

# Design and Fabrication of Attachable Wheelchair Automator

Shantanu G. Gulhane<sup>1</sup> Sumit R. Dafe<sup>2</sup> Mayur A. Shirbhate<sup>3</sup> Mrunali M. Mahalle<sup>4</sup> Prof. Ajinkya P. Edlabadkar<sup>5</sup>

<sup>1,2,3,4</sup>BE Student <sup>5</sup>Professor

<sup>1,2,3,4,5</sup>Department of Mechanical Engineering

<sup>1,2,3,4,5</sup>Yeshwantrao Chavan College of Engineering, Nagpur, India

**Abstract**— Attachable wheelchair automator provide a means to transport patients or mobility to people with walking disability. They can be attendant propelled, which are highly maneuverable in confined spaces, but offer no power assistance. Also, they can be electric powered with mechanical control interface, which provide power assistance. With the objective of providing power assistance and having excellent maneuverability, this paper presents a motorized attachable wheelchair automator. It is light and portable because it has no actuator. Moreover, its operation is simple. It is useful not only at home or in a nursing home, but on any flat surface during daily excursions and activities, even in a conventional lavatory.

**Keywords:** Attachable Wheelchair Automator

## I. INTRODUCTION

Wheelchairs have been used for transporting patients as well as disabled for quite a long time. Wheelchairs are driven by manual efforts. The disabled drive wheelchairs by their hands while another person is required to push patient's wheelchair. Here we propose a simple attachable extension that can be attached to a wheelchair and can transform wheelchairs into E wheelchairs that require no manual efforts. Also the system makes use of batteries to drive the wheelchair and no fuel based engine which makes it ecofriendly.

## II. LITERATURE REVIEW

**A. Title: Control and Evaluation of a Motorized Attendant Wheelchair with Haptic Interface**

Author: Oscar Y.Chuy Jr. And Jonathan Herrero

Published Date: 21 October 2017

Introduction: Patient lift is an assistive device for patients who lack sufficient strength or muscle control to be transferred between a wheelchair and a toilet or other places. Patient lifts of two kinds are commonly used: overhead lifts and mobile lifts. It is compact, light, and portable because it has no actuator. Its operation is simple. It is useful not only at home or in a nursing home, but on any flat surface.

Remark: Attendant wheelchairs can be attendant propelled. Attendant propelled wheelchairs are highly maneuverable, significant physical strength can lead to attendants' physical exhaustion.

**B. Title: Modelling Wheelchair – Users Undergoing Vibrations**

Author: Korkut Brown and Henryk Flashner

Published date: 20 July 2017

Introduction:

Early studies on wheelchair-vibrations have shown that on certain road conditions the accelerations experienced by the wheelchair-user exceed the standardized levels set for the

general population. The primary health concern that is associated with whole-body vibrations is back pain. Wheelchair-users with spinal cord injuries are particularly vulnerable to the negative effects of vibrations due to their limited capacity to stabilize their trunk.

Remark: Wheelchair manufacturers have responded to the growing concerns of wheelchair vibrations with suspension elements installed in the rare or caster wheels.

**C. Title: Attendant wheelchair –**

Author: Yoshikazu Mori and Akihiko Nakada

Published date: 6 November 2018

Introduction:

Attendant wheelchairs have been used in hospitals to transport patients who have limited mobility. In 2016, there were about 35 million registered admissions in hospitals in the United States. If each patient was at least transported four times, this led to more than 140 million usage of transportation devices such as attendant wheelchairs and stretchers. Assisted living facilities also use attendant wheelchairs to provide mobility to elderly people who cannot use/control wheelchairs. In US airports, attendant wheelchairs have been used to transport passengers with mobility issues and have served millions of passengers per annum. The above applications showed the significant importance of attendant wheelchairs.

Remark: Foldable patient lift that can be carried using a wheel chair it was sufficiently compact for use in a conventional lavatory.

## III. PROBLEM STATEMENT

In previous manual wheelchair the main problem is, we require human efforts to displace the wheelchair from its initial position. Due to manual operated, it is uncomfortable to the patient in sense of speed, sitting, movement control and many activities. Although many automatic wheelchairs are available in market but not affordable to all.

## IV. WORKING PRINCIPLE

The E- wheelchair attachment is designed to automate wheelchairs and thus achieve efficient and easy transportation medium to patients as well as disabled people. The attachment uses aluminium shaft and pipe arrangement designed to be attached to a wheelchair front rods and thus clamp on the front wheelchair rods. We then use a adjustable handle fabricated with efficient support in order to achieve directional movement. We now use chain and sprocket with motor that connects to the wheel arrangement in order to drive the attachment. Our system uses batteries to power the motor and a switching arrangement in order to switch on and off the motor and achieve desired movement.

## V. COMPONENTS

### A. Motor:

Specifications:

Power = 350W, Voltage = 24V, RPM=2650

Rated current = 15 A – 19 A, Rated torque = 2.5 Nm – 4 Nm



Fig. 1:

### B. Shaft:

We used Aluminium shaft in our project. The main reason to choose Aluminium over Mild-Steel (3kg) is weight.

Specifications:

Length = 2 feet, Weight = 0.9 kg, Diameter = 25 mm



Fig. 1.1:

### C. Chain and Sprocket:

Specifications:

Teeth on sprocket = 22, Teeth on Gear = 14

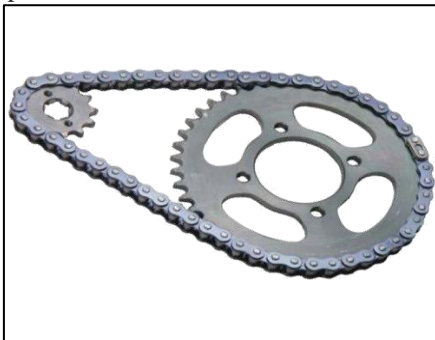


Fig. 1.2:

### D. Battery:

Specifications:

Rating-20 Ah

Voltage-12 volt at 7.2 ampere for 20 hrs

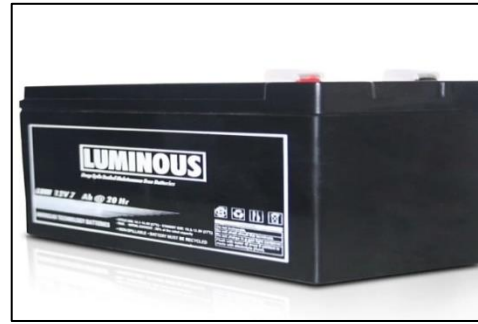


Fig. 1.3:

### E. Handle arrangement:

Specifications:

Mechanical brake Wheel diameter = 56 mm



Fig. 1.4:

### F. Bearings:

Specifications:

4 Deep groove ball bearings.

Inner diameter = 25mm, Outer diameter = 54 mm



Fig. 1.5:

### G. Controller:

Specifications:

Rated voltage = 24 volt DC, Watt = 350 w, under voltage = 20.5 volt,

Dimensions = 83 x 65 x 39 mm.

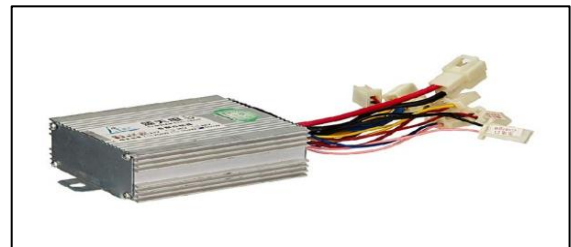


Fig. 1.6:

### H. Accelerator:

Specifications:

Inside diameter = 22 mm, Suitable voltage = 24 volt



Fig. 1.7:

#### VI. CALCULATIONS

Maximum capacity of load = 300 pounds  
Maximum capacity of load =  $300 \times 0.454$   
= 137 kg  
Maximum weight 'W' =  $137 \times 9.81$   
= 1344N

#### VII. CONCLUSION

This paper presented a motorized attachable wheelchair automator with haptic interface, which was a mathematical model describing the motion behavior of the desired system. The attachable wheelchair automator with haptic interface resulted in faster task completion times and hence outperformed the motorized attachable wheelchair automator.

The future works of this study will focus on other control strategies that will further aid the attendants such as shared control while ensuring the safety of the patients.

#### REFERENCES

- [1] Journal of Medical Devices. Received October 21, 2017; Accepted manuscript posted August 31, 2018. doi:10.1115/1.4041336, 2018 by ASME.
- [2] <http://biomechanical.asmedigitalcollection.asme.org/pdfaccess.ashx?url=/data/journals/jbendy/936373/> on 07/20/2017.
- [3] Journal of Medical Devices. Received October 16, 2018; Accepted manuscript posted November 06, 2018. doi:10.1115/1.4041918, 2018 by ASME.