



Faculty of Electrical and Electronic Engineering Technology



**DEVELOPMENT OF UV-C BASED GERMS DISINFECTING
DEVICE WITH SOLAR BATTERY CHARGING**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

NUR SHAHFIQAH NATASHA BINTI SAMSUDIN

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

2022

**DEVELOPMENT OF UV-C BASED GERMS DISINFECTING DEVICE WITH
SOLAR BATTERY CHARGING**

NUR SHAHFIQAH NATASHA BINTI SAMSUDIN

**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology (Industrial Power) with Honours**



Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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I declare that this project report entitled “Development of UV-C Based Germs Disinfecting Device With Solat Battery Charging” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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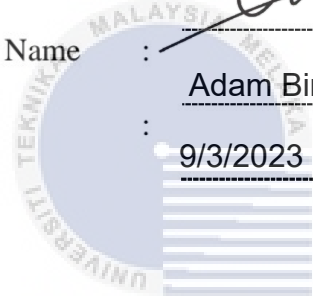


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DEDICATION

To my very special and beloved parents. My mother, Habibah binti Harun, and father, Samsudin bin Hamid. This thesis is the fruit of countless and arduous sacrifices. I also dedicate this dissertation to all my fellow friends and lecturers who have helped and support me throughout the process of finishing this thesis.



ABSTRACT

Human life today is faced with various types of obstacles parallel with the development of mainstream technology. Year 2019 saw a huge wave of obstacles resulting in changes in many aspects especially health. Corona virus 2019 (COVID-19) was discovered for the first time in the world. The virus is believed to have originated from a small town in China, Wuhan. Most frighteningly, many experienced scholars and doctors have done research to find the cure but failed. Until now, this virus still has no cure. The virus has claimed millions of lives and has scarred the hearts of many people so much that many countries have declared a state of emergency and movement control orders. Therefore, the authorities have made various initiatives to control the spread of this virus such as holding a Standard Operation Procedure (SOP) for example, social distancing, wearing face masks and wearing disinfectant fluids such as hand sanitizer regularly. Even so, this COVID-19 is still alive with us till this day. Precautions still need to be taken. Therefore, this project is an initiative to help us avoid this killer virus. The project applies light technology that has been proven effective to kill bacteria especially in hospitals as well as kill viruses in water and air. UV rays can be applied to 3 types, namely UV-A, UV-B, UV-C. The difference between these lights is their wavelength in nanometres. The most effective wavelengths for this eradication process are 100nm up to 280nm. In addition, this project uses renewable energy that is sourced from solar. In conclusion, in line with the currents of modernity we always have ways to avoid these symptoms of COVID-19. As the saying goes, "prevention is better than cure".

ABSTRAK

Kehidupan manusia hari ini dihadapkan dengan pelbagai jenis ujian selari dengan perkembangan teknologi arus perdana. Tahun 2019 menunjukkan gelombang ujian besar yang mengakibatkan perubahan di banyak aspek terutamanya kesihatan. Corona virus 2019 (COVID-19) ditemui buat pertama kalinya wujud di dunia. Virus ini dipercayai bermula dari sebuah pekan kecil di negara China iaitu Wuhan. Paling menakutkan, ramai para cendekiawan dan doktor-doktor berpengalaman telah membuat kajian untuk mencari penawarnya, namun gagal. Sehingga ke saat ini, virus ini masih tiada penawarnya. Virus ini telah meragut jutaan nyawa dan telah memarut luka dalam hati ramai orang sehinggakan ramai negara telah mengisytiharkan darurat dan perintah kawalan pergerakan. Oleh itu, pihak berwajib telah membuat pelbagai inisiatif untuk mengawal penyebaran virus ini antaranya adalah dengan mengadakan *Standard Operation Procedure* (SOP) sebagai contoh, penjarakan sosial, pemakaian pelitup muka dan memakai cecair pembasmi kuman selalu. Walaupun sedemikian, COVID-19 ini masih hidup bersama kita hingga ke hari ini. Langkah berhati-hati masih perlu diambil. Oleh itu, projek ini adalah suatu inisiatif untuk membantu kita mengelak daripada virus pembunuh ini. Projek ini mengaplikasikan teknologi cahaya yang terbukti berkesan untuk membunuh bakteria terutamanya di hospital serta membunuh virus di air dan udara. Sinar UV yang boleh diaplikasikan kepada 3 jenis iaitu UV-A, UV-B, UV-C. Perbezaan antara cahaya-cahaya ini adalah panjang gelombangnya dalam nanometer. Panjang gelombang yang paling efektif untuk proses pembasmian ini adalah 100nm sehingga 280nm. Tambahan lagi, projek ini menggunakan tenaga yang boleh diperbaharui iaitu bersumberkan solar. Kesimpulannya, seiring dengan arus kemodenan kita sentiasa ada cara untuk mengelak daripada gejala COVID-19 ini. Bak kata pepatah, “mencegah lebih baik daripada merawat”.

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LIST OF SYMBOLS

v - Voltage



CHAPTER 1

INTRODUCTION

1.1 Project Background

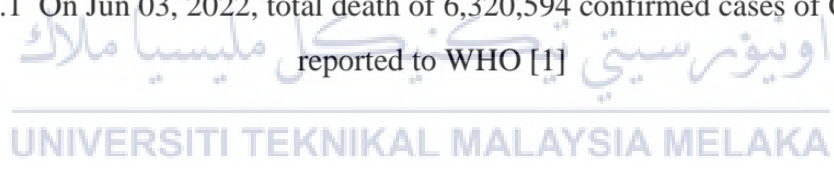
Since 2019, entire world was affected by an unseen killer that caused a pandemic of respiratory illness which we all know as Coronavirus disease. This killing disease was caused by the virus called SARS-CoV-2. World Health Organization (WHO) which the United Nations agency who providing leadership on global health matters first learned these cases on 31 December 2019. This case is reported after other diseases in Wuhan which a cluster of 'viral pneumonia'.

Most people infected with COVID-19 recover without the need for hospital treatment, but around 15% become extremely severely ill and need respiratory assistance such as oxygen, and 5% become very ill and require intensive and periodically care. Furthermore, for younger age, they can develop a severe inflammatory condition for some few days or weeks following on infection in rare circumstances. Other than that, people over the age of 60 are at the highest risk of developing severe sickness from COVID-19, and people who do have medical problems such as obesity, high blood pressure, heart and lung difficulties, diabetes, or cancer are at a higher risk of getting serious illness. Even so,

anyone at any ages can get infected by COVID-19 and have chance to become extremely ill or the worst thing is died.



Figure 1.1 On Jun 03, 2022, total death of 6,320,594 confirmed cases of COVID-19 reported to WHO [1]



How does this disease transmit to another? There are several different ways that this virus can be spread, like close contact with each other. It can spread in microscopic liquid particles from an infected person whenever they are having cough, speak, sneeze, or breathe. When virus particles in the air are inhaled at close range, another person can become exposed to the virus. The virus can also spread in cramped and poor ventilation interior environments, where people prefer to stay longer. People can potentially contract the disease by touching their eyes, nose, or mouth after coming into contact with contaminated surfaces or things.

Until now, the most effective strategy to avoid and slow down the spreading is to know about the virus and how the virus transmits. Staying at least 1 meter apart from others to protect yourself and others from infection, using a well fitted mask and often wiping or applying an alcohol-based rub to kill the germs at our hand. Also, get vaccinated to boost up our antibody and follow local guidance. Researcher has done so many studies to help our world fight against the disease. Therefore, some product to has been invented using various technology including, light technology which is Ultraviolet-C (UV-C).



Figure 1.1 Products against COVID-19 that was invented

UV-C lamps are can also called as "germicidal" lamps. In the pharmaceutical sector, UV-C radiation has long been used. UV-C radiation been used to disinfect water, air, and several surfaces. Also, UV-C radiation effectively decrease the spread of microorganisms such as tuberculosis for decades. UV-C radiation has been proved to manipulate the outer protein coating by the SARS-Coronavirus. The destruction ultimately inactivation of the virus. Thus, UV-C radiation may also be effective in inactivating and

destroying the SARS-CoV-2 virus, which is the virus that causes the Coronavirus Disease 2019 (COVID-19) on any surface.

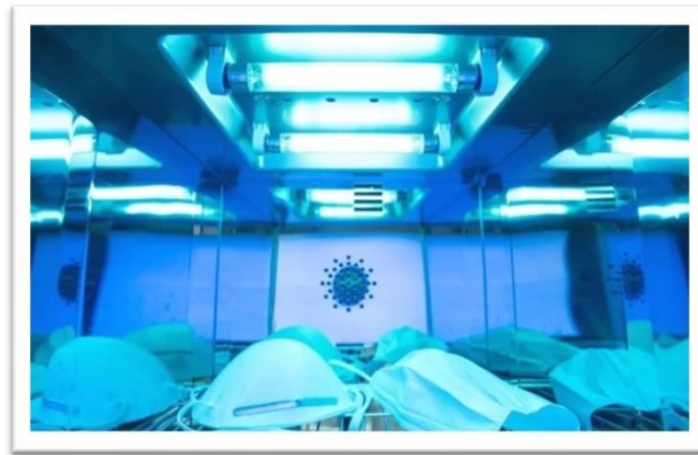


Figure 1.2 UV-C light prototype device



Figure 1.3 Autonomous robots helping kill coronavirus in hospitals which use UV-C light technology

Robot model	Xenex	Tru-D	Helios	UVD	Violet
Form factor (L x W x H)	76 x 51 x 97 cm	NA x NA x 168 cm	59 x 59 x 196 cm	93 x 66 x 171 cm	35 x 35 x 150 cm
Small form factor for operating in tight spaces	X	X	✓	X	✓
Can achieve a greater than 1-log reduction of most germs at distances of 1-2 m from the surface	✓	✓	✓	✓	✓
Can autonomously navigate (i.e., doesn't have to be pushed into place)	X	X	X	✓	✓
Cleaning staff can be deployed in the room at same time as robot	X	X	X	X	✓
UV lamp not too powerful to cause harm if exposed to	X	X	X	X	✓

Figure 1.4 Exploring the Applicability of Robot-Assisted UV Disinfection in Radiology

1.2 Problem Statement

Covid always infects without us being aware of where we found the virus from. Maybe, we get the virus from the stuff we always wear and hold like phones, wallets or even masks. This machine will help us to sanitize those things using Ultraviolet-C (UV-C) light technology. Also, we barely find other alternatives to change sanitizer liquid into something else that does not need any refill. This project will help to solve this problem effectively. This technology has a specific wavelength to microorganisms are killed by degrading nucleic acids and damaging DNA, rendering them unable to conduct essential cell tasks. This device applies two sources of energy to fill the rechargeable battery which are using solar energy or direct current.

1.3 Project Objective

Objectives will give some additional value to nowadays need which to always sanitize things effectively which help us to save money as well as energy.

- a) To design a UV-C based germs disinfecting device
- b) To develop a solar battery charging system on the disinfecting device an energy efficiency and low power consumption system
- c) To analyze efficiency of the disinfecting device

1.4 Scope of Project

The scope of this study is to use UV-C light technology to disinfect bacteria as an alternative to traditional disinfection methods. This project also consists of applying the solar

battery charging to make sure it works wherever portably. Due to some limitations and constraints, to avoid any uncertainty of this project, the scope defined as follows:

- a) Depending on UV-C dose or intensity, wavelength, and duration of radiation exposure, UV-C light may offer possible health and safety issues.
- b) If the virus or infectious particle on the object not directly exposed to UV-C radiation, it cannot be inactivated.
- c) This device will sanitize small and medium size of things such as smartphones, wallet, watch, mouse etc.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter represent previous research or study and analysis based on Ultraviolet-C (UV-C) light technology on germinal disinfecting. We will look at some of the sources such as paper, previous journals, articles, and websites from various sources as references for this project, then compile it all in this chapter.

Basically, the main goal for this project is to disinfect and sterilize everything using light technology which are an extremely effective form of disinfection, non-toxic, one of green technology that safe for human use and of course, affordable. Nowadays, we are always concerned about Covid that infects without us being aware of where we found the virus from. We can get the virus from the stuff we always wear and hold like phones, wallets or even masks. this machine will help us to sanitize those things using UV-C light technology. Microorganisms will be killed by the specified wavelength by disrupting their nucleic acids and disrupting DNA, rendering them unable to conduct important cell processes such as COVID-19. This device applies two sources of energy to fill the rechargeable battery which are using solar energy or direct current.

2.2 Relate review UV-C disinfecting device

Table 2.1 Comparison with other UV-C product

Model	Weight	capacity	Power source	Effectivity (253.7nm most effective)	Disinfect 360 degree
 <p>Phillips UV-C disinfection system [1]</p>	2kg	1 litres	Direct current, 15W operating power	254nm	Yes, the plate inside the poroduct will rotate in the process
 <p>CleanTray UV light streilization case</p>	0.3kg	0.7x3.9x1.1 inch	Direct current, 5W operating power	260-280nm	No
 <p>UV Light sanitizer bag</p>	0.28kg	10.6x7.9x4.7 inch	Direct current, 5W operating power	270-280nm	No