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Smart Wheelchair with Electric Bike

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***Abstract* - This paper involves the simple design of a wheelchair attachment, an electric bike attached to a standard manual wheelchair that gives the normal wheelchair mobility without any external force to be applied from the disabled person. The electric bike consists of an electric D.C. Geared motor to power the mechanism, two rechargeable battery, a controller to control the whole electric mechanism, an electric throttle to give motion to the mechanism, and an electric brake to stop the motion and switches to give the system power when required. As this idea is to help the middle-class disabled people, we have thought of making some parts of the project, as the scrap fabrication is affordable for middle-class families. The electric bike is designed to be a safe, lightweight, easily attachable, and aesthetic look. This electric bike can be easily detachable from the wheelchair. To avoid such shoulder pain, this wheelchair has been designed for the disabled person to go to near places around the disabled person's home and other places; our wheelchair will ultimately reduce the effort of driving the wheelchair.**

Keywords: Designing of electric bike, D.C. Geared Electric Motor, Rechargeable Batteries, Controller for Electrical Parts, Throttle and E-brakes, Attachable and Detachable.

I. INTRODUCTION

The disabled person who used to drive the wheelchair manually by the force of his arms, this manual wheelchair also provides physical fitness to the shoulder due to the use of the arms for giving motion to the wheelchair, but the use of such manual wheelchair for an extended period the people experience shoulder and wrist pain due to steering the wheelchair with only the upper limb muscles for a long time. Some people need to seek medical treatment in these cases, and some require even surgical treatment in severe cases. To avoid such shoulder pain, the wheelchair industry has come up with may fully electric wheelchair which can be easily operated with a joystick attached to the wheelchair or a remote which will be with the patient and can be operated according to his requirement, but these types of wheelchair are costly and cannot be afforded by an average middle-class family. So, we have an idea of building an attachment to the wheelchair, which will be manually attached and detached to the wheelchair whenever required. Whenever it is not required, this attachment will make the wheelchair easily mobile, and the person driving the wheelchair can move from one place to another with ease, and the patient will not have to put any physical effort to move the wheelchair to the required position.

We have considered using scrap materials for manufacturing this electric bike to reduce the price to be affordable for regular middle-class family members. We have decided to use an old bicycle front part to manufacture the attachment and the electrical parts required to make the electric bike entirely in motion. So, we have decided to use a D.C. Geared Electric Motor to power the whole mechanism along with a chain drive to transfer the power from the electric motor to the wheels of the bicycle, and this motor will be controlled with the help of a 24V controller and electric throttle and electric bike to accelerate and de-accelerated the whole attachment this whole attachment is powered with two 12V batteries. This attachment will help the users to move to the required place without much physical effort.

II. PROBLEM DEFINITION

Some of the significant problems faced to make this model of the project in practice are as follows:

- We are searching for the perfect powered electric motor that will power the whole mechanism and also carry the load of the disabled person and wheelchair altogether.
- We are fabricating attachment, so the motor's power drives the attachment with the help of a chain drive.
- We have to find perfect specification parts like controller & batteries which will be compatible with motor capacity and power.
- Design a proper clamping mechanism so that it will be easy to attach and detach.
- It must be perfectly wiring all the components so that there must be no failure in the future.

III. METHODOLOGY

- Materials and parts selection.
- Designing and layout finalization of the project.
- Calculation and verifying the problems.
- Actual model making.
- Final testing of the project.

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IV. DESIGN CALCULATIONS

Weight of wheelchair with person = 70Kg
Efficiency mechanical efficiency=85%
Wheel radius=0.228m
Speed=20Km linear distance travelled =2πr
= 2 x 3.14 x 0.228=1.4318m

1] Speed=20Km/Hr.
Speed= (20 x 1000)/3600 =5.56

2] RPM
RPM= (Total distance covered per hour)/ (Linear distance)
=20000/1431 x 60

3] Power
P= (m x g x v x rolling resistance) +(air density x coefficient of drag x area x v3)
P= (70 x 9.81 x 5.56 x 0.00) +(1.225+1.8 x 0.30+5.563)
P=163.330

4] Torque =
η=85%
$\eta=(P_{output}/P_{input})$
P_{input}=163.33

5] Power output=η x P_{input}
T x ω =0.85 x 163.33+
ω= (2πN/60) = (2 x 3.14 x 265.392)/60
ω=27.79
τ= (0.85 X 163.33)/27.79
τ=4.99Nm

Here we have another method to calculate torque,
1Nm=10kg
Therefore 70kg= 7m
We have,
The radius of wheel=0.228m

We will calculate Force and then put into equation of Torque
Force=m x a
Here a=v/t
=5.56/15
=0.3706m/s2
 F = 70 x 0.3706
F=25.942 N

Torque is
τ =Radius x Force
τ=0.2 x 25.942
τ=5.1884

To illustratethe selection of power rating, a Motorized wheelchair of 70 kg, a motor with an output power rating of 350W has to be selected. In this way, the power rating required to drive an electric vehicle of a particular load is calculated. Therefore, selecting an appropriate motor is also equally important, so we have selected D.C. Geared Electric Motor.

V. MODEL OF PROJECT

Figure 1: Front view of the model

Figure 2: Side view of the model

VI. ANSYS CALCULATION OF MODEL

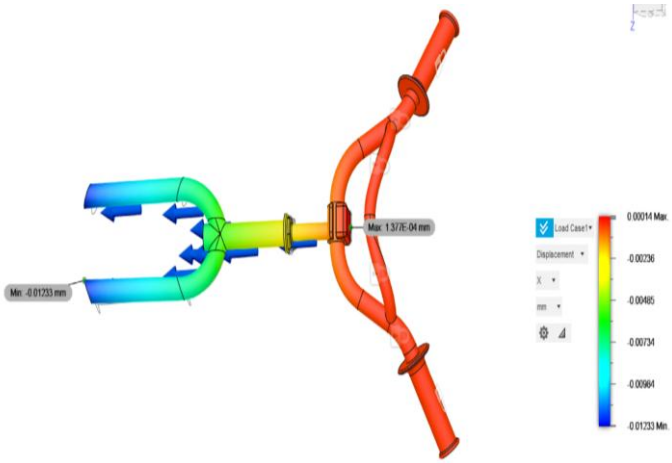

Figure 3: Displacement calculation of the hand bike

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VII. COMPONENTS

1. 350W Geared DC Electric Motor

This is an E-bike MY1016Z2 24V 350W Gear DC Motor – 3300 RPM complete with a nine-teeth sprocket having 1/2″ (12.7mm) pitch. This motor is great for those who want to make their custom electric vehicle, whether it is a scooter, electric bicycle, or something the world is not ready for; this electric motor comes with gear reduction, which produces more low-end torque than a standard motor. Motor direction can be changed to left or right by just reversing wires.

2. 12V Lead Acid Battery

The batteries to be used are lead-acid batteries of 12V and 7Ah the whole system required a power input of 24 volts, so we have decided to use two batteries to power the whole attachment.

3. Motor Controller

This Motor Controller 24V for MY1016Z2 24V 350W includes the motor, accelerator, brake, battery, battery charging, brake light, power lock. This motor brush controller for Electric bicycle & scooter is compatible with the MY1016Z2 24V 350W motor.

4. Electric Throttle and Brake

24V/36V/48V E-Bike Twist Throttle Grip Accelerator for E-bike product is an attachment to a motorcontroller for MY1016Z2, 24V, and 350W motor. It is used as input to control the motor. It is similar to the scooter accelerator available in the market. It features linear control over the E-Bike motorand lets it change its speed according to requirement. It obtains a direct connection with the E-Bike Controller Circuitry through the wire attached to it. The e-brake lever is a replacement for the regular brake lever and cuts out the controller or engages regenerative braking in the controller when the lever is squeezed, which prolongs the motor's lifespan. We have integrated levers for mechanical and hydraulic brakes; furthermore, they can be added to existing levers to turn them into e-brakes. It provides smooth braking and does not damage the motors and their performance.

VIII. CIRCUIT DIAGRAM

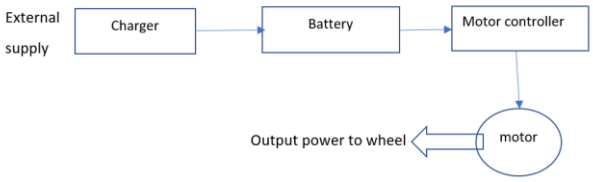

Figure 4: Block diagram of power transmission flow

IX. FABRICATION

Used an old bicycle front part, i.e., the fork of the bicycle, and assembled all the components required for doing the final project into the fork of the bicycle. We went to a near welder for the fabrication and joined the motor and other components to the bicycle structure; furthermore, for the connection of the electric parts, we took the help of an electrician who has expertise in these sectors.

Figure 5: Final look at the project

Figure 6: How the motor drives the wheels of the attachment

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Figure 7: How the battery, controller throttle are connected and their wiring

X. FUTURE SCOPE

- GPS trackers so that the wheelchair's location can be located using the smartphone through a GPS tracking app.
- We can use a shock absorber for comfort.
- We can use solar energy by installing roofs of solar panels to charge the battery.

XI. CONCLUSION

The motorized hand bike that can be attached to a manual wheelchair is presented in this paper. It aids disabled people to ride on roads easily and reduces the strain on their shoulders. As the hand bike attached manual wheelchair can be used outdoors and indoors, it eliminates the need for a separate mobility vehicle for each purpose.

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REFERENCES

[1] Nirmal T. M. 2014. Wheelchair for Physically and Mentally Disabled Persons. International journal of electrical and electronic research, 2(2):112-118.

[2] Dr. S. V. Satish, Vaibhav Mattoo, T. Srichandan3 2017. Motorized Bike Handle for Wheelchair:120-122.

[3] Arnet, U., van Drongelen, S.,Veeger, D. H. E. J., and van der Woude,L. H., "Shoulder load during handcycling at a different incline and speedconditions" Clinical Biomechanics 27, pp 1–6, 2012.

[4] S.D. Kumar, Avinashi Jangir, Nishant Saraswat, AnadiNema, Bhargav Patel 2019. Design and Fabrication of Drivable Wheelchair Attachments. International journal of innovative technology and exploring engineering, 8(8):2643-2648.

[5] Dan J.L. Brett c, Catherine Holloway 2019. Adjusted method to calculate an electric wheelchair power cycle: fuel cell implementation example. journal of energy storage 23: 371-380.

[6] Ammer, W., Cooper, R., Ding, D., Guo, S., Hayashi, S., LoPresti, E., Sharma, V., and Simpson, R., "A prototype power assist wheelchair that provides for obstacle detection and avoidance for those with visual impairments" Journal of Neuro Engineering and Rehabilitation, pp 1-11, 2005.

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