



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

“STUDY OF SYSTEM INTEGRATION OF PORTABLE ABLUTION USING SOLIDWORKS”

This report is submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree in Engineering Technology
Manufacturing (Product Design) with Honours.

by

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ABSTRAK

Tesis ini membentangkan penerangan tentang *Ablution System*. Pengambilan wudhuk mendefinisikan sebagai persiapan penggunaan air dengan menyucikan bahagian tertentu tubuh sebelum memulakan solat. Wudhuk adalah perkataan yang sinonim dengan penggunaan air, umat Islam telah diwajibkan untuk melaksanakan wudhuk sebelum memulakan sesuatu ibadah. *Ablution System* telah direka untuk menangani isu penggunaan air yang berlebihan semasa pengambilan wudhuk. *Ablution System* ini mesra pengguna dan juga dapat meminimumkan jumlah air yang diperlukan untuk melakukan wudhuk, ianya membolehkan pengguna menjimatkan lebih banyak air selepas melakukan wudhuk bagi mengelakkan pembaziran. Tujuan projek ini adalah untuk merekabentuk sistem wudhuk menggunakan perisian SolidWorks untuk mencapai hasil struktur yang baik, pemilihan bahan, ergonomik dan kos rendah untuk melaksanakan projek 'Ablution system' ini. sambil mengurangkan penggunaan air. Jumlah air yang digunakan oleh 25 orang responden hanya 3750ml. Konsep yang digunakan untuk menyiapkan 'Ablution System' dengan menggunakan keadah pembuatan, proses buatan tangan dan proses pemesinan.

ABSTRACT

This thesis presents the description about the ablution system. Ablution defines as a cleaning prepare that utilizing water with washing the certain part of the body before performing a prayer. Ablution is truly synonym word with water, so Muslim have been presented the put to perform this ritual activity. Portable ablution has been designed to address the excess water issue used during ablution rituals, this Wudhuk machine is user-friendly and also produce the minimum amount of water needed to complete the process and the benefits of Wudhuk machines enable buyers to store excess water at whatever point they take ablution before performing commitments. The purpose of this project is to design an ablution system using SolidWorks software to achieve a good result for the structure, material selection, ergonomics and the low cost to fabricate this ablution system project while minimization in water consumption. The total use of water that analysed among 25 respondents is only 3750ml. The finalized concept of the Ablution System was fabricated using the manufacturing method, handmade process and machining process.

DEDICATION

To my beloved parents and siblings

Hj Ali Arashid Bin Sihat

Hjh Rasilah Binti Abd Manaf

Thank you for all supports, sacrifices and patients that has been shared with me.

To my honoured supervisor and co- supervisor

Puan Nur Aiman Hanis Binti Hasim and Encik Mohd Hidayat Bin Abdul Rahman

Thank you for always giving me guidance to complete this thesis project.

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TABLE OF CONTENT

	PAGE
DECLARATION	ii
APPROVAL	iii
ABSTRAK	iv
ABSTRACT	v
DEDICATION	vi
ACKNOWLEDGEMENTS	vii
TABLE OF CONTENT	viii
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF APPENDICES	xiii
CHAPTER 1 INTRODUCTION	1
1.0 Background of Study	1
1.1 Problem Statement	2
1.2 Objective	3
1.3 Scope of Research	3
1.4 Significant of Research	3
CHAPTER 2 LITRERATURE REVIEW	4
2.0 Introduction	4
2.1 Ablution	4
2.1.1 Introduction of Ablution	4
2.1.1.1 System of Water	6
2.1.1.2 System Shape of Design	7
2.1.1.3 Ergonomic Study Of Ablution	10
2.2 Summary of Journal	13
CHAPTER 3 RESEARCH METHODOLOGY	23
3.0 Introduction	23
3.1 Flow Chart	24
3.2 Software Applications	25

3.2.1 SolidWorks Software	25
3.3 Material Selection	26
3.3.1 Fibre Reinforced Polyester	26
3.4 Machine	27
3.4.1 Selective Laser Sintering (SLS) 3D Printing	27
3.4.2 The SLS Printing Process:	29
3.5 Water Pipe System	30
3.6 System Design Sketching	32
3.7 Concept of Selection Method	36
3.8 Conclusion	38
CHAPTER 4 RESULT & DISCUSSION	39
4.0 Introduction	39
4.1 Conceptual Scoring Matrix	40
4.1.1 Concept Screening Matrix	43
4.2 Water System	45
4.3 Type of Machine	47
4.4 Fabrication Process	54
4.5 Design of Portable Ablution System (PAS)	61
4.6 Finishing Process	63
4.7 Result of Ablution System	64
4.8 Water Analysis	66
4.9 Conclusion	69
CHAPTER 5 CONCLUSION AND RECOMENDED	70
5.0 Introduction	70
5.1 Challenge	70
5.2 Limitation of Product	70
5.3 Recommendation	71
5.4 Conclusion	71
REFERENCE	72
APPENDICES	75

LIST OF TABLES

TABLE	TITLE	PAGE
Table 3.1:	Mechanical Properties of Fiberglass	27
Table 3.2:	Example of Concept Screening	36
Table 3.3:	Example of Concept Scoring	37
Table 4.1:	Ablution System Concept Screening Matrix	43
Table 4.2:	Ablution System Concept Scoring Matrix	44
Table 4.3:	Performance Rating	44
Table 4.4:	Selective Laser Sintering Machine (SLS) Process	49
Table 4.5:	Laser Cut Machining Process	52
Table 4.6:	Water Analysis	66

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1:	Step of Whuduk	5
Figure 2.2:	Example of Framework of Study For Development of Smartwhuduk	7
Figure 2.3:	Example of The 3D Drawing Using Solidworks Software	8
Figure 2.4:	Example of Analysis by Using Solidworks Software	8
Figure 2.5:	Anthropometric Data For Malaysian Wheelchair User	9
Figure 2.6:	The Condition of Wudhuk Activity Before Intervention	10
Figure 2.7:	Example of Ergonomic Ablution Space	12
Figure 3.1:	Example of 3D Drawing Using Solidworks Software	26
Figure 3.2:	Example of Analysis by Using The Solidworks Software	26
Figure 3.3:	Selective Laser Sintering (SLS) 3D Printing	28
Figure 3.4:	Selective Laser Sintering (SLS) Process	29
Figure 3.5:	Example of The Weight of The Water and The Force of Gravity Give Pressure to The Water	30
Figure 3.6:	Hose Connector Switch Adjustable	31
Figure 3.7:	Design System Concept 1	32
Figure 3.8:	Design System Concept 2	33
Figure 3.9:	Design System Concept 3	34
Figure 3.10:	Design System Concept 4	35
Figure 4.1:	Sizing	40
Figure 4.2:	Adjustable Height	40
Figure 4.3:	Flip	41
Figure 4.4:	Ergonomic	41
Figure 4.5:	Water Pumping	42
Figure 4.6:	Top and Bottom Side	45
Figure 4.7:	Wasted Water Container	46
Figure 4.8:	Selective Laser Sintering Machine (SLS)	47
Figure 4.9:	Laser Cut Machine	48

Figure 4.10: Bone Part of The Whole Body	54
Figure 4.11: Bottle Holder	55
Figure 4.12: Controller Nozzle Rod	55
Figure 4.13: Adjuster Valve	56
Figure 4.14: Bottle Holder and Valve Pipe To Tube At Top Side	56
Figure 4.15: Bottle Holder and Valve Pipe To Tube At Bottom Side	56
Figure 4.16: Flow Water System Assembly	57
Figure 4.17: Sink of Flow Water System	57
Figure 4.18: End Flow	58
Figure 4.19: Tank of Wasted Water	58
Figure 4.20: Wasted Water System	59
Figure 4.21: Flow Water System For Portable Ablution	59
Figure 4.22: Support Angle of Body	60
Figure 4.23: Full Assembly of Portable Ablution System	60
Figure 4.24: Isometric View oSolidworks Software	61
Figure 4.25: Top View of Solidworks Software	61
Figure 4.26: Side View of Solidworks Software	62
Figure 4.27: Front View of Solidworks Software	62
Figure 4.28: Function of The Portable Ablution	63
Figure 4.29: Front View	64
Figure 4.30: Side View	64
Figure 4.31: Top View	65

LIST OF APPENDICES

		PAGE
Appendix 1	Gant Chart	75
Appendix 2	Drawing of Ablution System Body	76
Appendix 3	Drawing of Pipe Connector Piping	77
Appendix 4	Drawing of Bottle Holder	78
Appendix 5	Drawing of Side Holder	79
Appendix 6	Drawing of Handler	80
Appendix 7	Drawing of Sink	81
Appendix 8	Drawing of Waste Water Tank	82

CHAPTER 1

INTRODUCTION

1.0 Background of Study

Recently, research has shows an interest in designing an ablution workstation with concurring to the users' comfort. It appears that ablution workstation is really important in Muslim lifestyle because it is one of the everyday routine for a Muslim who should be practicing for their religion. Ablution defined as a cleaning preparation using water with washing certain part of the body before performing a prayer. A complete ablution process includes washing the face, both of hand, head and feet which follow the sequence with repeated two or three times. Ritual ablution need clean and the holy water to make sure the ablution is accepted by God. Ablution is truly synonym word with water, so Muslim have been presented the put to perform this ritual activity. Previous studies have reported many idea and design were established near the prayers house such as Mosque and Musollah. Each of the design ablution system workstations in the mosque will design in many variations as human behavior that will influence the way a Muslim performing ablution.

The increment in human population has driven to a need of water supply due to different exercises counting logging exercises that influence water flows. Quick development in Malaysia also causes water to be retained into the soil and proceeds the flow into the stream (Rachmat et al. 2013). This has come about in a drop in the amount of groundwater, influencing the supply of clean water. Hence, portable ablution has been designed to address the excess water issue used during ablution rituals. The requirements for

a designed machine can make users minimize the utilization of water during Wudhuk. Furthermore, Wudhuk machine is user-friendly. The benefits of Wudhuk machines is it can enable buyers to store excess water at whenever point they take ablution before performing the ablution ritual.

1.1 Problem Statement

Upon ablution, there are several problems that seldomly Muslim encounter but not been realised. One is the wastage of water. In a holy Quran states that *“Indeed, the wasteful are brothers of the devils, and ever has Satan been to his Lord ungrateful.”* (Surah Al-Isra’: 27). This explains that waste is one of the acts that are not noble. To solve this problem, water saving system has been created on portable ablution. In spite of the cheap water in our nation, waste could be a matter of no benefit in terms of Islamic religious law.

Most of the ablution system uses are less of ergonomic practice. In fact, it can burden the user. It requires the user to bend in performing Wudhuk (Siti Zawiah et al. 2017). So that, some ergonomic practice must be included in the ablution system in order to solve this problem and it might be very user friendly to all ages.

Recently, individuals have created the first automatic ablution machine, but when it is commercialized the price is indeed expensive and is targeted at specific market segments. So, for that reason, there is a need to develop an easy-to-use and cheap ablution system. With this new design ablution system, it will be able to minimize the wastage of water resources and is suitable for outdoor use because it is easy to use and portable.

1.2 Objective

- 1) To study about ablution system.
- 2) To design system for a portable ablution machine using SolidWorks.
- 3) To fabricate a prototype of Portable Ablution System.

1.3 Scope of Research

This project displays as an answer to avoid wastage of water during ablution ritual. In addition to reducing waste water, it is also one of the tools in addition to ergonomic and portable, easy to use. This task centre on analyse research overviews on surveys distributed by google forms, surveys and fill out forms by 250 respondents. The data analysis obtained in this project is required before designing the fabrication and piping system to encourage the flow of water contained in portable Ablution to work smoothly.

1.4 Significant of Research

This study will embark the usage of portable ablution system in modern generation nowadays. Water saving factors got to be emphasized so that water savings can help in reducing wastage of water. Furthermore, the piping system has been designed to complement the waterways to create the best Portable Ablution System (PAS). This PAS will be design with ergonomic perspective in oder to ensure the comfartablity among user while using this PAS. In addition, it is also easy to carry everywhere and is ideal for weddings and organizers.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will discuss the literature review of five subtopics. The first subtopic is the introduction of ablution. The second subtopic is a system of water ablution. The third is a system shape of design and the last subtopic is an ergonomic study of ablution. The study material was found from journals, thesis, case studies, and technical documents.

2.1 Ablution

2.1.1 Introduction of Ablution

Ablution could be a custom washing performed by Muslim based on Quran, Sunnah and the researcher consensus, the bathing custom which they have many rules and way when performing the ritual and it is part of obligatory exercises to guarantee cleanliness before the Muslim perform prayer. (Haliza Johari, et.al,2013)

Abd Rahman, et.al (2017) said that to perform a prayer, ablution is a necessity and fundamental practice for Muslim. As a Muslim for five daily prayers, it utilized around 25 litres of waters. In Islamic view the grey water delivered from ablution is consider as Musta'mal water. Figure 2.1 underneath shows the steps of whuduk.



Figure 2.1: Step of Whuduk

According to Al Mamun, et.al (2014) says that the amount and quality of the utilized water after ablution can be effectively recycled and reused because it is not much polluted and can utilize for common cleaning and landscaping purpose, after sand filtration. Shockingly, within the contexts of Malaysian climate, the treatment and reuse of commercial greywater would be as well expensive. With low maintenance treatment systems, it can treat and reuse ablution water from the Masjid and the water can easily be utilized for the landscaping and toilet flushing activities, which can reduce the water utilization within the college.

2.1.1.1 System of Water

Wudhu usually takes a few minutes at a water facility, but there are a few who do not focus on excessive use of water when taking a bath. This has led to a large amount of waste water. Other than that, the ritual when performed in musollas and mosques, particularly during the Friday prayers, involves critical wastage of treated water. These records expressly show they have to be compelled to review and move forward, in case possible, the current practice of performing the ablution ritual, particularly in the aspect of water preservation. Greywater produced from the ablution ritual is generally clean because it contains no cleanser or strong pollutions, but small amounts of microorganisms basically from washing. Thus, by accumulation this contaminated water and channelling it through water treatment, the water can be recycled and reused. The treated water can be utilized indoor for flushing toilet bowls and common washing, whereas open-air applications incorporate water system of flowerbeds, plant nurseries as well as car-washing. All these clearly appear how the ablution water can be reused in advantageous ways with a closed-loop water recycling system.

Suratkon et al (2014) said that as a rule ablution ritual continuously expends a huge sum of water where the greywater is permitted to run free and drain away, particularly in musollas and mosques. However, referring to previous studies Rachmat et al (2013), about six to nine liters of water is usually required to make ablution process, but according to the hadith of Islam, about half to two liters will only be used for wudhuk. Water conservation is strongly emphasized in Islam as declared by Prophet Muhammad SAW and more clearly, the Prophet Muhammad once performed whuduk only with mud water (similar to $\frac{2}{3}$ litres). Figure 2.2 below show the example of framework of study for development of SmartWHUDUK.

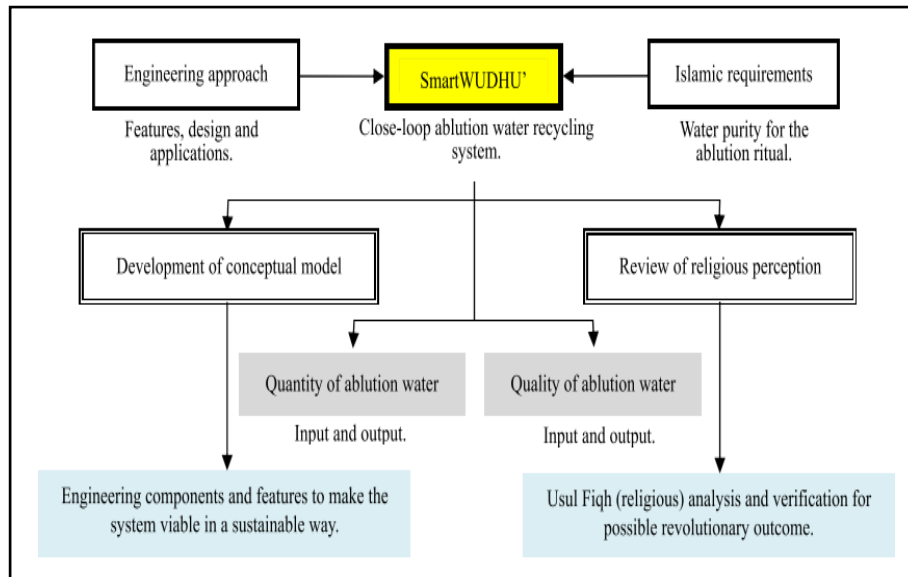


Figure 2.2: Example of framework of study for development of SmartWHUDUK

2.1.1.2 System Shape of Design

This project will use SolidWorks as a device to illustrate the demonstration of portable ablution design. The Computer Aided Design (CAD) programming collects 2D and 3D solid models with no complex part, speedier and minimal exertion deficiently way. This SolidWorks is exceptionally simple to utilize, utilizing straightforward design user interface and simpler to utilize compared to other CAD solid modeling software. SolidWorks is consolidated with Solid demonstrating, movement, simulation, toolbox, device investigator, circuit works, photo view 360, ScanTo3D, e-illustrations and DWG manager. SolidWorks moreover can design different things, and the simulation provided by the software, moreover the product can be test in a really effective way. Thus, it may be an accommodating device to make the most excellent plan for portable ablution. Figure 2.3 and Figure 2.4 below shows the examples of 3D drawing and analysis by using SolidWorks software.

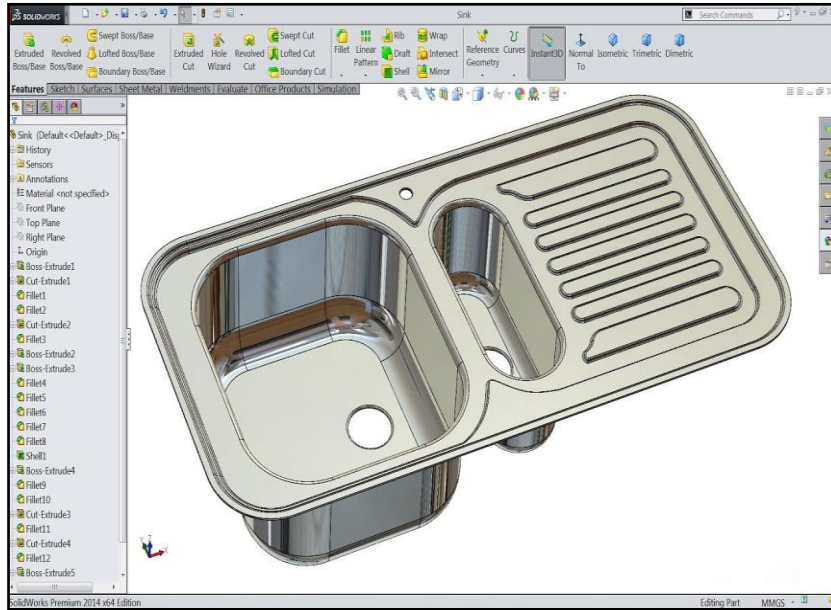


Figure 2.3: Example of the 3D drawing using SOLIDWORKS software

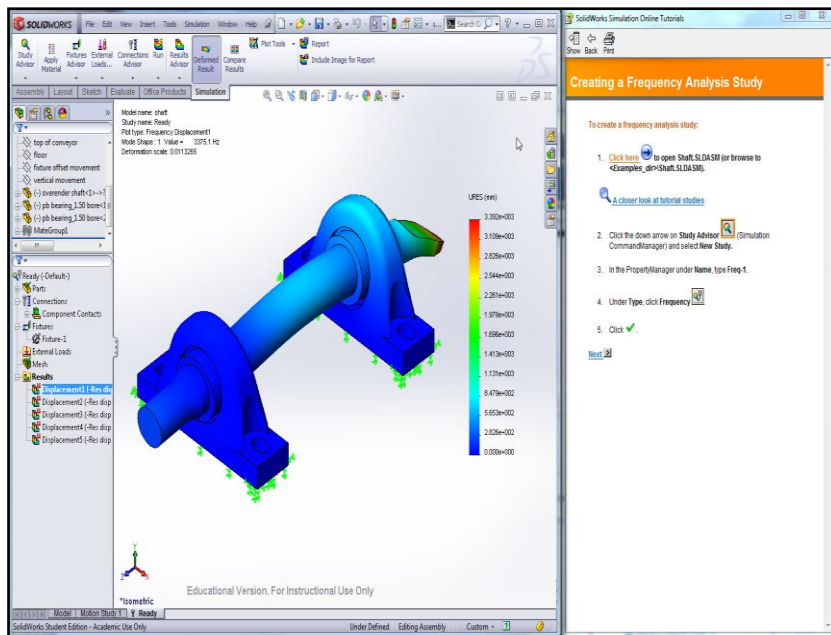


Figure 2.4: Example of analysis by using SOLIDWORKS software

Siti Zawiah et al. (2017) states that in Malaysia, each designer and the creator must take after rules set by the Malaysian Standard set to construct public facilities accessible to powerless groups such as disabled individuals and the elderly. In any case, none of the

standard developed exclusively specified on ablution workstation in detail for disabled populations. Figure 2.5 shows the several factors such as the right posture within the limitation and ability of the disabled people especially the wheelchair user and pertinent anthropometric dimensions for designing the ablution workstation. This ergonomic ablution system is created to ensure that the user have more confidence in performing their Wudhuk.

No.	Dimension	Male				Female			
		Mean	SD	5th Percentile	95th Percentile	Mean	SD	5th Percentile	95th Percentile
1	Weight	65.6	19.6	41.6	97.4	62.0	15.1	44.0	79.0
2	Sitting height	77.9	6.0	66.1	86.2	74.4	10.4	62.3	88.6
3	Eye height, sitting	67.1	6.5	57.7	77.4	61.3	6.8	51.5	68.5
4	Shoulder height, sitting	52.2	6.8	43.8	60.7	47.8	7.1	38.4	56.5
5	Waist height, sitting	16.7	3.1	12.5	20.5	NA	NA	NA	NA
6	Thigh clearance	12.0	3.5	6.4	17.2	12.7	3.6	7.7	16.2
7	Sitting elbow height	19.9	4.9	14.0	24.4	17.0	4.5	11.0	21.9
8	Arm Reach upward	115.6	22.5	79.5	157.4	103.9	6.7	94.8	111.0
9	Knee height sitting	48.8	4.3	41.7	57.6	51.4	8.0	43.1	62.4
10	Popliteal height	39.4	4.2	34.2	46.9	40.9	9.5	31.4	54.0
11	Arm reach forward	80.7	4.8	71.7	86.4	75.1	4.7	70.2	81.1
12	Forearm-hand length	30.3	9.3	22.5	45.6	25.2	2.5	21.8	28.0
13	Elbow fingertip length	43.6	4.0	38.3	48.7	41.4	2.6	39.3	44.5

Figure 2.5: Anthropometric data for Malaysian wheelchair user

Most of the mosque's facilities are planned without accommodating impaired individuals, particularly for disable people. Hence, the World Health Organization coordinates the significance of bringing in correspondence between people who are physically debilitated and focusing on the design of ablution facilities to manage with loss of motion considers safety and consolation. With the ergonomic approach and the productivity of consumer engagement can plan modern abilities for ablution premature birth. (Mansur.et.al, 2015). Figure 2.6 shows the condition of wudhuk activity before intervention