

**ULTRA VIOLET SCANNER, PCB DEVELOPER AND ETCHING MACHINE**

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## ABSTRACT

ULTRA VIOLET SCANNER, PCB DEVELOPER AND ETCHING MACHINE is a machine created to solve handling "jumper" problems over a PCB board in designing a circuit. The concept and idea was obtained by observation and studied with close study while designing a circuit during engineering workshop. The problems that usually arise are the unruly usage of ultraviolet scanners, developer and etching machines, the machine is too large and long period of time required for a process to be carried out. Therefore, this project was created by using the concept of rocking bay that operates automatically to erode the copper not required in the circuit production. This project attempts to develop a low cost yet reliable PCB maker. It is also a portable machine and the operating system can be easily operated. It is expected that this project can be used by users who wish to produce circuits easily with quality comparable to that produced in factories. The using of the machine is so effective because the handling operations is too easy to understand, it does not require continuous monitoring, and safe to use by students or small industries.

## ABSTRAK

ULTRA VIOLET SCANNER, PCB DEVELOPER AND ETCHING MACHINE adalah sebuah mesin yang dicipta untuk menyelesaikan masalah pengendalian “jumper” diatas sebuah papan PCB semasa ingin menghasilkan sebuah litar. Konsep dan idea ini telah didapati dengan pemerhatian dan dikaji dengan telitinya semasa ingin membuat dan menghasilkan satu litar ketika menjalankan bengkel kejuruteraan. Masalah yang ditimbul ialah penggunaan ultraviolet scanner, developer dan mesin etching yang sedia ada adalah begitu sukar dikendalikan, sebuah mesin yang terlalu besar, dan jangka masa yang terlalu lama diperlukan untuk sesuatu proses yang dijalankan. Oleh yang sedemikian, projek ini telah dicipta dengan menggunakan konsep ‘*rocking bay*’ yang beroperasi secara automatik untuk menghakis tembaga yang tidak di perlukan semasa penghasilan sebuah litar. Projek ini dicipta untuk menghasilkan mesin membuat papan litar bercetak (PCB) yang rendah kos pembuatannya. Ia juga mudah dibawa kemana-mana sahaja dan sistem pengoperasian mesin ini mudah dikendalikan. Diharapkan agar projek ini dapat digunakan oleh pengguna yang ingin menghasilkan litar dengan mudah dan kualiti yang setanding dengan litar yang dihasilkan di kilang. Penggunaan mesin ini begitu efektif kerana operasi pengendalian ia terlalu mudah di fahami, tidak perlu pengawasan yang berterusan, serta selamat digunakan oleh pelajar-pelajar mahupun industri-industri kecil dan sederhana.



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**LIST OF ABBREVIATIONS**

PCB	-	Printed Circuit Board
UV	-	Ultra Violet
LED	-	Light Emitting Diode
WWW	-	World Wide Web
PSU	-	Power Supply Unit
SMPS	-	Switching Mode Power Supply
AC	-	Alternate Current
DC	-	Direct Current
IC	-	Integrated Circuit



# **CHAPTER I**

## **INTRODUCTION**

### **1.0 Introduction**

This chapter gives an overview of Ultra Violet Scanner, PCB Developer and Etching Machine. The objectives of the project are stated clearly. There are few problem statements that explain about existing problems which eventually leads to this project development. The scope of the project is being discussed in this chapter as well. The significant of the project is explained briefly.

### **1.1 Introduction of Project**

In the modern era, a UV Scanner, PCB Developer and Etching Machines become more widely used in big or small industries, individual, institutions or local private schools and others. A machine that is large and unruly will complicate consumers using the machine. This is because they must be supervised at all times while using the machine. A complex control system process that takes a long time will cause the user to not use these machines.

Etching method is very important for the person who makes the circuit on their own. They want to create work of art with their own hands. But if the use of machinery is too difficult, complicated and expensive than the cost of their ability will cease. An etching machine that is easy for them would be more efficient, if they want to create their own circuit by undergoing steps such as scanning circuit, developer and etching. An etching machine can reach up to nearly tens of thousands of dollars. The ability to have a machine could not be achieved. A machine that is produced by the factory has its own disadvantage. Among others are the PCB board can easily to breed if the etching process takes a long time and UV Scanner does not scan with sufficient UV radiation. Therefore, these methods have less quality if compared to quality produced by large factories.

To overcome the problem faced, a UV scanner, developer and etching machine is produced to have a machine that can control that easily, does not take a long period, cost cheaper than the market price and the quality of the resulting product is equivalent to those produced by the factory.

The etching machine uses a 12V power supply fan power to run processes such as developer and etching. Develop is the process of tracing lines that have been scanned using a scanner that uses UV LED onto the board. This process will take only 5 minutes.

Etching process will be done using the same machine. Etching process acts to erode parts of the copper which is not applicable. This process takes only 10 minutes. Therefore, a PCB UV resulted comparable to those of the market.

## 1.2 Objectives

After completing the 'Ultra Violet Scanner, PCB Developer and Etching Machine' project, the objectives to be achieved are:

- i. To design a cheaper and economically machine that is able to be obtained by anyone.
- ii. To produce a smaller and portable machine that is easy to bring anywhere .

- iii. To produce machine that is durable and not easily damaged.
- iv. To produce a user-friendly machine where the machine can be conducted by any person without higher skill/dexterity.

### **1.3 Scope of Project**

The scope of the project is the limitations of project specification that will be produced. The 'Ultra Violet Scanner and Etching Machine' that I will produce is just for positive etching PCB. The Ultra Violet Scanner cannot operate properly on the other type of PCB. If consumers use different types of PCBs other than those already fixed, probably the quality of etching would not necessarily be good.

Besides that, the Ultra Violet Scanner the maximum size would be for A4. Therefore, the PCBs bigger than A4 is not suitable for this Ultra Violet Scanner. Lastly, this project does not include the washing process. Users need to prepare water manually to wash the positive etching PCB produced. PCB must be cleaned afterwards because to remove layers of metal waste left behind. After the PCBs are clean, then a layer of metal will appear on the PCB surface.

### **1.4 Problem Statement**

I have studied about the etching machines that are available nowadays. Users faced some problems while using those machines. The major problem that consumers face now is the difficulty to move current machines because of the physical size of the machines which is big and heavy. Because of that, I try to develop a machine that is smaller and more flexible. The machine that will be produced will only need a small space to be kept.

Current Ultra Violet Scanners are bigger because they use fluorescence ultra violet inside the scanner. UV LED is used to replace the fluorescence to make the scanner thinner. The costs for machines available nowadays are also expensive. The

whole machine that will be produced is cheaper than the machines that are already in the market.

### **1.5 Project Significant**

Every job or project that will be done has its own significance. Therefore, the project that will be produced also have significance. My project is significant for:

- 1) Help students involved in the electronic field to produce PCB circuit for their projects.
- 2) This machine can help lecturers in electronic fields to teach student in learning process.
- 3) To assist SME industries involved in electronic to solve their problems in making electronic circuits.

## **CHAPTER II**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

In this chapter, the literature review will focus on related previous project that entitled Negative Film Resist and my project entitled Ultra Violet Scanner, PCB Developer and Etching Machine. The Negative Film Resist project gave some review on several other previous projects. These projects, have become inside guide for the Ultra Violet Scanner, PCB Developer and Etching Machine.

Besides that, it also gave me the idea namely, necessary additions and how to design it. In addition, the theoretical study will be discussing about some related theories and explanations on each equipment used in this project. Fact finding is the formal process to collect and capture the entire information about the system, system requirements, and system preferences. Fact finding is the most crucial part of the system planning and system analysis. It helps to learn about problems, opportunities, constraints, requirements and priorities of a system.

Interview, research, and case study are the fact-finding techniques commonly used by each developer during the development of their system. These techniques are used during the early stage of the system planning and analysis phase in order to collect the related information about their system. Information should be collected

from a variety of sources. Information can be gathered from formal and informal sources. For formal sources, the information can be gathered from books, journal, research paper, encyclopedias, newspaper, magazines, handbooks, thesis, bibliographies and World Wide Web (WWW). For informal information sources it includes contact with peers, colleagues, supervisor and the user of the system. As a whole, the literature review draws on the knowledge, culture, methodology and theories of the topic.

## 2.1 History

Etching process was used by gold smith and manufacturer of steel in Europe since the Middle Ages with the purpose of decorating tools such as pistols, shields, cups and tableware. However, the decorative shield that found in Germany believed to be imported from Italy about a century to -15 birthplace of printing techniques. Print process is believed to have been invented by Daniel hopfer (about 1470-1536) in Germany Ausburg. Proof of work he is a shield in 1536 and Real Madrid kept the sword in the Museum Nuremburg. Exchange on the use of copper began in Italy and then etching technique is becoming increasingly popular process for Printmaking. It is an advantage because the engraving process requires a high skill in handling the iron.

At present etching techniques are used not only in metallic materials, it is also used for making electronic circuits on the PCB UV. Traditional circuit manufacturing process requires care and techniques for the production of quality work. However, current technology make improvements made this etching process become very simple, fast and practical. Use of ultraviolet radiation has been used to form UV-selected routes in the circuit more durable and quality. If the early use marker pen and use techniques that are now no longer apply because the etching process can result in lost line created. Ultraviolet radiation on the track PCB UV more durable and resistant to acid etching process used to it.

## 2.2 Comparison between Current Machines with Ultra Violet Scanner, PCB Developer and Etching Machine

From research done, present machines are more complicated compared to Ultra Violet Scanner, PCB Developer and Etching Machine. This is because current machines usually used in large organization is more focused to manufacturing industry. Meanwhile, Ultra Violet Scanner, PCB Developer and Etching Machine will be developed specifically for education field or small industry. Table 2.1 shows the comparison between current machines with the machine that will be produced.

	<b>Ultra Violet Scanner, PCB Developer and Etching Machines (Current Machines)</b>	<b>Ultra Violet Scanner, PCB Developer and Etching Machines (New Version)</b>
<b>Ultra Violet Scanner</b>	<ul style="list-style-type: none"> <li>• Use Fluorescence Ultra Violet to produce ultra violet light.</li> <li>• Large physical size.</li> </ul>	<ul style="list-style-type: none"> <li>• Use LED Ultra Violet to produce ultra violet light.</li> <li>• Smaller physical size.</li> </ul>
<b>PCB Developer</b>	<ul style="list-style-type: none"> <li>• Without transparency housing -Difficult to monitor PCB condition and need to take-up the PCB every time to view the current condition during developing process.</li> <li>• Circuit will be damaged if the time is exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>• With transparency housing:               <ul style="list-style-type: none"> <li>- Easy to monitor PCB condition and without having to take-up the PCB during developing process.</li> </ul> </li> <li>• Include the timer to control the machine during the machine operate.</li> </ul>
<b>Etching Machine</b>	<ul style="list-style-type: none"> <li>• Separated with PCB developer. Therefore more storage space needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Can reduce the storage space because the housing for etching and PCB developer has been combined</li> </ul>
<b>Easiness of Use for the Whole</b>	<ul style="list-style-type: none"> <li>• Requires one person that has skill to control the machine while the machine is operating.</li> </ul>	<ul style="list-style-type: none"> <li>• The machine can be operated and conducted by any person without any skill or dexterity.</li> </ul>

<b>System</b>		
<b>Quantity of acid used</b>	<ul style="list-style-type: none"> <li>• Using a large quantity of acid because the machine is bigger</li> </ul>	<ul style="list-style-type: none"> <li>• Using a small quantity of acid because the machine is smaller</li> </ul>

Table 2.1: Shows the comparison between current machines and the machine that will be produced

## 2.3 Methods of Etching Process

There are various ways or processes to do etching, stage by stage. Circulation period has led to various methods and innovations which are reserved to facilitate the etching process. Among the forms of the etching process:

### 2.3.1 The first study - In the Middle Ages (1470- 1536)

#### 2.3.1.1 Draw the circuit

This process is done manually from the start that process until the etching process ends. Start by drawing lines in the circuit using a marker pen on the transparent plastic. This process requires high precision and efficiency because lines must be drawn with straight lines and not merged between the other lines. Spacing between lines spaced as necessary during the etching process occurs most likely lines drawn will be merged with one another. If this problem occurs the circuit is drawn cannot function properly and will short-circuit occurrence.