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Design and Fabrication of Head Tilt Controlled Wheelchair for Disabled

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Abstract: ***The quantity of crippled people is expanding consistently. Versatility helps are valuable for patients for transportation and are situation for strolling particularly in indoor and outside climate. Moving the patients from wheelchair to cot or to the clinical bed is generally an issue for the chaperon or assistant. Understanding the different issues with respect to the versatility gear and presenting a superior plan will be a resource for the clinical field and assistance for impaired people. There is a requirement for a wheelchair cum cot to work with the debilitated patient's portability and to give an original clinical hardware to use in the Indian emergency clinics. Here we are fostering a framework which is equipped for moving different positions (Seat, Semi-Seat and Cot) physically. These positions can be accomplished by a lead screw associated with a pivot joint. Lead Screw makes an interpretation of transforming movement into direct movement. Likewise, the level of the cot can be changed utilizing a fastener system physically. It is put on a level plane which pushes against a switch which lifts the primary arm. And furthermore, there is a cover on seat which can be opened to wipe out human waste. This is an expense lessening project which assists fundamentally deadened patients with doing their everyday things.***
Keywords: Arduino, Dc motor, Relay Motor, Battery, wheel chair, Disabled.

I. INTRODUCTION

The different sorts of wheelchairs are manual wheelchairs, electric-controlled wheelchairs and game wheelchairs. An essential standard manual wheelchair consolidates a seat and back, two little front (caster) haggles huge wheels, one on each side, and a stool. Wheelchairs are much of the time minor departure from this essential plan, yet there are many kinds of wheelchairs, and they are frequently exceptionally tweaked for the singular client's requirements. The seat size (width and profundity), seat-to floor level, ottomans/leg rests, front caster outriggers, movable backrests, controls, and numerous different elements can be modified on, or added to, numerous essential models, while certain clients, frequently those with specific requirements, may have wheelchairs exceptionally constructed. Different discretionary adornments are accessible, for example, against tip bars or wheels, seat straps, customisable backrests, slant as well as lean back highlights, additional help for appendages or neck, mounts or conveying gadgets for props, walkers or oxygen tanks, drink holders, and attire defenders. Tests have additionally been made with strange variation wheels, similar to the omni wheel or the system wheel. These permit more directional development choices. Mechanization is the most often spelled term in the field of hardware. The strive after mechanization acquired numerous transformations the current advances, which had more noteworthy turn of events, is the accelerometer sensor. These had more noteworthy significance than some other innovations because of its easy-to-understand nature. Accelerometer sensor based gadgets can be effectively battery-powered to the everyday person because of its less complex activity. This gadget is compact and client can wear it to his wrist like a watch and can work it by shifting the accelerometer sensor.

II. MATERIALS & METHODOLOGY

A. Components Of Head Tilt Controlled Wheel Chair

1) Arduino Microcontroller: The Arduino microcontroller is an open-source electronics platform based on easy-to-use hardware and software, with various models offering different specifications for input/output, memory, and processing capabilities.

Fig. 1 Arduino Microcontroller

2) *Accelorometer:* An accelerometer is a device that measures the proper acceleration of an object. Proper acceleration is the acceleration (the rate of change of velocity) of the object relative to an observer who is in free fall (that is, relative to an inertial frame of reference). Proper acceleration is different from coordinate acceleration, which is acceleration with respect to a given coordinate system, which may or may not be accelerating. For example, an accelerometer at rest on the surface of the Earth will measure an acceleration due to Earth's gravity straight upwards of about $g \approx 9.81$ m/s^2. By contrast, an accelerometer that is in free fall will measure zero acceleration.

Fig. 2 Accelorometer

3) *Relays:* A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. In our project, we have used 4 SPDT relays in order to operate the two DC motors of the wheelchair.

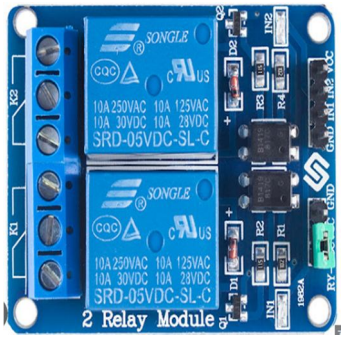

Fig. 3 Relay

4) *DC Motor:* DC geared motors are used in our wheelchair to drive the system in forward, backward, left and right directions as indicated in table 1. 12 V DC motors have been used powered by a rechargeable battery of 12 V, 7 Ah.

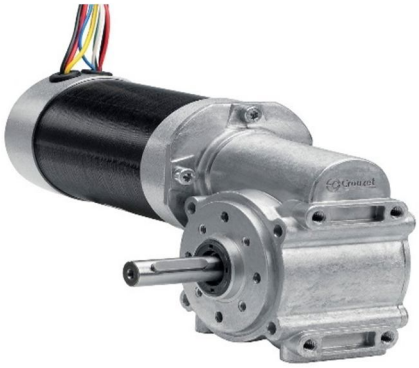

Fig. 4 DC Geared Motor

5) *Battery:* A battery is a device that stores chemical energy and converts it into electrical energy through a controlled chemical reaction. It typically consists of one or more electrochemical cells, each composed of two electrodes (an anode and a cathode) separated by an electrolyte. When a circuit is connected to the battery, electrons flow from the negative terminal (anode) to the positive terminal (cathode), generating an electric current. Batteries come in various types, including alkaline, lithium-ion, lead-acid, and nickel-metal hydride, each with different characteristics suited for specific applications.

Fig. 5 Battery

6) *Gyroscope:* A gyroscope is a device used to measure or maintain an angular position. It works using the principles of angular momentum. The gyroscope is made up of a spinning wheel or disc, as well as (in some cases) many other moving parts. It helps with navigation, and plays a part in such things as a gyrocompass and artificial horizon.

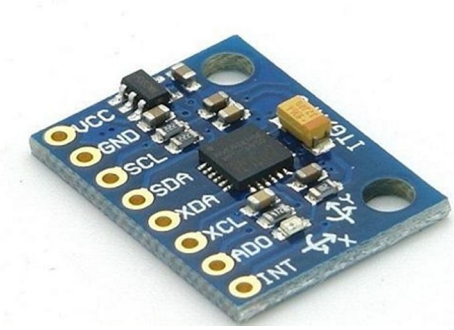

Fig. 6 Gyroscope Sensor

7) *Spur Gear:* Spur Gear is the most used gears, having Straight teeth and are mounted on two or more parallel shafts. The design of spur gear is simple. The spur gear is also known as slow-speed gears due to noisy operation at high speed.

Fig. 7 Spur Gear

III. DESIGN AND WORKING

A. *Design*

In mechanical engineering, several design software options are commonly used ,For this design we used Solid Edge software.
Solid Edge is a 3D CAD, parametric feature and synchronous technology solid modeling software. It runs on Microsoft Windows and provides solid modeling, assembly modelling and 2D orthographic view functionality for mechanical designers. Through third party applications it has links to many other Product Lifecycle Management (PLM) technologies.

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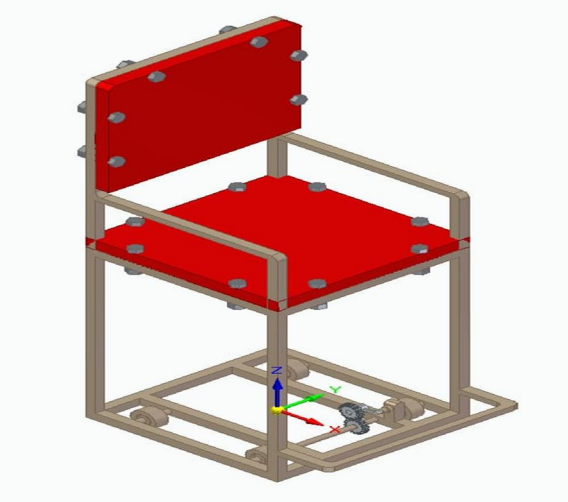

Fig. 8 Design of wheelchair in Solid Edge software

B. Working Principle

We have deigned the wheelchair chassis considering the cost effective features. The Mechanical design has been made using a chassis of Mild Steel that is a rectangular frame supported by from two castor wheels and rear drive wheels. The power is provided to the rear wheels using the DC geared motor. Castor wheels act as free wheels to allow easy rotation of the wheelchair. The drive shaft includes custom designed Hubs for mounting the motor onto the shaft of wheels through a gear transmission system. A gear reduction using two spur gears with the gear ratio of 1:10 is used to drive the rear wheel. This is done in order to reduce the load on the motor shaft while a person sitting on the wheelchair and operating it. Complete chassis made using welding and lathe machining. A chair is fitted on the top of the chassis for sitting and again fitted using welding joints on the base. Circuit board of the receiver unit is placed on the back of the chair using nut-bolts.

Fig. 9 Fabrication of head tilt controlled wheelchair

C. Benefits of Present System

The design and fabrication of a Head Tilt Controlled Wheelchair comes with several benefits. Let me share a few of them with you:

1) *Accessibility:* Allows individuals with limited mobility or disabilities to operate the Wheelchair using Head Tilt, promoting independence and mobility.
2) *User-Friendly Interface:* Head Tilt provide a natural and intuitive interface, reducing the need for complex manual controls and making the Wheelchair easier to use
3) *Hands-Free Operation:* Users can control the Wheelchair without the need for manual input, allowing them to perform tasks or navigate environments while keeping their hands free**.**
4) *Efficiency:* Head Tilt Control can streamline operation, allowing users to quickly and efficiently control the wheelchair without the need to physically interact with buttons or switches.

5) *Safety:* Head Tilt Control minimizes the risk of accidents or errors that may occur when using manual controls, enhancing overall safety for the user.
6) *Customization:* Head Tilt Controlled systems can be customized to recognize individual moments, providing a personalized user experience and accommodating specific needs or preferences**.**

The fabrication of a Head Tilt Controlled Wheelchair offers several advantages. It not only saves time and effort but also reduces costs, all while promoting environmental sustainability. This innovative solution represents a smart and convenient approach to ensuring the effective maintenance of moving.

IV. CONCLUSION

With the completion of our wheelchair, we have concluded that it works well for head tilt motions and it proves to be an effective solution for quadriplegic patients with more than 45 % disability or for the patients with spinal cord injury who could not move their hands and legs for driving a manual or automatic wheelchair. This system proves better than automatic joystick powered wheelchairs in terms of ease of operation and head tilt control. Also, the project comes out to be economical as compared to other available wheelchairs in the market.

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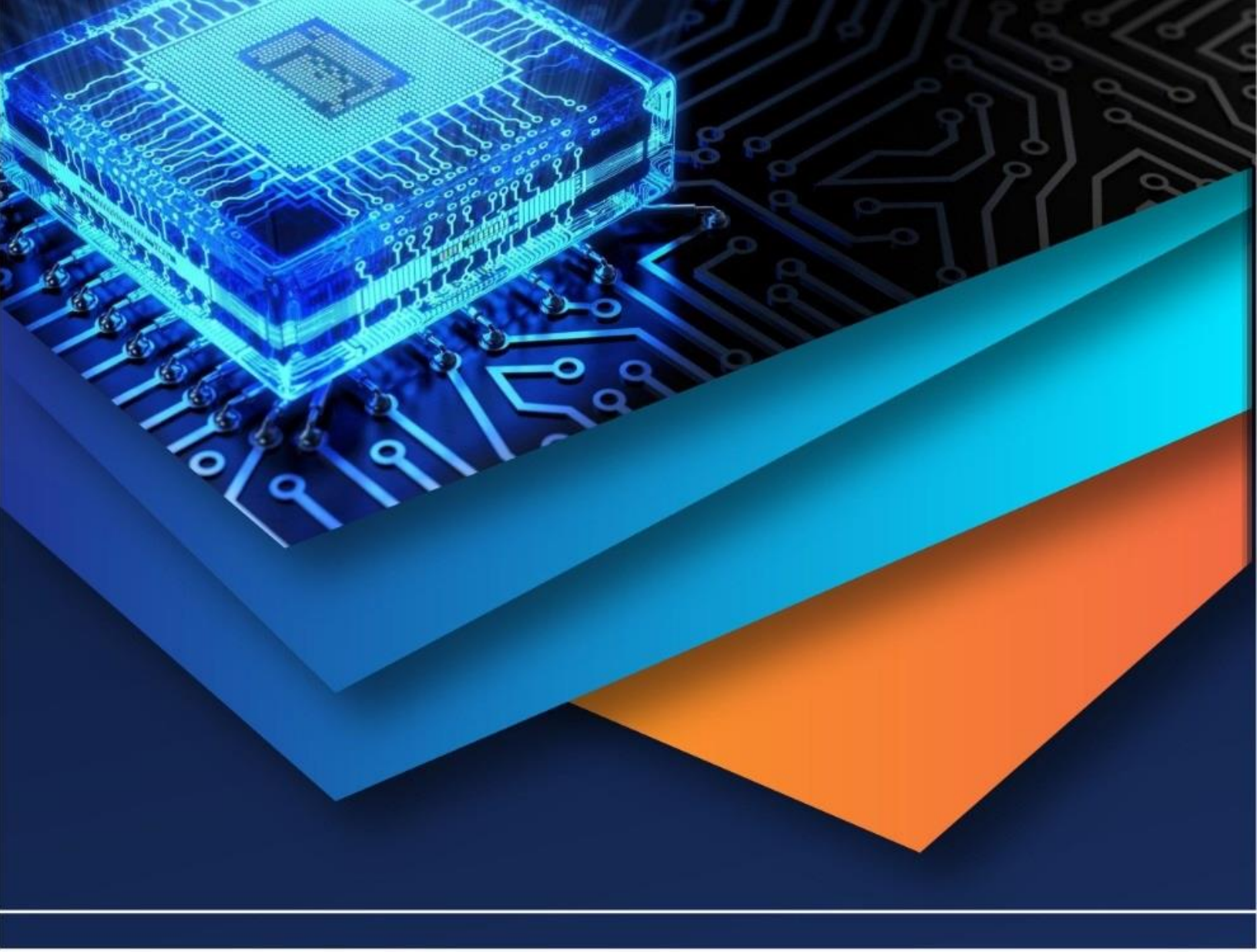

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