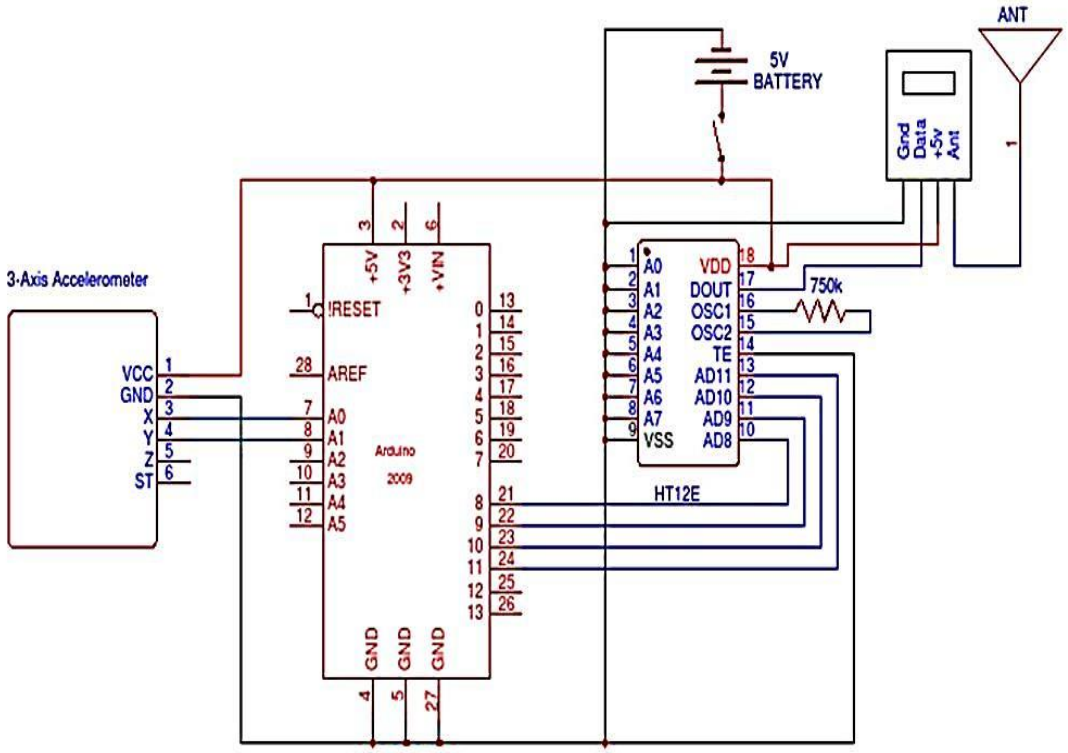

Figure 2: *Transmitter Section*

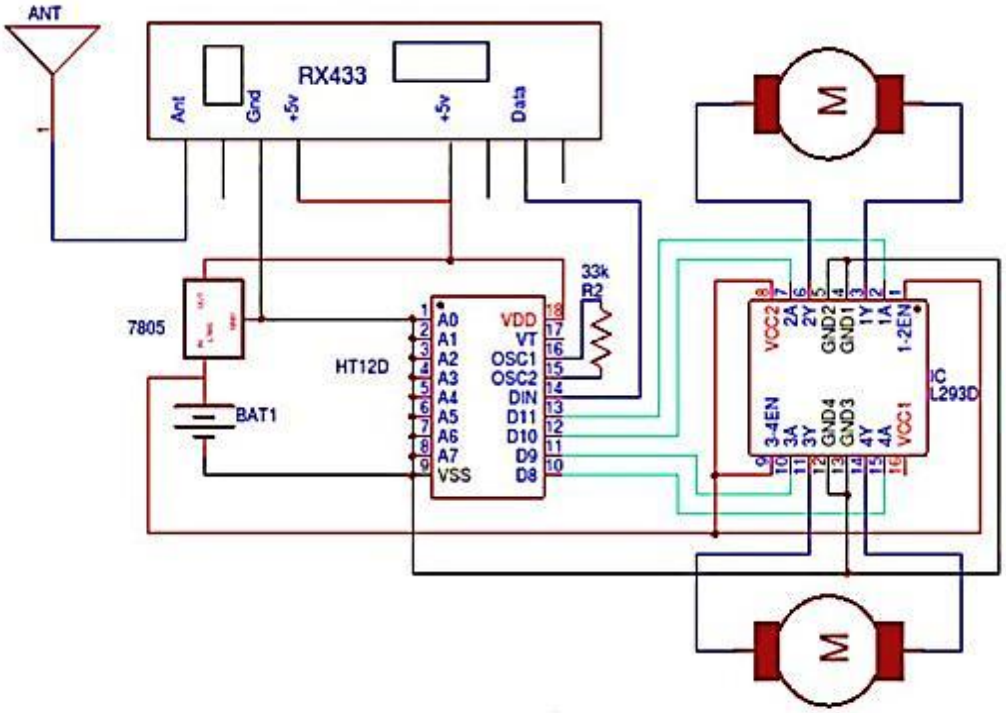

Figure 3: *Receiver Section*

SIMPLIFIED ALGORITHM

We designed a simplified algorithm for wheelchair control that was based on the recognition of the hand gestures, performed by the right arm of the user. To work on with the gesture control mode, the operator places his/her right hand in hand gesture circuit/glows. The user executes the gesture according to the instructions. During the gesture control mode, the wheelchair is driven by the electric motors. When the arm is in a neutral position, the motors do not work and the wheelchair does not move. The user sets the wheelchair movement direction by moving his/her hand away from the neutral position. If the hand is moved to the left, the wheelchair rotates to the left. In the same way, the wheelchair rotates to the right when the hand is moved to the right. Stretching the hand beyond the neutral position causes forward wheelchair movement, while the bending of the arm and moving the hand closer to the body causes a reverse movement. This way, the wheelchair direction can be controlled easily by changing the position of the users hand. The wheelchair stops when the user returns his/her hand into the neutral position. The gesture recognition mode can be turned off if the arm is moved outside the hand recognition zone.

CONCLUSION

We propose a hand gesture-based wheelchair control system for helping wheelchair users in activities that require holding an object within hands and driving the wheelchair at the same time. The viability of the proposed approach was tested with an initial prototype that was operated with the intentional motions of one hand and utilized four motion commands defined by the hand position. The effectiveness of the gesture recognition system was clarified with several initial

perfor-mance tests. The experiments gave us new practical experience and design ideas for improvement. In our future work, we intend to explore further the practicality of the system by various experimental scenarios. The long-term goal of this project is to build a new system based on the recognition of the movements of both arms and also provide certain features for more applications.

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