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Semi Auto Wheelchair

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Abstract

Semi-Auto Wheelchair (SAWc) is mobility device to provide patient independently movement for indoor and outdoor, such as moving to and placing on bed, and self-lift assistance through electrical control. Currently, patients and attendees are facing problem to be shifting from wheelchair to vehicles or bed. This research project started to know its evaluation from earlier to the present generation through literature review and market survey. Also considered to know the customer satisfaction and needs of existing product in market through questionnaires. Market survey was taken from different users and attendees for design methodologies. SAWc are driven by manual and 24 volt electrical power control. The redesign of manual wheel chair divided into two main functions: 1. Controlling lifting for up and down with electrical control, 2. the positioning control for sitting state and lying state was considered for this project, and 3. alarm or emergency system is provided to inform the attendee that there is a need of his or her presence to the patient. The design motivation of the SAWc is to reduce injury according to lack of patient handling and will meet a customer satisfaction.

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Key-word: - wheelchair, self control and semi-auto

1. Introduction

The use of wheelchair is increased from year to year. As has been reported by (LaPlante 2003) it is between 1969 and 1995, for each group under the age of 6 years up to age 65 years and older. In 2002, more than 1.6 million wheelchair individuals users are manually operated (Kaye et al. 2002); where 88,000 users are children. While according to the US Census Bureau Public Information Office (2006) reported that in 2005, about 80,000 of child

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use a manual wheelchair for everyday use to their daily activities. The importance of wheelchairs to disabilities children and adults it is important for daily activities.

2. Product Design

Product design is one of the concepts adapted in engineering. It includes a systematic approach for consumer needs, existing products, the necessary improvements, propose a new concepts that generate a better quality of products and low cost. In this research, by focusing at some aspect, that is, the users weight not more than 100 kg. The height of the wheelchair is 4 feet. This wheelchair can use at home and hospital for disable people. It Made of strong materials and simple installation.

3. Current Wheelchair

A chair that has wheels designed for replacement for the walk known as wheelchairs. It is used for the movement of the physically disabled, the elderly, children who have difficulty and unable to walk. There are different types of motion devices, whether it is self-propelled, motor or with the help of an assistant. Existing wheelchairs adopted in hospitals and at home are limited in terms of functionality. It requires an assistant to lift the patient onto the bed or vice versa. In terms of safety also has the disadvantage of lacking especially when moving a restricted place and down the slope. In addition, it is less convenient in terms of shape and position when putting the patient to a wheelchair. Based on a survey conducted through consumer and hospital assistants, found a number of problems that exist on the existing wheelchair; that is; discomfort and limited functionality. Reasonable price with various functions and this is one of the criteria being viewed. Hence, wheelchair should be modified in order to resolve the problem so that the wheelchair can be adopted and provide comfort to the user and can be used without any assistant. For these reasons, the wheelchair must have safety features to avoid any accident occurs and easy handling without any help of others. The purpose of this research is to improve the existing wheelchair, to analyse the use of wheelchair for a variety functions and the comfortability. In addition, to test the effectiveness of the wheelchair for the user.

4. Related Work

Wheelchair specially designed to replace a person using the legs to move. According to Batavia (1998) [4], it is used for the movement of those with disabilities, the elderly and children are not who are unable to move on its own. The first wheelchair, which was introduced in 1595 that made the King of Spain called Philips. Next, in 1655, the Stepen Farfler had built a wheelchair which can be actuated by the user himself with three wheels. Whereas in 1783, John Dawson has created a wheelchair called "bath wheelchair" has features with 2 large wheels and one small wheel (Batavia 1998). The design of back rest existing wheelchair create stress injuries repeated if the patient is sitting for a long time (Yan 1998). The design "back rest" existing recurring effect on patients if prolonged sitting in a wheelchair. While the current design should emphasize the pressure that may occur when stopping the wheelchair and use the brake on slopes (Yan 1998). According to (Chitale and Gupta 2000), patients are now faced with the design problem of the back rest for existing wheelchairs and recurrent pain to use for long periods of time. The arm rest become an obstacle when the patient be transferred to a vehicle, no solution to the existing design to simplify the process of lifting a patient into the vehicle [6], therefore it needs to be fixed. According to (Kumar et al. 2012), at the moment the patients have problems when defecating. Patients should be raised and helped to undress to defecate, which in emergency situations would cause discomfort. The braking system also and need improvement

and It is no solutions for lifting patients from wheelchair to vehicle (Kumar et al. 2012). In terms of ergonomics, the wheelchairs are those that involve interaction with regard to the mechanical aspects of the vehicle and the physical condition of the user (Chakrobarati 1997). According to (Wikipedia 2015), ergonomic design of the wheelchair should be able to reduce the stress that can cause pain due to prolonged usage. Therefore, the study of ergonomics for wheelchair can be categories such as force, repetition, duration and posture. It should be taken into account by the designer of wheelchairs to provide comfort to the user or patient.

5. The Methodology of Research

The research methodology includes product design, theoretical framework, population and sample of respondents, data collection methods and procedures, methods and procedures for analysing data.

Research Design

In this product design involved market research, product design specification, development of concept, engineering design, fabrication, testing and market survey as shown in Figure 1.

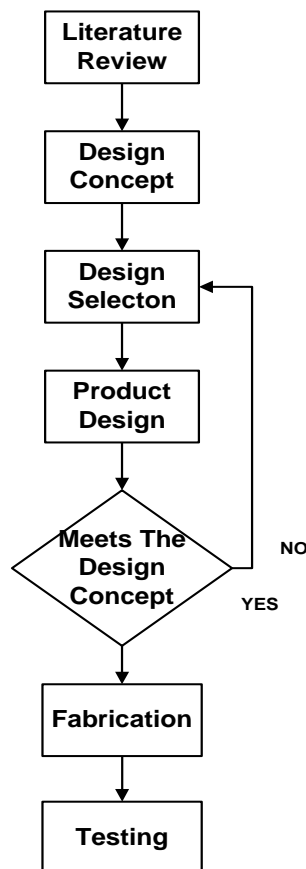


Figure 1 The research method

Market Research

Market research was conducted to identify the needs of the users, to understand the product market demand and business competitors in the market. Through the market survey from 30 respondents; which including medical assistants, pharmacists and patients, found that, current wheelchair design wheelchair is uncomfortable, unfriendly and difficult to conduct alone. Therefore, a more user-friendly, easy handling design should be made to ensure user comfort ability.

Product Features Analysis

Analysis of the design is intended to ensure the quality and strength of the product. Table 1 shows the specification of the product and will be tested to users.

Table 1: Data analysing

Description	Specification
Capacity	Maximum 100 Kg.
Place use	House, hospital and open place
Operation	Manually and electrical control
Maintenance	All spare part easy to replace
Safety	Only 12 V battery and easy handling. Alarm system

6. Product Design

Adjustable sliding arm rest was provided to provide comfort to the arm while resting and for the ease of shifting the patient from chair to the bed or to the vehicle. A proposed design in Figure 2 and Figure 3 shows the wheel chair with foldable a frame design, cushioned seat with head rest that allows the patients to rest the head and back comfortably (Neck injured, back injured, stomach operated, shoulder injured people). Another part, a cushioned leg rest to provide cushioning effect for the leg injured patients, adjustable backrest and leg rest with screw lock system with angular rotating design as shown in Figure 4 provided for rotating the seat and leg rest to inclined angle as required by the patient while resting. Then, a back rest can be dismantled and the chair can be folded which helps in ease of transportation. In order stop the wheelchair, a good braking system is proposed, it is provided to stop the wheelchair when moving down stairs in inclined angle. Furthermore, for the emergency, navigation light and bell provided for indication of help required by the patient at the time of assistant or attendee away from patient. Additionally, a support for keeping plates while having food and drinking, as a book and laptop supporter for a patient. It offers more users friendly.

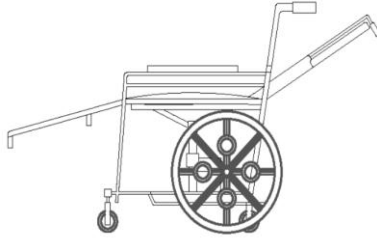


Figure 2 Side view

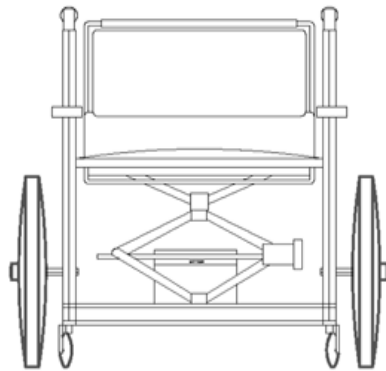


Figure 3 Front view

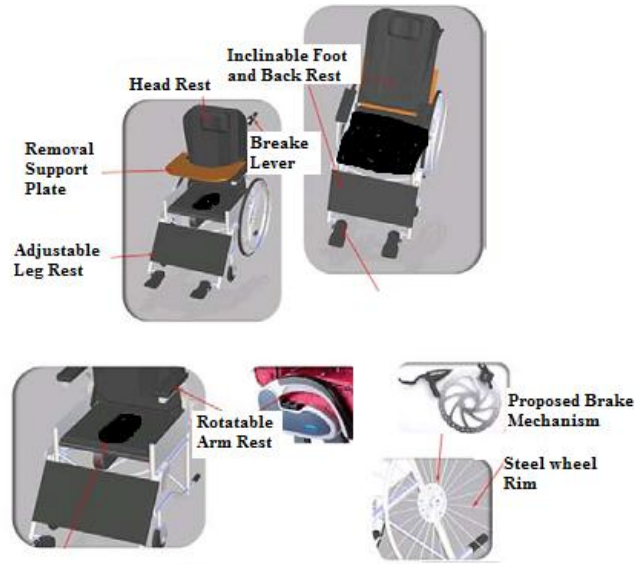


Figure4 Proposed Wheelchair Design

7.0 Electrical Component

DC Motor

A electrical DC motor Motor used for controlling a lifting patient up and down through hydraulic jack. By pressing a push button on a wheelchair, patient can control lifting according to their needs without the help of others. It can also be used to move the wheelchair automatically by simply pressing a switch and it would move without the use of human power.

Control Circuit and Power Supplier

The control parts and circuit involved a DC motor with 12 Volt battery. While hydraulic jack is operated by DC motor for up and down movement of the wheelchair seat. Figure 5 and Figure 6 shows the the system of the hydraulic system.

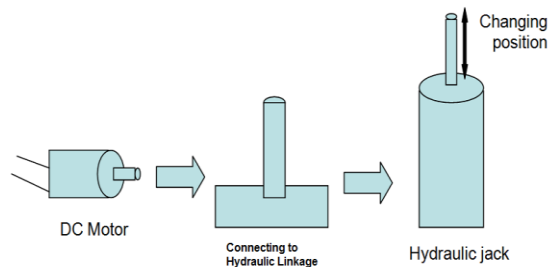


Figure 5 Hydraulic Jacks System

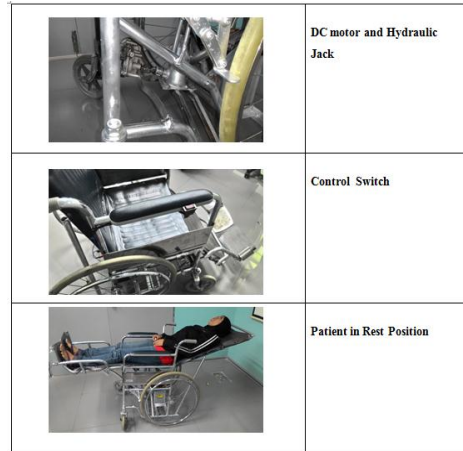


Figure 6 Electrical Control

8. Proposed System for Automatic Control

The proposed automatic control system are as follows using electrical relays, it is useful to control the motor but has a few problems that need to be addressed, using a MicroController, it can be used to control a complex circuit and more flexible and other proposed system through power electronic devices (used diodes and SCR's), it can be used for automatic control and it has a some benefits, that is; reasonable cost, simple circuit building, small size and there are available in the market.

Conclusions

This wheelchairs that combine mechanical and electrical engineering can benefit to all the users for better life, safe and better environment and comfortable. The proposed design also hoped that this research can somehow contribute to the good of locally manufactured products to be on par with the invention of the wheelchair outside the country.

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