GESTURE CONTROLLED WHEELCHAIR

D. Sharath Babu Rao, T. Anusha

Abstract— **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.**

***Index Terms*— accelerometer, gesture sensors, touch pad, wheelchair.**

I. INTRODUCTION

Quadriplegia is a spinal cord injury resulting in loss of sensory and motor receptors which leads to loss of movement in limbs. Automated wheelchair is a device to support and help a quadriplegic. With the help of automated wheelchair, solve the problem of mobility, they do not help them in carrying out other day to day activities successfully. Quadriplegic people make use of brain signals or joystick to move the wheelchair bound person in and around places.[5]

Now a days, many of the people need wheel chair because of the increased percentage of elderly and disabled people who want to make their personal mobility easy, for them wheelchair is the suitable device. A disabled or an invalid individual (usually the disability of the lower part of the body) can find it convenient to move around and maneuver using the help of a chair constructed on wheels which can either be pushed by another individual or propelled either by physical force or electronically. Such a chair is called as a Wheelchair. [2]

Traditional wheelchairs have some limitations in terms of flexibility, bulkiness and limited functions [1]. Our approach allows the users to use gestures of movement like hands, head and synchronize them with the movement of the wheelchair so that they can use it comfort.

The control interface is one of the most important in the case of electric-powered wheelchair (EPW). In earlier days conventional wheelchairs are operated with the help of position sensing joysticks. These conventional position sensing joysticks (PSJ's) provide access to the electric-powered wheelchairs (EPW's) for many people with disabilities, but some disabled people do not have strength to operate a PSJ effectively. Tremors, spasms, weakness, and inadequate range of motion are some conditions that make it difficult or even impossible to drive an EPW using a PSJ [3].

Conventional power wheelchairs are not suitable for some people with physically handicapped and some people who are not even to move by their own. For those people the wheelchairs are made with a joystick or other standard input device. Those wheelchairs may be difficult or even impossible to get sufficient control over a power wheelchair to move within a home or some area . to overcome those problems an electrically powered wheelchairs are proposed by the electric wheelchair .

Wheel chair is a device designed for moving 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 wheel chairs are electrically powered.

Some wheelchair are designed with embedded sensors and an acquisition, processing and communication platform based on a multifunction I/O module and an embedded PC for monitoring of physiological stress parameters and motion activity of the wheelchair unobtrusive . But making use of the pc along with the chair makes it bulkier and increases complexity. This complexity is reduced by making use of the mems accelerometer , the size of which is very compact and can be placed on the fingertip of the patients. [10]

To overcome the drawbacks of the existing system we propose an efficient gesture controlled wheelchair for physically challenged people, shifting patients from one place to another. One of the advanced feature is by the user

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gestures that is head and hand gestures the wheelchair is controlled.

In the existing system user is provided with an option to move wheelchair either with the hand gestures or head gestures.

In this paper, we design and develop a gesture controlled wheelchair. The proposed wheelchair is controlled with either hand or head gestures.

II BLOCK DIAGRAM OF PROPOSED SYSTEM

Fig 1 shows block diagram of gesture controlled robot with hand gesture sensor and the receiver for wireless head gesture sensor. Microcontroller process the data from the hand and head gesture sensor. High torque dc motors are used in the wheelchair. Motors are controlled based on the data process from the microcontroller according to the user gestures.

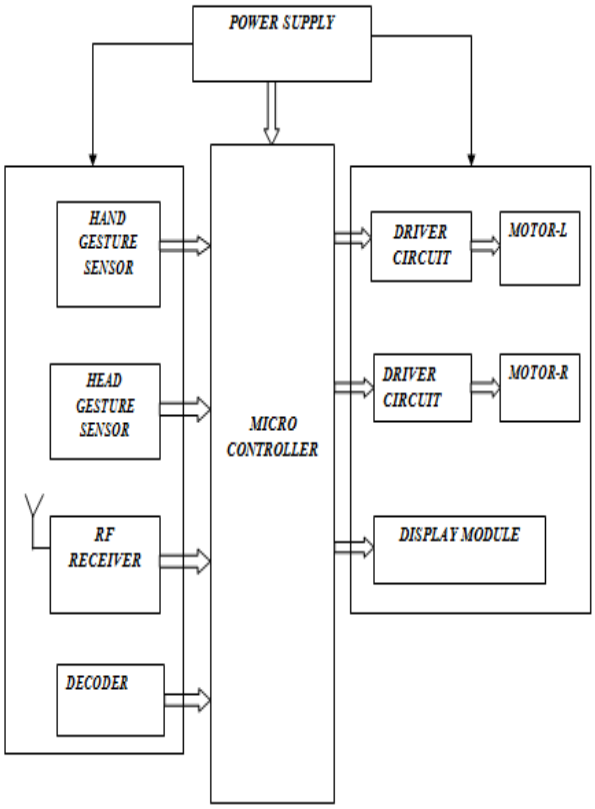

Fig1.Block diagram of gesture controller wheel chair with hand gesture sensor and receiver for wireless head gesture sensor

Wheelchair has to be built before it is to be controlled project. Wheelchair parts for the model included structure (example base, wheels), the controller, hand gesture sensor that is touch pad , head gesture sensor that is 3-axis accelerometer(ADXL330), high torque dc motor and other parts like batteries, power cables, wheels etc.

In this proposed system the wheelchair can be operated with the gestures either with hand gesture sensor or head gesture sensors. Touch pad is calibrated and place the symbols to indicate direction of motion that is forward, right, left and halt. According touch on the touch pad by using ADC in the controller the x-axis and y-axis values are calibrated and mark the directions.

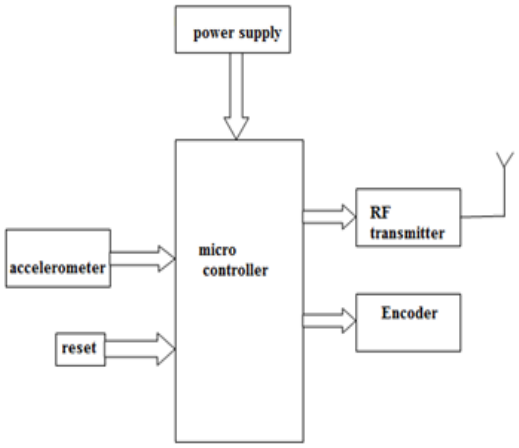

Fig 2.Block diagram of wireless head gesture sensor transmitter

Fig 2 shows the block diagram of Block diagram of wireless head gesture sensor transmitter. This basically consists of microcontroller, 3-axis accelerometer, and encoder and RF transmitter. According to the tilt of the head movement sensor which is attached to head the wireless transmitter sends the signal to the receiver and the wheelchair takes the direction of the movement.

According to the tilts of the head by using the 3-axis accelerometer the angle of tilt can be calculated with the help of ADC in the controller.

In this proposed system high torque dc motors are driven by the driver circuit. The driver circuit is designed with two IR2101(S)/IR2102(S) are high voltage, high speed power MOSFET drivers with independent high and low side referenced output channels.

PWM signal is given to the driver circuit which will rotate the wheels according the speed set by the PWM channels.

III.CONTROL STRATEGIES

The user interface has control over the microcontroller and feedbacks to the wheelchair status to the microcontroller. The system is powered through Lead-acid batteries. Wheelchair is powered with two 12V and 18A batteries connecting in series. Wireless accelerometer is powered through 7V battery. This is a two wheeled robotic system. Wheels are driven through high torque dc motors to carry human weight. The wheelchair is controlled with three different motions: Forward, right, left and halt. To make the wheelchair to move in these directions we should operate the motors as shown in table 1.

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TABLE 1

DIRECTION OF MOTORS

Direction / Motor	Forward	Right	Left	Halt
Right motor	anticlockwise	anti clock wise	clock wise	stop
Left motor	anticlockwise	clockwise	anti clockwise	stop

IV CONTROL STRATEGIES

The software running in controller is embedded C. Embedded C is a set of language extensions for the C programming language. Extra functions and libraries that are related to the specific controller have been added to the original C language.

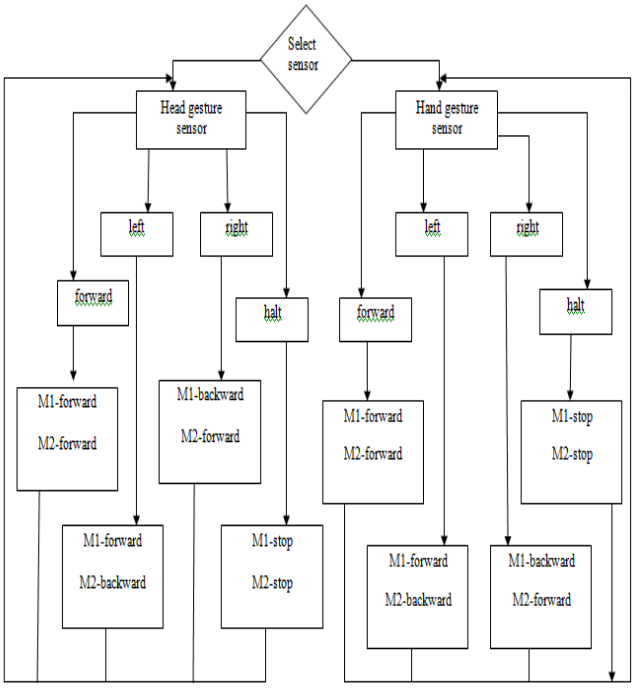

Fig 3: Flowchart

Fig 4: Gesture controlled wheelchair

Fig 3 shows the control program structure for the gesture controlled wheelchair. In program structure user can use either hand gesture sensor or head gesture sensor. When head gesture sensor is used then the system takes data from the 3-axis accelerometer. Based on the user head gestures the wheelchair takes the direction.

When the hand gesture sensor that is touchpad is used then the system takes the data from the touchpad. Based on the gestures from the user the wheelchair takes the direction.

The Fig 4 shown in below is the final hardware picture of the gesture controlled wheelchair with the gesture sensors that is ADXL330 accelerometer (head gesture sensor) and touch pad (hand gesture sensor). The hardware mainly involves two wheels, base to sit user, two high torque dc motors (to carry human weight), two driver circuits and batteries.

V CONCLUSION

This paper presents a new gesture controlled wheelchair with many advantages such as reduced complexity, easy controlling, low cost and great reliability compared to other conventional wheelchairs. The switching operation for the mode selection that is either touch pad or accelerometer is separated by using a switch. This adds up to the efficiency of the wheelchair and reducing the cost and size of the system. The proposed wheelchair can be used in many applications such as hospitals, old age homes and airports etc.

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