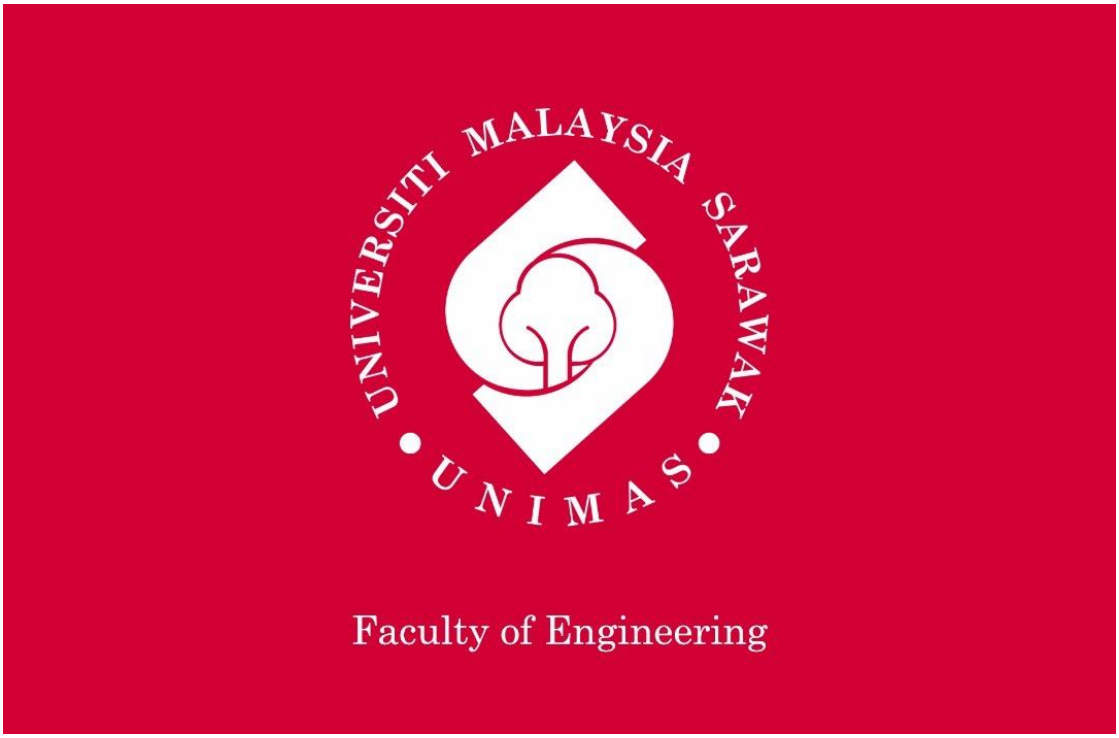


# Automatic Hand Washer

**Noamie Anak Balai**

**Bachelor of Engineering with Honours**

**(Mechanical and Manufacturing Engineering)**

**2017**

UNIVERSITI MALAYSIA SARAWAK

Grade: A-

**Please tick (√)**

| | |
|---|---|
| Final Year Project Report | ✓ |
| Masters | |
| PhD | |

## DECLARATION OF ORIGINAL WORK

This declaration is made on the 13 day of July 2017.

**Student's Declaration:**

I Noamie Anak Balai, 42738, Faculty of Engineering
(PLEASE INDICATE STUDENT'S NAME, MATRIC NO. AND FACULTY) hereby declare that the work entitled Automatic Hand Washer is my original work. I have not copied from any other students' work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

19/7/2017
Date submitted

Noamie Anak Balai (42738)
Name of the student (Matric No.)

**Supervisor's Declaration:**

I Andrew Ragai Henry Rigit (SUPERVISOR'S NAME) hereby certifies that the work entitled Automatic Hand washer (TITLE) was prepared by the above named student, and was submitted to the "FACULTY" as a * partial/full fulfillment for the conferment of Bachelor of Mechanical and Manufacturing Engineering (PLEASE INDICATE THE DEGREE), and the aforementioned work, to the best of my knowledge, is the said student's work.

Received for examination by: _____ Date: 19/7/17
(Name of the supervisor)
Andrew Ragai Henry Rigit

I declare that Project/Thesis is classified as (Please tick (√)):

☐ CONFIDENTIAL (Contains confidential information under the Official Secret Act 1972)*
☐ RESTRICTED (Contains restricted information as specified by the organisation where research was done)*
☑ OPEN ACCESS

**Validation of Project/Thesis**

I therefore duly affirm with free consent and willingly declare that this said Project/Thesis shall be placed officially in the Centre for Academic Information Services with the abiding interest and rights as follows:

- This Project/Thesis is the sole legal property of Universiti Malaysia Sarawak (UNIMAS).
- The Centre for Academic Information Services has the lawful right to make copies for the purpose of academic and research only and not for other purpose.
- The Centre for Academic Information Services has the lawful right to digitalise the content for the Local Content Database.
- The Centre for Academic Information Services has the lawful right to make copies of the Project/Thesis for academic exchange between Higher Learning Institute.
- No dispute or any claim shall arise from the student itself neither third party on this Project/Thesis once it becomes the sole property of UNIMAS.
- This Project/Thesis or any material, data and information related to it shall not be distributed, published or disclosed to any party by the student except with UNIMAS permission.

Student signature _____ (17/7/2017) (Date)

Supervisor signature: _____ (Date) 19/7/17

Current Address:
LOT: 11912, Palm Villa 2, Taman Jelita Off Taman Tunku, 98000, Miri, Sarawak

Notes: * If the Project/Thesis is **CONFIDENTIAL** or **RESTRICTED**, please attach together as annexure a letter from the organisation with the period and reasons of confidentiality and restriction.

[The instrument is duly prepared by The Centre for Academic Information Services]

# AUTOMATIC HAND WASHER

NOAMIE ANAK BALAI

A dissertation submitted in partial fulfillment

of the requirement of the degree of

Bachelor of Engineering with Honours

(Mechanical and Manufacturing Engineering)

Faculty of Engineering

Universiti Malaysia Sarawak

2017

To my beloved family and friends

## ACKNOWLEDGEMENT

First of all, I would like to express my gratitude towards God for the blessing that given to me along the journey of completing my Final Year Project.

I would also to thank my supervisor, Prof. Ir. Dr. Andrew Ragai Henry Rigit for his supervision, guidance and support throughout this Final Year Project.

Besides, I would also like to thank my parents and family for the supports and understandings that given to me throughout my 4 years of study in Universiti Malaysia Sarawak.

Lastly, I would like to express gratitude and thanks to all my friends that has helped me in completing this project.

## ABSTRACT

Hand washing is a process of removing the germs from the hands. It is a vital process after done doing any activities. Hand washing helps to prevent any diseases that spread through contact. In order to eliminate most of the germs on the hands, one needs to apply a good hand washing practise. This hand washing practise involves 3 important steps which are rinsing, soaping, and drying. The main focus of this thesis is to design a convenient automatic hand washer that involves 3 vital steps in a good hand washing practise. The automatic hand washer is also a fully automated operation that does not need any single touch from the user for it to operating. Besides, this thesis also focuses on the simulation of the water flow in the nozzle inside the device so it gives a good water spray effect.

## ABSTRAK

Membasuh tangan merupakan proses penyingkiran bacteria di tangan. Ia merupakan satu proses yang harus dilakukan setelah selesaikan melakukan aktiviti harian. Membasuh tangan juga menghalang penyakit yang berjangkit melalui sentuhan dari terus merebak. Bagi untuk mengelak sebarang penyakit berjangkit melalui sentuhan merebak, seseorang perlulah mengamalkan amalan mencuci tangan yang baik. Amalan tersebut mengandungi 3 langkah yang penting iaitu membilas, menyabun, dan mengeringkan tangan. Fokus utama tesis ini adalah untuk mereka bentuk "Automatic Hand Washer" yang mengandungi 3 proses penting di dalam amalan mencuci tangan yang baik. "Automatic Hand Washer" juga beroperasi secara automatik sepenuhnya tanpa memerlukan sentuhan dari pengguna untuk memulakan operasi mesin tersebut. Selain itu, tesis ini juga fokus dengan simulasi aliran air di dalam nozel mesin tersebut. Simulasi tersebut bertujuan supaya aliran dan pancutan air dari nozel bersesuain untuk kegunaan membasuh tangan.

TABLE OF CONTENTS

# LIST OF TABLES

LIST OF FIGURES

## LIST OF SYMBOLS

| | | |
|---|---|---|
| A | - | Area |
| D | - | Diameter |
| g | - | Gravitational force |
| h | - | Height |
| P | - | Pressure |
| Q | - | Flow rate |
| V | - | Velocity |
| $P$ | - | Density |

## LIST OF ABBREVIATION

| | | |
|---|---|---|
| CDC | - | Center for Disease Control and Prevention |
| HAI | - | Health – care Associated Infections |
| HFMD | - | Hand Foot Mouth Disease |
| WHO | - | World Health Organization |

# Chapter 1

# Introduction

## 1.1 Background of Study

The practice of hand washing is important as it can prevent the spreading of diseases. Most people are practicing hand washing but they are not practicing a good hand washing technique. It is learnt that hand washing is the single most important factor in preventing the spread of disease (Parker, 1999).

In order to have a good hand washing practices, 5 important steps need to be followed. Those 5 steps are wet, lather, scrub, rinse and dry. Hands need to be scrub well for at least 20 seconds in order to eliminate most of the bacteria on the hand (CDC, 2012). Most people usually clean their hands less than half of the times they should. This cause the bacteria on the hands are not fully removed.

Unfortunately, it is hard to remove most of the germs after hand washing process. This is due to recolonization of germs after hand washing process. Recolonizations of germs occur when the users need to touch the knob of the faucets after hand washing. This is because the knob itself contains million of germs.

There are several diseases that can spread through contacts which are diarrhea, flu and hand, foot and mouth disease (HFMD). Health-care associated infections are

also one of the deathly diseases that spread through contact between the health workers and patients. These diseases can be easily transferred to one and another.

It is important to have a good hand washing as it can save many lives by preventing disease that spread through contacts. The three elements that can eliminate the germs on the hands are water, soap and dryer. These three elements will be combined into the automatic hand wash where the user only needs to insert their hands in the machine for hand wash. The well design of automatic hand washer will ease the process of hand washing. Besides, the automatic hand washer will remove any germs on the hands efficiently and will reduce the health-care associated infections which occur among the health care workers.

## 1.2 Problem Statement

The lack of hygiene especially in the hands can cause deathly disease to spread through contacts. According to WHO (2013), every year, diarrhea has taken 760 000 lives of children under five years old. It is also estimated that around 1.7 billion cases of diarrhea are recorded each year. The high amount of death cases due to the diseases causes it to be one of the top killers for children under five.

Besides, the lack of hand hygiene can contribute to spread of microbes that cause health care-associated infections .The microbes that cause HAI will easily spread from the health-care workers to patients. This will endanger the patient's life as they are exposed to various microbes.

By hand washing, it can prevent the disease and microbes from spreading (Burton, Judah, & Curtis, 2011). It is difficult to remove most of the microbes on the hands if

they are not practicing a good hand washing technique. Most of the microbes will be removed from the hands when the human uses soap, scrub the hands thoroughly for 20 seconds and dry them after the hand washing process. Human will has good hand hygiene and less case regarding the disease that spread through contact will be recorded if there is device that can conduct a hand washing efficiently.

## 1.3 Objectives

This study is focus on designing the automatic hand washer. Through this well design technology, it can prevent the deathly disease from spreading into others. The objectives of this project are as below:

1) To design a well and convenient automatic hand washer
2) To allow users to soap, wash and dry their hands without a single touch from the users
3) To do simulation of water flow in the nozzle of the automatic hand washer

## 1.4 Scope of Works

The scope of works for this study is to apply the application of automatic hand wash. The automatic hand wash will wash human hands efficiently where it will remove most of the microbes. It will improve human's life by having more convenient and efficient hand wash technology. It also will increase the hand hygiene in humans.

# Chapter 2

# Literature Review

## 2.1 Introduction

In this chapter, it will discuss in detail about the past and current knowledge of hand washing technique. It will also discuss all the matter that need to be taken into consideration during conducting this project. Besides, the methodology that needed in this project will be discussed briefly.

## 2.2 Hand washing

There are millions of germs that live surround us such as in bathroom, kitchens and even on the telephone. It is hard for humans to prevent themselves from having any contact with the contaminated surface. The germs can live in harsh conditions and easily transfers into other surfaces. Once human touched the contaminated surface, the germs on the hands will easily transfer into other by only single touch. The germs on the hands can easily enter into the body through eyes, nose and mouth which then causes sickness

(Ejemot, Ehiri, Meremikwu, & Critchley, 2008). In order to remove most of the germs on the hands, one needs to wash hands as clean as possible and several times per day.

Hand washing is the act of cleaning hands in order to remove the germs on hands. Hand washing is very important where it is listed as one of the guidelines for standard precautions that need to be followed by the health care. According to Powers, Armellino, Dolansky, & Fitzpatrick (2016), it is recorded that 63% of the health care will wash their hands after removal of gloves while 82% wash their hands after provision care. This shows that there are still people are not applying hand washing technique. This situation will promote of spreading of germs through contacts.

### 2.3 Current hand washing technique

According to Centers for Disease Control and Prevention (CDC), humans need to have a good hand wash technique in order to remove most of the germs on the hands. The current technique involves water, soap and dryer. There are 5 important steps provided by the CDC in order to have a good hand wash technique. Those 5 steps according to CDC are as below:

1. Wet hands from the finger tips to wrist by using warm water
2. Soap hands until its lather
3. Scrub hands thoroughly from wrist until our finger tips for 20 seconds.
4. Rinse hands completely
5. Dry hands by using dry towel

The technique may look simple but most people are not able to apply all the steps. Besides, according to Teare (1999), most of the health care workers still fail to wash

their hands. Usually, people will take lightly in drying their hands completely after hand washing. According to Rybicki (2011), germs can grow and spread faster in a damp environment. Estimated 85% of microbes are transferred to surroundings by using moist hands compare to dry hands which only transmitted 0.06% of microbes. This shows that it is important to apply the last step which is drying in order to avoid recolonization of the microbes on the hands.

Basically, the important steps in a good hand wash technique is wet, soap, scrub, rinse and dry. Meanwhile, the important elements in hand wash are water,soap and dryer. Furthermore, the 20 seconds of scrubbing hands after applying soap is important. This is because the microorganism will eliminate if the scrub is performed for 20 seconds.

### 2.4 Current hand washing technology

The basic elements for handwashing that need to be focused are water, soap and dryer. The current technology that being used by all which applying these 3 elements are water faucet, soap dispenser and hand dryer. These current technologies are working separately and not functioning in one device. Besides, the current technology involve a lot of contact in order for it to functioning. The technologies are not fully automated. This will causes the germs will easily get on the hands seconds after the hand washing process is done.