"I confess that I have read this report and from my observation this report is fulfill the term of scope and quality in Fulfillment for the Degree of Mechanical Engineering (Design and Innovation)

Signature: .....

Supervisor Name: MOHD NAZIM BIN ABDUL RAHMAN

Date: 5th MAY 2007

DESIGN OF AN AID TO ASSIST HANDICAP/OLD PEOPLE TO TOILET/SHOWER

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Thesis submitted to Faculty of Mechanical Engineering in fulfillment for the Bachelor Degree of Mechanical Engineering (Design & Innovation)

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May 2007

"I confess that this project report is on my own work except for any diagrams, figures and reports that I have verified the sources on each of them."

Signature: .....

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Date: 5th MAY 2007

ABSTRACT

Nowadays, assistive devices for handicap and old people are less to be found in the market in our country. Disabled persons usually use old fashion devices which are consider non safety to them. Transferring to the toilet bowl or bathing chair is quite difficult to them according to their physical limitation. Persons with disability faced a problem in most of their daily activities which need an assistive device to improve the quality of life and make them independently. The reason for them to use an assistive aid in toilet and bathroom is to prevent an accident from happening as there are many case of accident happened involving this people through years. For the reason, a design proposal of an aid to help handicap and old people to toilet and shower is pursued in this project. The project proposed a design that useful and relevant to user in assisting to toilet and shower considering ergonomics and safety factor. A detail study on disabled persons and existing assistive device are made to develop and design the aid in helping disabled persons to toilet and shower. Hopefully the concept that have been generate can assist this people and decrease accident among them during toileting and bathing.

ABSTRAK

Pada masa sekarang, alat bantuan orang kurang upaya dan warga emas kurang diambil berat. Di negara kita, alat bantuan ini tidak banyak dijual dan digunakan oleh mereka yang memerlukannya. Mereka memerlukan alat yang direka bentuk untuk memudahkan kehidupan mereka dan tidak bergantung pada orang kedua dalam melakukan rutin harian mereka. Antara salah satu sebab mengapa mereka perlu menggunakan alat bantuan semasa ke tandas dan bilik mandi adalah untuk mengelakkan kemalangan yang sering berlaku di tempat sedemikian. Disebabkan itu, satu cadangan telah dibuat untuk mereka bentuk satu alat yang dapat digunakan oleh orang kurang upaya serta warga emas dalam membantu mereka semasa ke tandas dan juga bilik mandi. Alat bantuan tersebut direka dengan mengambil kira faktor-faktor ergonomik dan juga keselamatan. Kajian terperinci mengenai orang kurang upaya dan warga emas serta produk yang sedia ada telah dilakukan dalam usaha untuk membangunkan dan mereka bentuk alat yang dapat membantu mereka semasa ke tandas dan bilik mandi. Konsep yang dicadangkan diharap dapat membantu orang kurang upaya dan warga emas untuk ke tandas dan bilik mandi di samping mengurangkan kemalangan yang sering berlaku kepada mereka.

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LIST OF ABBREVIATIONS

SUBSCRIPT	DEFINITION
ADA	American with Disabilities Act
AT	Assistive Technology
CAD	Computer Aided Design
HFES	The Human Factors & Ergonomics Society
IDEA	Individual With Disabilities Education Act
IEA	International Ergonomics Association
NATRI	National Assistive Technology Research Institute
OSHA	Occupational Safety and Health Act(s)
RESNA	Rehabilitation Engineering and Assistive Technology Society of North America
RULA	Rapid Upper Limb Assessment
WHO	World Health Organization

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CHAPTER I

INTRODUCTION

For many elderly and disabled persons using the toilet or bathroom is a problem. When help is needed, their quality of life often drastically decreases. This research aims to study the problem face by disabled and elderly people during their toilet ritual and develop assistive device which can solve their problem.

Ageing and disabled people in general deal with decrease of physical and sensory capacities. Because of sitting down and getting up require postural control, this people are likely to have more trouble than others. The study of human factor and safety than will be apply in the design hopefully will help the people with disability during the toileting and bathing comfortable and independently.

1.1 Objective of Study

To design, develop and simulate an aid to assist handicap/old people to toilet/shower.

1.2 Design Scope

Student is expected to perform preliminary study on constraints/problem faced by handicap/old person to toilet/showers. This study should include safety and ergonomics factor into the design. Student is expected to use 3D software, namely Catia /Solidwork to design model and simulate the aid/proposed design.

1.3 Problem Definition

During the research on the problem/constraint faced by handicap/old people, problem facing by them is difficulty performing their toilet ritual. Moreover, handicap/old people also having a problem on bathing. A second person are needed by this people during bathing and toilet ritual to prevent an accident or injured.

During the toilet ritual, the most problem faced by them is difficulty to move to the toilet bowl which needs a second person to help them. In addition, this people also faced a problem on bathing which also need a second person to help them. Slippery bathroom and toilet room are one of the factor that make this people cannot perform this two ritual independently. Another factor that limit handicap and old people in bathing and performs the toilet ritual is some assistive device that use by them quite non-safety and not fulfill the ergonomic factor of human factor posture. An addition highly cost of the device also make them not interested in using the safety and ergonomic assistive device in performing the two rituals. Moreover, some assistive devices are difficult to use outside home. Some public toilet doesn't have proper hand support to assist this people to use it. In this country, handicap and old people toilet available at some places which made this people find difficult to go anywhere independently without a helping from second person.

1.4 Purpose of Study

This research is to study the constraint/problem faced by handicap and old people to toilet and shower and overcome the problem by designing an assistive device that can be use for bathing and toilet ritual. The study must consider safety factor and human factor (ergonomic) into the design.

1.5 Project Goals

- Identify the constraint/problem faced by handicap and old people to toilet and shower
- Identify the solution to overcome the constraint/problem
- Design an assistive device to overcome the problem faced by handicap and old people to toilet and shower
- Design an assistive device that consider safety and ergonomic factor
- Transfer the design idea into CAD drawing using 3D software namely Catia or Solidwork
- Simulate the design and human factor analysis using appropriate software

1.6 Research Questions

(1) How do the elderly/disabled use the supports during the entire toilet ritual/bathing?

(2) Which absolute positions of the supports do elderly/disabled people find most comfortable for sitting down on and rising from a toilet?

(3) Which positions of the supports relative to the body do elderly/disabled people find most comfortable for sitting down on and standing up from a toilet?

(4) What kind of supports do elderly/disabled people prefer during each phase of the toilet ritual and bathing?

(5) What kind of support is useful for elderly people during each phase of the toilet ritual and bathing?

CHAPTER II

LITERATURE STUDY

In order to have a better understanding of this project, literature reviews have been made on several topics. The purpose of this chapter is to provide the brief of the literature review on assistive technology, ergonomic, and design for safety. The first section of this chapter will be discussed on term and meaning of engineering design, and product realization. Moreover, the literature study contents the characteristics of successful product development. Meaning of disability and assistive device also one of this chapter content. In addition, literature study also was done on the history of assistive technology. Design for Ergonomic and Safety also were review in this chapter as it will be applied into the project design.

The chapter also consist existing product review and method in gathering outside information which are interviewing, patent searching and journal study.

Literature study was done by using 3 main sources as an input to the project research.

The three main sources are:

i. Internet
ii. Books
iii. Interview/Questionnaire

2.1 Engineering Design

Engineering design is the set of decision-making process and activities used to determine the form of an object given the functions desired by the customer. Whether designing of a component, product, system, or process. (Rundolph J. Eggert 2004, p. 2)

For example, the task of deciding which customer needs is important, including necessary product functions and desirable product features. Designer also has to try to determine desirable levels of performance and establish evaluation criteria with which can compare the merits of alternative designs. Consider of the technical, economic, safety, human factor, social, or regulatory constraint that may restrict designer choice.

Designer also uses creative ability to synthesize alternative designs incorporating varied shapes, configurations, sizes, materials of composition, or different manufacturing process. Moreover, designer utilize knowledge and methods from basic sciences, mathematics, and engineering sciences to predict or simulate the performance of each alternative before it is built, thereby avoiding the time and expense of tinkering.

2.1.1 Product Realization

The product realized process is the mean by which a customer need is transformed into a realized product. Alternatively, Dixon and Poli define the product realization process as complex set of interrelated activities, both cognitive and ceived produced, brought to market, serviced, and disposed of. The process involves physical activities and decision making (cognitive), including sales, marketing, industrial design, engineering design, production design, manufacturing, distribution, service, and disposal as shown in Figure 2.1.(Rundolph J. Eggert 2004, p. 12-13)

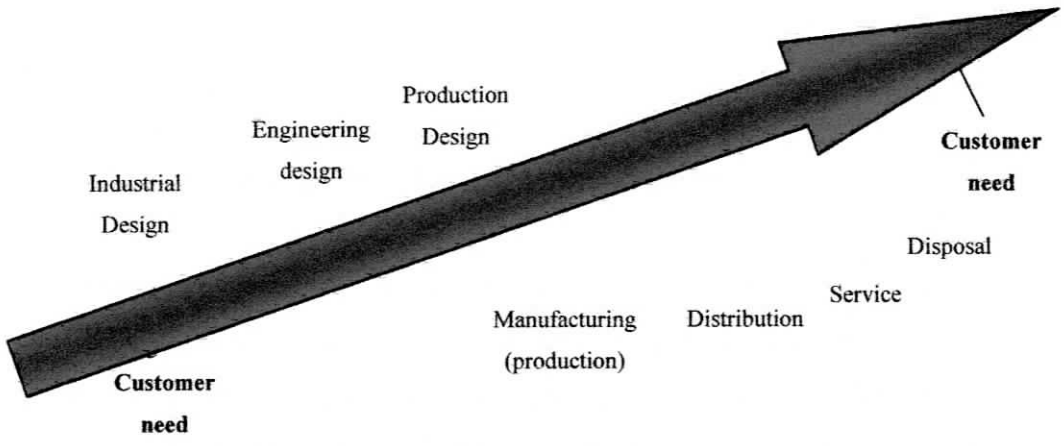

Figure 2.1, the product realization is the means by which customer need is transformed into a realized product (Rundolph J. Eggert 2004, p. 12-13)

Industrial Design activities focus on hoe the new or revised product idea is compatible with the customer's anatomical limitation and/or aesthetic trends in the marketplace (Rundolph J. Eggert 2004, p. 12-13). Usually the industrial design group will prepare an artistic rendering or a physical model that illustrates basic product form, color, texture, and intended functionality.

Engineering design activities result in recommended manufacturing specifications that satisfy the customer's functional performance requirement and manufacturing constraints (Rundolph J. Eggert 2004, p. 12-13).

Production design activities involve the design, fabrication, and installation of production equipment such as jigs, fixtures, machine tools, quality control instrumentation, and material handling equipment (Rundolph J. Eggert 2004, p. 12-13).

Manufacturing activities relate to fabrication, assembly, and testing. They also include training, scheduling, and supervising production employees (Rundolph J. Eggert 2004, p. 12-13).

Distribution activities involve shipping the product in wholesale-sized lots to distribution centers located around the country or world (Rundolph J. Eggert 2004, p. 12-13).