DESIGN AND ANALYSIS OF ARM OPERATED HANDICAPPED VEHICLE

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Abstract—A Wheelchair is a wheeled Mobility device used by persons for whom walking is difficult or impossible. Most of them are manually driven while some are electrically powered. The main disadvantage of Electric Wheelchair is their Expensive Price. Also Persons suffering from HYPODACTYLY, AMELIA and Amputation cannot drive these Vehicles. Hence our project involves developing a Low Cost Motorized Handicapped Vehicle for People with above mentioned deformities. DC motors are used to move the wheel chair. Switches are provided for on and off control of the motor. A behavior-based approach was used to establish sufficient on-board autonomy at minimal cost and material usage, while achieving high efficiency, sufficient safety, transparency in appearance, and extendibility. The ergonomic conditions are considered and the model is designed and tested using SIMULATION SOFTWARES.

Keywords—mobility, hypodactyly, Amelia, simulation softwares.

1.0 INTRODUCTION

Robotics Wheelchairs extend the capabilities of traditional powered devices by introducing control and navigational intelligence. These devices can ease the lives of many disabled people, particularly those with severe impairments by increasing their range of mobility. For handicapped people human found a wheel chair which can be moved by using hands for those who don't have legs. But the peoples who don't have legs as well as hands cannot move their wheel chair self. They need some other person to move their wheel chair. But sometimes such person faces so many problems if they didn't get any person to move their wheel chair

2.0 AUTOMATIC WHEEL CHAIR

This paper "Auto Wheel Chair" aimed to resolve the above-mentioned issue. In this project we are going to make a wheel chair which can be controlled automatically as well as manually. This wheel chair controlled manually through head of the person sitting on it. He/ she just need to move his/her hand into the direction it wants to move by using accelerometer. In automatic control user just need to press keys for saved destination. Then the wheel chair will automatically move into the direction of saved destination by using encoder wheels. The movement of the powered wheelchair depends on the motor control and drive system which consists of microcontroller and motor driving

2.1 HISTORY OF WHEEL CHAIR

A wheelchair is a wheeled mobility device in which the user sits. The device is propelled either manually (by turning the wheels by the hand) or via various automated systems. Wheelchairs are used by people for whom walking is difficult or impossible due to illness (physiological or physical), injury or disable disability. A wheelchair is a chair fitted with wheels. The device comes in
variations allowing either manual propulsion by the seated occupant turning the rear wheels by hand, or electric propulsion by motors.

There are often handles behind the seat to allow for different individuals to push. Wheelchairs are used by people for whom walking is difficult or impossible due to illness, injury, or disability. Here we are going to improve the performance of the wheel chair. We install the joystick feature in it for the movement of the wheel chair. The IR sensors also fixed for finding if there are any obstacles in the path of the wheelchair. Here it improves the handing and movement functions of the wheel chair.

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3.0 LITERATURE REVIEW

Jesse Leaman and Hung Manh La investigated a smart wheelchair (SW) is a power wheelchair (PW) to which
computers, sensors, and assistive technology are attached. In the past decade, there has been little effort to provide a systematic review of SW research. This paper aims to provide a complete state-of-the-art overview of SW research trends. We expect that the information gathered in this study will enhance awareness of the status of contemporary PW as well as SW technology and increase the functional mobility of people who use PWs. We systematically present the international SW research effort, starting with an introduction to PWs and the communities they serve. Then, we discuss in detail the
SW and associated technological innovations with an emphasis on the most researched areas, generating the most interest for future research and development. We conclude with our vision for the future of SW research and how to best serve people with all types of disabilities

ZannatulRaiyan et al (2017) represented the design of an Arduino based voice controlled automated wheelchair. The design is developed with a voice recognition system, which allows the physically disabled person to control the wheelchair by voice command who have issues in hand movement due to ageing or
paralysis for joystick-controlled wheelchairs. The design also provide some additional features such

as obstacle detection for the safe movement and a GSM based navigation system for tracking and sending notifications to increase the usability of the automated wheelchair system. To implement the design, Arduino Mega2560, Easy VR3 speech recognition module, SIM900A GSM module and relay-based motor controller circuits are used along with the wheelchair. The designed wheelchair system does not require any wearable sensors for using other biomedical signals to control wheelchair movement (i.e. EEG, EMG, EOG sensors) as reported in several research studies which require complex signal processing techniques done with an extra bulky computing system attached with the wheelchair.

Ghule et at (2013) developed a speech-controlled wheelchair for physically disabled person is developed which can be used for different languages. A speech recognition system using Mel Frequency Cepstral Coefficients (MFCC) was developed in the laptop with an interactive and user-friendly GUI and the normal wheelchair was converted to an electric wheelchair by applying a gear mechanism to the wheels with DC motor attached to the gear. An Arduino Uno board is used to acquire the control signal from MATLAB and give it to relay driver circuit which intern results in the motion of wheelchair in desired direction. The speech inputs such as forward, back, left, right and stop acquired from the user and then the motion of the wheelchair made according to the respective command. The performance of MFCC in presence of noise and for different languages was studied to know the reliability of the algorithm in different condition.

4.0 DESIGN OF MOTOR

The selection of motor based on the requirement is discussed below.

CALCULATIONS FOR SELECTION OF MOTOR

Torque = Force * Radius of the wheel $T = F * r$

Frictional Force = Coefficient of friction * Normal Force

$F=\mu*N$

Normal Force = Weight = Mass * Acceleration due to gravity $N = m * g$

Assumptions:

m = 80 kg

g = 9.81 m/s^2

r = 26 inches = 0.694 m

μ = 0.9 (For high frictional roads)

N = 80 * 9.81 = 784.8 N

F = 0.9 * 784.8 = 706.32 N

T = 706.32 * 0.694 = 490 Nm

T_X= (490 / 80) * X,

Where X is the variable weight of the individual.

Torque value is used to determine the appropriate motor for the vehicle**.**

5.0 COST ESTIMATION

5.1 MATERIAL COST

The cost involved for making the vehicle is discussed below.

Sl.No	Component Name	Qty.	Cost (Rs)
1	Mild Steel Rod	3 Kgs	180
2	Battery	1	600
3	Wiper Motors	2	450
4	Toggle Switches	2	120

5.2 LABOUR COST

LATHE, WELDING, GRINDING, POWER HACKSAW, GAS CUTTING:

Cost = Rs 3150 /-

5.3 OVERHEAD CHARGES

The overhead charges are arrived by "Manufacturing cost"

Manufacturing Cost = Material Cost + Labor cost

= 1350 + 3150

= Rs 4500 /-

Overhead Charges = 40% of the manufacturing cost

= Rs 1800 /-

5.4 TOTAL COST

Total cost = Material Cost + Labor cost + Overhead Charges

= 1350 + 3150 + 1800

= Rs 6300 /-

Total cost for this project= Rs 6300 (Approx.)

6.0 WORKING OF VEHICLE

Working of the wheel-chair is controlled by a two-way switch provided at the hand rest of the chair. When the button is switched to the bed position the RC circuit is activated and motor rotates in clockwise direction transmitting power through worm and worm wheel with high velocity reduction, which further operates chain drive and then shafts making the backrest move backwards and the leg rest upwards. As soon as it reaches the bed position the cam pushes the micro switch thus breaking the circuit and the motor stops. Similarly, for the chair position the motor rotates in anticlockwise direction making the backrest move upwards and the leg rest downwards. When it reaches the chair position the micro switch is pushed by the cam again and the motor stops. Left and right turns can be obtained by keeping one wheel idle and the other wheel rotating i.e. to turn right, the left wheel motor operates and right wheel motor is idle, thereby making a right turn. Similarly, the right wheel rotates for a left turn.

Table1: Mechanical Properties of Mild Steel

Property	Material
Density	7,860 kg/m^3
Hardness (Rockwell)	24HRB
Elongation	30%
Tensile Strength	400MPa
Yield Strength	250Mpa

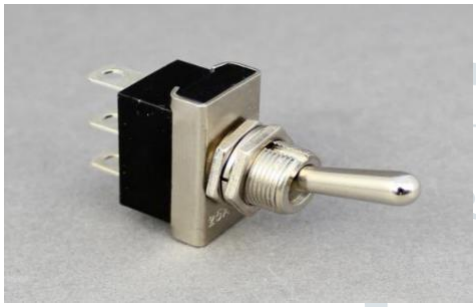

Fig 1.Two way Toggle Switch

SOLIDWORKS ASSEMBLY

Fig 2:Rendered assembly

Fig 3:Finished assembly

ANSYS RESULTS

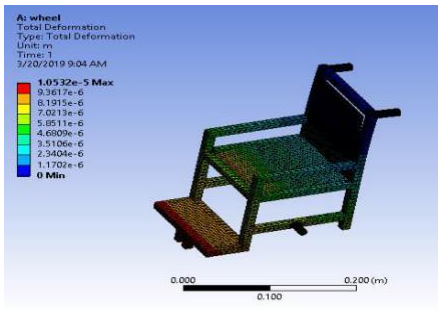

Fig 4: Total Deformation

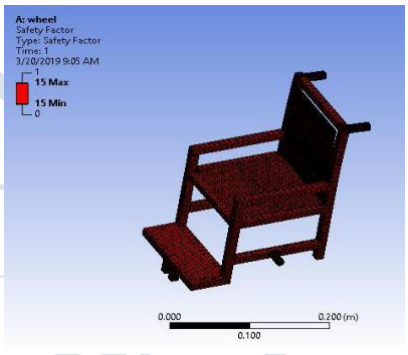

Fig 5: Safety factor

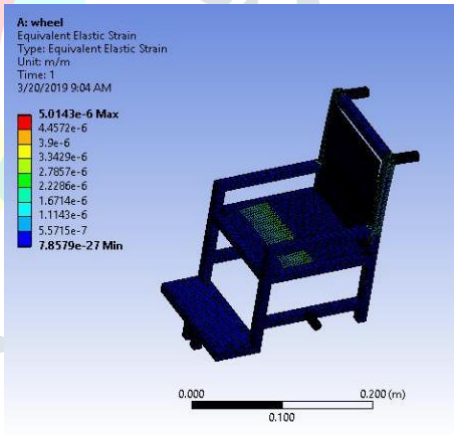

Fig 6: Equivalent Elastic Strain

7.0 CONCLUSION

This decreases the dependency of patient which is simple in design and construction. This design can be use both as wheelchair and stretcher. This Wheel chair can be stopped at any comfortable position. Because of the inclusion of chain drive system this design proves to be effective.

REFERENCES

[1] Alexander, Betty Martin, J Surya,Theja Rao, Azmat Ali, "Development Of A Transformable Electrically Powered Wheel Chair Into A Medical Emergency Stretcher", ISSN: 0975-766X, CODEN: ILPTFI(Received on 10-05-2016)

[2] Akhil Sivadas, Christy Joseph Jacob, Ebin Philip, Finny Varghese, "An Evaluation of Wheel Chair Cum Bed Mechanism with Side Panel Movement for Bed", IJIRST – Volume 2,Issue 11 April 2016 ISSN (online):2349-6010.

[3] Sumedh J. Suryawanshi, Dr. K. Janardhan Reddy, "Conceptual Product Development of Wheelchair for People Disabled in Legs", Volume 1, Issue 2, October-December, 2013, pp. 01-10.

[4] Rajeev V.R, Ramjith Krishnan R, Prof. K Gopalakrishna Pillai, "Fabrication of Advanced Wheelchair cum Stretcher", Volume 02, No. 2, February 2016 ISSN NO 2395 0900

[5] JyothishKSunny,Kiran P.Karunakaran,ThomasPaul, BibinVarkey, "Design and Fabrication of Stretcher Cum Wheel Chair", IJIRST – Volume 4, Issue 7, April 2016 ISSN

[6] Rashid Ahmed, Safar Abdul Razack , Vishnu Prasad ,"Design and fabrication of Pneumatically Powered Wheel Chair-Stretcher" IJIRST – (an iso 3297: 2007 certified organization) vol. 4, issue 10, october 2015

[7] Prof. Ehsanullah Khan, Dr. C.C.Handa, Dr. R.D.Askhedkar, "Systhesis Of Trolley Cum Wheelchair For Patient Handling", IJEST-ISSN : 0975-5462 Vol. 3 No. 8 August 2011

[8] Ninad M. Borkar, Saurabh A. Apte, Tejas N. Deshmukh, Sampada M. Apte' "Mechanically Operated Wheelchair Convertible Stretcher", IJMET-Volume 7,Issue 2,March-April 2016,ISSN Print: 0976-6340 and ISSN Online: 0976-6359.

[9] "Design and development of voice/joystick operated microcontroller based intelligent motorized wheelchair" H.R. Singh, Abdul Mobin, Sanjeev Kumar, Sundeep Chauhan" and S.S. Agrawal Central Electronics Engineering Research Institute, CSIR Complex, Hillside Road, New Delhi-110 012, India.