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### Hand gesture recognition for wheelchair control using pic microcontroller

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#### ABSTRACT

In this era of fast growing medical and health facilities, there are some handicapped persons who are finding it difficult for day to day locomotion and they depend on others for help. But world becomes fast, everyone is very busy and there are only few to take care of these people properly. Driving a wheel chair in domestic environment is difficult task even for a normal person and becomes more difficult for people with arms, legs and hand impairments. We propose a system that will solve the difficulties faced by these individuals. This design detects the hand gesture given by the user and the gestures are recognized by ACCELEROMETER sensor. Then wheel chair is controlled by PIC MICROCONTROLLER. Our goal is to help the physically disabled people to lead the life effectively. This proposed design is also used in shopping malls where the customers use the shopping cart to purchase the items is automatically controlled by this system.

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#### INTRODUCTION

The hand Gesture based Wheel Chair control system has user interface and identifies trends in current technology, application and usability. This system present very useful and an integrated approach to real time detection, hand gesture based data glove technique is very used which controls the wheelchair using hand movements by using the ACCELEROMETER sensor. It offers great flexibility, low voltage supply, low-cost and small 3-axis wireless system to control the wheelchair using PIC MICROCONTROLLER.

#### PROTEUS

Proteus is a simulation and design software tool developed by Lab center Electronics. It containing schematic, simulation and PCB designing. It allows to draw schematics and simulate the circuits in real time and provides human access during run time, thus providing real time simulation. The most exciting and important feature of Proteus

VSM is its ability to simulate the interaction between software running on a microcontroller connected to it. Proteus accepts only hex files, once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller. Proteus is a programmer which itself contains a microcontroller in it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed. As the Proteus programmer requires power supply to be operated, this power supply is given from the power supply circuit designed and connected to the microcontroller in proteus. The program which is to be dumped in to the microcontroller is written in proteus and is compiled and executed to check any errors and hence after the successful compilation of the program the program is dumped in to the microcontroller When the change in the hand gesture then sensor generates analog signal from mechanical signal and this is given to ADC

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which, converts analog to digital signal. Microcontroller doesn't understand analog signal so the digital signals are given to it. According to the change in direction of the sensor, the micro controller controls the motor direction by motor driver. Proteus is best suitable for embedded simulation. The designer can also develop 2D drawings for the product.

## EXISTING SYSTEM

Accelerometer module is used for Gesture recognition. This Gesture recognition module is the one of the most important part of this project. The moment of hand is detected by the accelerometer sensor or module. The wheelchair control system is designed with the help of MEMS accelerometer sensor, AVR microcontroller, Motor driver IC and RF module is mainly used in this project, as the motor drivers we used the L293D IC and control the motors from it. The hand gesture based wheelchair reduces the extra effort of the physically handicapped person and elder peoples so they can live freely and independently in the today's fast world and it is very easy to use by the needed person. The aim of this work is to develop a hand gesture recognition based wheelchair which is control by the physical disable person or needed person with the movement of the hand or motions of the hand only that could move forward, backward, left and right direction very easily.

The main purpose of this work is to provide supports or help to the physically challenged person who cannot move from their places without other person helps. A wheelchair consists of MEMS accelerometer sensor as sensing element, a AVR microcontroller unit a decision making device and motors to navigate the control the movement of wheelchair that motors are control by

the L293D motor driver IC. By tilting accelerometer sensor using hand movement it quickly control or move the wheel-chair in four directions.

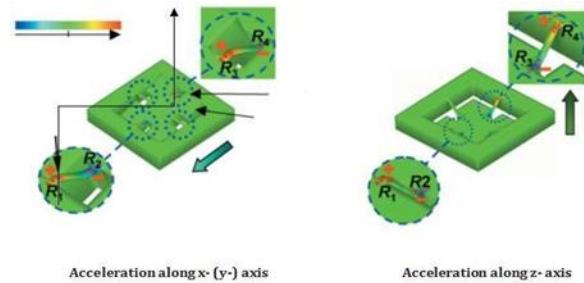
Hand Gesture control wheel chairs are extensive employed in human for non-verbal communication, in which the accelerometer is used control the gesture controls using the movements of the hand and hand gesture also making the system very less complex and lighter in weight. The Existing system has some disadvantages because it uses only the hand gesture to control the movement of wheel chair. The paralyzed person who are not able to move the hand is not possible to give the gestures. Sometimes the person can give invalid gestures they can move the hand for any other purpose .Even this also detect by the sensor makes the wheel chair to move. There are many possibilities for false operation of the existing System.

## PROPOSED SYSTEM

The proposed system overcomes this difficulties by using not only hand gestures also voice command given by the person to control the movement of wheel chair. The proposed system can be effectively used by the handicapped persons in best way .The heart of the existing system is MEMS accelerometer sensor and voice recognition module. The Purpose of choosing accelerometer sensor is because of highly sensitive, easily detect acceleration, inclination and vibration by measuring the motion in the x, y and z-axis simultaneously. By sensing the mounting angle, the sensor can assist in compensating for the devices mounting angle, and it possible to use normal SMD technology in high density boards, and also to realize the precise detection of the inclination angle.

## Principle of detection

### Piezo Resistor

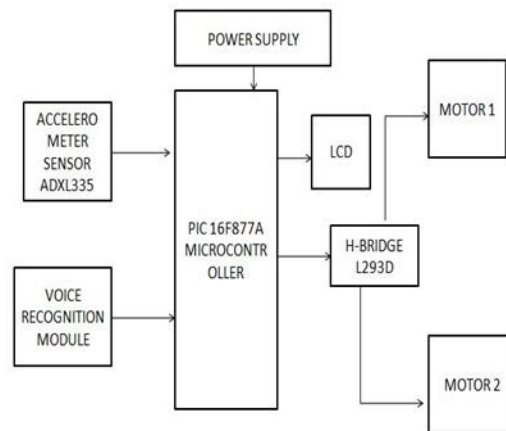


**Fig [1] Principle of Detection**

The MEMS 3-axis accelerometer consists of a Mass at the center of the sensor's chip, which is suspended by 4 Beams doped with Piezo resistive material. When the sensor is subjected to acceleration in any direction, the movement of the Mass causes the 4 Beams to deform and so change the resistance in the piezo material. This enables the sensor to detect the acceleration motion.

The working procedure of existing prototype involves the user's gesture sensed by the sensor, then sensor generates appropriate signals. This generated analog signals converted to digital and given to controller. On receiving this input signal,

the microcontroller compares the data which is preinstalled in the controller. If the input data matches the preinstalled data then the signal is given to motor driver L293D IC which allows the DC motor to drive on the particular direction. On receiving the signal the L293D IC gives the signal to relays and then the wheelchair starts moving. We chose ADXL335 accelerometer as the sensing device because it records even the minute changes. The first challenge is to calibrate the accelerometer according to user needs so that we can precisely control the motion of wheelchair.



**Fig [2] block diagram of proposed system**

### Accelerometer sensor

An accelerometer is a device that measures proper acceleration. The proper acceleration measured by an accelerometer is not necessarily the coordinate acceleration (rate of change of

velocity). For example, an accelerometer at rest on the surface of the earth will measure an acceleration  $g = 9.81 \text{ m/s}^2$  straight upwards, due to its weight. By contrast, accelerometers in free fall or at rest in outer space will measure zero. Another term for the type of acceleration that

accelerometers can measure is g-force acceleration. Accelerometers can be used to measure vehicle acceleration. Accelerometers can be

used to measure vibration on cars, machines, buildings, process control systems and safety

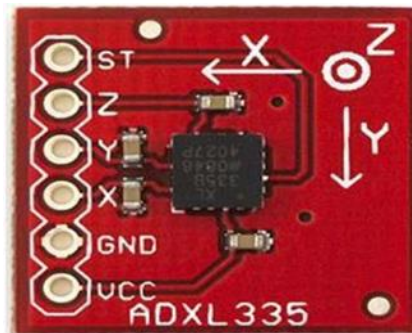


Fig [3] Accelerometer ADXL 335

**PIC16F877A CONTROLLER** PIC16F877A microcontroller has 40 pins. It consists of two 8 bit and one 16 bit timer. Capture and compare

modules, serial ports, parallel ports and five input/output ports are also present in it.



Fig [4] PIC16F877A

## H-BRIDGE IC

An H bridge is an electronic circuit that enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run forwards and backwards. H bridges are available as integrated circuits, or can be built from

discrete components. The H-bridge arrangement is generally used to reverse the polarity of the motor, but can also be used to 'brake' the motor, where the motor comes to a sudden stop, as the motor's terminals are shorted, or to let the motor 'free run' to a stop, as the motor is effectively disconnected from the circuit.

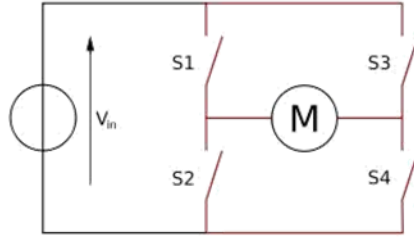


Fig [5] L293D MOTOR DRIVER IC

**DC motor**

A D.C. Motor is a machine which converts electrical energy into mechanical energy. The internal configuration of a DC motor is designed to harness the magnetic interaction between a

current-carrying conductor and an external magnetic field to generate rotational motion. It is used where high starting torque is required such as for driving hoists, cranes, trains etc. It can be used to drive load at various speeds.

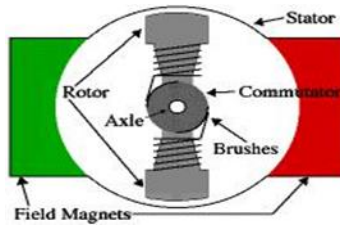


Fig [6] DC MOTOR

**METHODOLOGY**

The wheel chairs are gesture controlled by both hand and voice command. If the hand gestures are invalid sometimes to overcome this problem, we have to move on with voice control. In this gestures are sensed by accelerometer sensor and these are controlled by PIC16F877A Microcontroller. Hand gestures and voice controls are used for disable persons and old citizens.

**WORKING DIRECTION OF WHEELCHAIR**

When both the wheels of wheelchair rotate in forward direction then the wheelchair moves in forward direction. When both the wheel rotates in reverse direction then the wheel chair moves in backward direction. When left motor rotates and right motor shaft is stationary then the wheelchair moves in right direction, and when right motor rotates and left motor is stationary then the wheelchair moves in left direction.

Table [1] Direction motor with respect to direction of hand gesture

Direction of Hand Gesture	Movement of left Motor	Movement of Right Motor
Forward	Forward	Forward
Backward	Backward	Backward
Right	Forward	Stop
Left	Stop	Forward

## CONCLUSION

This project gives a development of gesture based wheelchair-effortless to use, customizable, economical, highly convenient and non-instructive gesture based wheelchair control system for

elderly and physically challenged. Our system definitely will help all the misfortune physically challenge and elderly people. Further the system can be combined with different type of gesture like head, eye and voice based on user's preference.

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