UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF IOT BASED PORTABLE ULTRAVIOLET LIGHT-EMITTING DIODE (LED) EXPOSURE BOX FOR PCB CIRCUIT PRINTING

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer System) with Honours.

by

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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF IoT BASED PORTABLE ULTRAVIOLET LIGHT-EMITTING DIODE (LED) EXPOSURE BOX FOR PCB CIRCUIT PRINTING

Sesi Pengajian: 2019

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I hereby, declared this report entitled DEVELOPMENT OF IoT BASED PORTABLE ULTRAVIOLET LIGHT-EMITTING DIODE (LED) EXPOSURE BOX FOR PCB CIRCUIT PRINTING is the results of my own research except as cited in references.

Signature: ……

Author : PRASANTH A/L SAGIVAN

Date:

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer System) with Honours. The member of the supervisory is as follow:

Signature : .....

Supervisor : Ahmad Sayuthi bin Mohamad Shokri

ABSTRACT

The ‘Development of IoT Based Portable Ultraviolet Light Emitting Diode Exposure Box’ is mainly designed a smart advance technology to ease and save time of PCB development process. This invention for daily usage of student and lecturers use in Universities. It also can use by small electronic shops that can sell printed circuit board. Microcontroller NodeMCU used in this project for control and monitor the usage of project. NodeMCU is the main brain of the project it will interface between all the input and output devices. The cloud server Blynk application created through the smartphone to control the timer and monitor energy of this project. Purpose of the current monitoring is to prevent damage to the PCB board. The NodeMCU interpret the sensor data and display on LCD display and Blynk application. This project can expose PCB in 45 seconds. Development of IoT based portable ultraviolet light emitting diode is undertakes monitoring the data from current sensor and controlling exposure activities through smartphone. The proposed device decreases the PCB exposure time and has higher efficiency.

ABSTRAK

‘Development of IoT Based Portable Ultraviolet Light Emitting Diode Exposure Box’ adalah terutamanya direka sebagai teknologi pendahuluan pintar untuk memudahkan dan menjimatkan masa proses penghasilan PCB. Ciptaan ini untuk penggunaan harian pelajar dan pensyarah digunakan di Universiti. Ia juga boleh digunakan oleh kedai elektronik kecil yang boleh menjual papan litar bercetak. Mikropengawal NodeMCU digunakan dalam projek ini untuk mengawal dan memantau penggunaan projek. NodeMCU berfungsi sebagai otak utamanya dalam projek ini yang akan menjadi antara muka dengan semua peranti input dan output. Aplikasi pelayan Blynk awan diwujudkan melalui telefon pintar untuk mengawal pemasa dan mengawasi tenaga projek ini. Tujuan pemantauan semasa adalah untuk mengelakkan kerosakan pada papan PCB. NodeMCU mentafsirkan data sensor dan paparan pada LCD dan aplikasi Blynk. Projek ini boleh mendedahkan PCB dalam masa 45 saat. Pengembangan UV LED exposure box mudah alih berasaskan IoT menjalankan pemantauan data dari sensor semasa dan mengawal aktiviti pendedahan melalui telefon pintar. Peranti yang dicadangkan mengurangkan masa pendedahan PCB dan mempunyai kecekapan yang lebih tinggi.

DEDICATION

To my beloved parents

Mr. Sagivan S/O Keshavan and Mrs. Setera D/O Velayuthan

My talented supervisor

Mr. Ahmad Sayuthi bin Mohamad Shokri

and

My beloved siblings

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CHAPTER 1

INTRODUCTION

1.1 Background

1.1.1 Light-Emitting Diode

LED stands for Light-Emitting Diode. Approximately 90percent better than incandescent and fluorescent light bulbs are produce by LED lighting products. So how they work? How do they work? A microchip is use for lighting the small source of light, which we call the LEDs, and which is the resulting light is visible. In useful lives, LED lighting products differ from other light source, such as fluorescent or compact lighting, as mentioned above. Typically, LEDs do not usually burn out or fail to light up. Rather, they endure lumen-depreciation, where the luminosity of the LEDs decreases slightly over time.in comparison to incandescent bulbs, the lifetime of LED is based on a estimates of 30 per cent decrease in light output. In general, illumination applications, LEDs are included in bulbs and fixtures. Light Emitting-Diodes are small in size that offers unique design possibilities. Certain of the LED bulb can look physically like familiar light bulbs and better suit the conventional light bulb look. LED lights can be used as a permanent light source in certain LED-fixtures. Hybrid approaches are also available when a non-traditional bulb or replaceable light source format is used and specially designed for the unique fixture. LEDs provide enormous innovative lighting factor opportunities and fit a broader range of applications than traditional lighting technologies. (Star 2014)

Light emitting diodes absorb and dissipate the heat produced by the LED into the surrounding environment using heat sinks. This prevents overheating and combustion of LEDs. Thermal management is generally the main factor for successful LEDs throughout their lifetime. The higher the LED temperature, the faster the light degrades and shorter the lifetime of use. LED products use a range of unique heat sink designs and setups to manage the heat. The advances in materials today allowed manufacturers to design LED bulbs, which match traditional incandescent bulbs in shapes and sizes.

1.1.2 Ultraviolet

Ultraviolet (UV) means an electromagnetic spectrum wavelength band between 10 nm to 400 nm, which is less than visible light, but longer than x-ray. Figure 1.1 proves the above statement. Moreover, in sunlight, UV radiation contribute approximately ten per cent of the total output of the solar light. UV radiation is also produced via electrical arcs and specialized lights, similar like mercury vapor lamps, tanning lighting and black lights. (Anon. n.d.)

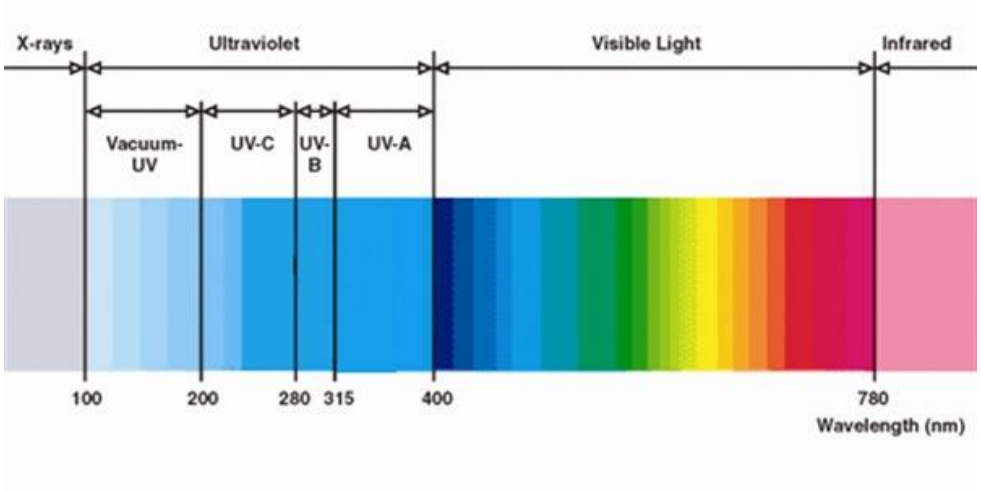

Figure 1.1 : Electromagnetic Spectrum (Pulay and Williamson 2019)

LEDs can be produced to emit ultraviolet radiation. The LED efficiency is around 5 to 8 per cent at 365 nanometers, whereas efficiency is nearer to 20 per cent at 395 nanometers and the power outputs at these longer UV wavelengths are better. These LEDs are already used for digital and inert UV curing applications and have already been successful in these fields. The most commonly used industry standard LED technology for cross-linking works in wavelengths from 36nm to 405nm is 385 to 395nm. The modules can take up to 100 LEDs or more. It also controlled by an intelligent circuit, which allows them to be switched in multiple zones. Zone circuits allow adjustment to working width, resulting in energy- saving potential.

1.1.3 Ultraviolet Light-Emitting Diode (UV LED)

The LED industry has rapid technological changes and changes in the market driven by the development of the powerful white LEDs for liquid crystal displays (LCDs) and illuminations. The benefits of UV LEDs will be higher efficiency, higher output power and lower costs, especially since UV and white LEDs are technically similar. The challenges of the market no matter how slow down constant UV LED performances improvements. This gives a wide overview of recent UV improvements. The visibility of LED technology and market changes also discussed the influence of such developments of UV LED systems for UV devices. LEDs start challenging existing lights and electronic ultraviolet devices.in general lighting, white LEDs are sufficiently bright for the replacement of mercury and sodium vapor lamps (yellow light used for street lighting). UV LEDs for electronic applications are also being developed, but progress is being made at a much slower rate.

Technically, the LEDs used in UV curing and lighting system applications are similar to those used in UV curing or illumination applications. They are similar.

1.2 Problem Statement

Most exposure systems used in universities are exposure systems with fluorescent UV lamps or metal halide lamps. Both systems are very expensive, too wide UV radiation and not suitable for the sizes of the PCB to the equipment (Nor Azura Osman, Azhar Ramli 2018). This results in a waste of electricity in the exposure system if the PCB is small. This UV exposure system only supports a single side PCB. Furthermore, the timer and buzzer are not considered as a requirement of the exposure system's old design that causes a lot of rough estimates during PCB exposure. One of the main concerns is the costing of the UV exposure system.

Moreover, a portable exposure system is an handheld device which that can easily be carried. It is a small form factor of a device that designed to be held and used in the hands. So that the device small and light weight, making staff and students of universities easy to carry and hold. Whenever student and lecturer wanted to make Printed Circuit Board they no need to book for laboratory or workshop in advance. This can save time for the lecture or lab activities. Consequently, monitoring sufficient current to UV-LED panel is very important because the brightness of LEDs plays a major role in this system. Hence with the help of current sensor and cloud server user can monitor the use of an energy that is not suitable for brightness of UV LEDs.

1.3 Objectives

After studying the above problem statement, the key objectives of the lead of PSM are:

i. To develop a ioT based portable UV-LED exposure box for PCB circuit printing in less than a minute.
ii. To monitor the sufficient current to UV-LEDs using current sensor through smartphones.
iii. To analyze the effectiveness of the LED brightness towards the exposure.

1.4 Scope

The scope of this project is mainly introducing smart advance technology to ultraviolet led exposure for printed circuit board (PCB) circuit printing. This project is invented for daily usage of students and lecturers use in universities. It is also convenient for small electronic shops that performs this printing method. NodeMCU used in this project for monitoring and notifying the usage of energy of LEDs. This project is restricted to the load (UV-LED panel) test current not more than 5A because of the utilization of the 5A current sensor. The cloud server app (Blynk app) is used in this project to monitor the effectiveness to LED brightness because all the LED must be light up equal brightness for the decent exposure.

1.5 Summary

This project focuses on advancing the UV exposure system based on ioT and cloud server. This report consists of five chapters. Initially, a brief introduction to the issue, objective and scope is given in chapter one. At that point, take after chapter two literature reviews of existing methods embraced and different advances that have been actualized in the past venture. The comparison in terms of pros and cons will be discussed in the interim. Next, the components and method portrayal that you wanted to use will be clarified in chapter three. In addition, a brief of the project's outline stream may appear here. The results information of the results, including data tabulation and project analysis, will then be discussed in chapter four. Finally, the conclusion and future suggestion will be highlighted in chapter five.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter mainly focuses on the information and theory, previous research and comparison between methods used by the researcher. This chapter concerns the "Development of ioT Based Portable Ultra violet Light Emitting Diode (UV-LED) exposure box". UV LED box is a comfortable device intended for the production of printed circuit boards at domestic. It saving time and achieves superb quality boards. The manufacture of UV-A spectrum light sources for impressed circuit boards is necessary, in order to use UV spectral fluorescent lamps or UV LEDs. It seemed that it was much simpler and cheaper to use LEDs. LEDs should be farther from the produced board than fluorescent lamps to achieve even lighting across all manufactured PCBs. However, reflectors with LEDs are not required because LEDs emit light in a single direction in comparison with fluorescent lighting.

2.2 Related Previous Works

2.2.1 "Design and Development of Ultra Violet LED Machine" by Nor Azura Osman and Azhar Ramli.

A group of researchers (Nor Azura Osman, Azhar Ramli 2018) wrote this article from Polytechnic Sultan Azlan Shah in the year 2018. This paper introduces a photolithography techniques on a PCB. Photolithography techniques on a PCB are a process of UV exposure that was used in micro-manufacturing to pattern parts of a substrate's thin film. Light is used to transfer a geometric pattern from a photo mask to a light-sensitive chemical (photoresist) on the substrate. In universities, most of the UV exposure process used UV florescent lamps or Metal Halide lamps as an exposure system, both of which are expensive and produce a wide UV radiation that is not suitable for the PCB, which will increase electricity consumption.

UV fluorescent lamps and metal halide lamps are the methods commonly used to expose the photoresist. Because of low light reflection and smoothness, this method has low efficiency. In addition, everything will be exposed to UV light in the exposure room.-Through these two methods, the second layer of double layer PCB is difficult to expose at the same time. Including the use of professional equipment, many methods used to expose and test photoresist exposure.

There are some problems when using professional equipment such as heating time, cost of equipment, and sensitivity of chemical process and the use of printer transparency in non-vertical-and-non-uniform UV-light illumination. Efficient and rapid production of the PCB is important for professional purposes to reduce the prototype's research and development time before it is marketed. In educational institutions, such as