



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF PORTABLE PLOT  
MACHINE BY USING ARDUINO**

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

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**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

Tajuk: Development of Portable Plot Machine by Using Arduino

Sesi Pengajian: 2020/2021

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## DEDICATION

I dedicate this project to my lovely parents Azman Bin Mohamad and Yushawazah Binti Yusof, my sibling Nur Fatin Afeefa Binti Azman and Muhamad Farisi Anaqi Bin Abdul Rahman. I would like to thank my supervisor Encik Adam Bin Samsudin and to all my lecturer in University Teknikal Melaka Malaysia (UTeM) for the guidance and assisted me for this project. Lastly praise to Allah S.W.T. for this project to complete well and function properly as I plan.



## ABSTRACT

This project was developed for plot image or text to paper through the plot machine. The plot machine can operate well and easy to use. My main focus for this project is to make the plot machine is portable. As we know, plot machine in industry is quite big and not portable. So this project can bring to anywhere for example meeting or in classroom. This plot machine is operate by Arduino. The Arduino will make the motor move as the command input. The coding of the Arduino must be correct so that the motor can move can plot the image or text accurate to the input given. This project also can make people arduino can do many types of machine and it is not difficult to write the coding. The arduino will works according to the coding accurately. This portable plot machine also can be example for learning and student can understand how this portable work.



## ***ABSTRAK***

Projek ini dibangunkan untuk melukis gambar atau teks ke kertas melalui mesin plot. Mesin plot mudah alih ini dapat beroperasi dengan baik dan mudah digunakan. Fokus utama saya untuk projek ini adalah menjadikan mesin plot mudah alih. Seperti yang kita ketahui, mesin plot dalam industri cukup besar dan tidak mudah alih. Jadi projek ini boleh dibawa ke mana sahaja contohnya perjumpaan atau kegunaan di kelas. Mesin plot ini dikendalikan oleh Arduino. Arduino akan menjadikan motor bergerak seperti mana input arahan diberikan. Pengekodan Arduino mestilah betul supaya motor dapat bergerak untuk memplot gambar atau teks lebih tepat berdasarkan input yang diberikan. Projek ini juga dapat membuat orang ramai mengetahui bahawa arduino dapat melakukan banyak jenis mesin dan tidak sukar untuk menulis pengekodan. Arduino akan berfungsi mengikut pengekodan dengan tepat. Mesin plot mudah alih ini juga boleh menjadi contoh untuk pembelajaran dan pelajar dapat memahami bagaimana mesin plot mudah alih ini berfungsi.





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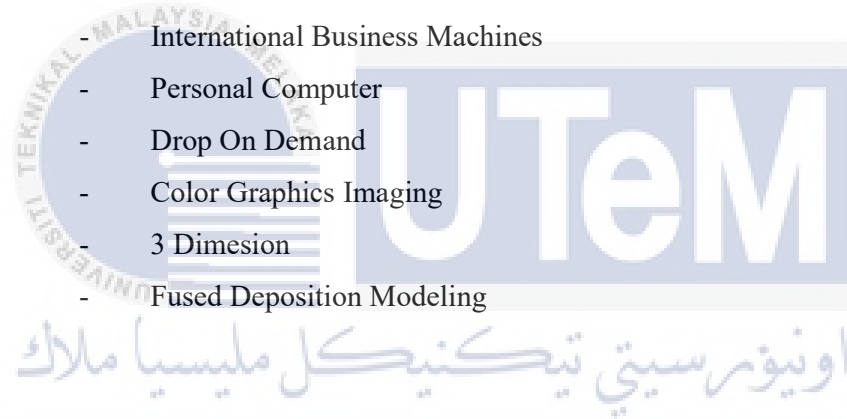
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## LIST OF SYMBOLS AND ABBREVIATIONS

CNC	-	Computer Numerical Control
CAM	-	Computer Aided Manufacturing
CAD	-	Computer Aided Design
USB	-	Universal Serial Bus
APT	-	Automatically Programmed Tool
UNIVAC	-	Universal Automatic Computer
HP	-	Hewlett-Packard
dpi	-	Dots Per Inch
IBM	-	International Business Machines
PC	-	Personal Computer
DOD	-	Drop On Demand
CGI	-	Color Graphics Imaging
3D	-	3 Dimesion
FDM	-	Fused Deposition Modeling



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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

The world we live right now is become more advance in technology because electrical or electronic device is become smaller and thinner. Computer numerical control (CNC) is common in machine technology. It is the automation of machine tools that operated by programmed common encoded on the storage medium. Numerical control also can manually control by lever or hand wheels or mechanically automated. The design in the current CNC program is more of highly automated end to end product by using the computer aided manufacturing (CAM) and computer aided design (CAD). The programs help on generate a computer file can constructed the commands so that the machine can operate on a specific task.

The machine should be run automatically because it can achieve a very productivity especially on industry. This also can reduce man works because the machine can be run non-stop. The operator or technician just needed to do maintenance. The development of this numerical control begun when the machine tool automation is the first introduced the principal is the programmable logic. As time flows, they continue to evolve with a better technology of CNC. (Reintjes, 1991)

The first CNC machine that been build is in the 1940s and 1950s. They were basically designed of existing tool and just only been updated with motors. The motors function is to push the control for obey points fed to the punched tape device. The servomechanisms is

become more evolve because of the analog and the digital computer are producing the very high technology machine tool for the CNC.

Diskettes or a direct links portable computers is use to pass the CNC program to machine tools. Based on the technology, currently the using of Universal Serial Bus (USB) flash drive is common and have been replace the using of tapes. The gemination of CNC make the need for a new CNC standard that is not subject for the licensing or a specific design concepts, for the example Automatically Programmed Tool (APT).

Over a period of times, many of different standard proliferated is commonly focus on the vector graphics for marking up the supported plotter language. The file format is represented in the EIA standard. (Peter Smid, 2008)

## **1.2 Problem Statement**

Today, our world is full of technology that everyday become more and more complicates as we live in the modern world. The Plot machine is already build but none of them are portable. So, this project will work on development of a portable plot machine that will be more easier to bring anywhere and can operate very well. Next, the cost of making previous plot machine actually high. But we plan to create this portable plot machine by using low cost and recycle item. Many people does not use full function of these Arduino. The project will prove that we can easy plot machine by using Arduino. This project also help in learning process especially student. Most of printing machine need to be refill the ink so cost of refill actually quite expensive. The portable plot machine can use many types of pens or pencils, we just need to put the pen or pencil to the machine.

### 1.3 Research Objective

The goal of this objective is to manufacture a very high quality portable plot machine.

The technology area covered in this review are:

- a) To design and develop portable plot machine by using Arduino that can be use easily without any problem.
- b) To examine how well to machine can operate base on program that been input to the Arduino and to compare how this plot machine is more portable than other plot machines.
- c) To create a low cost portable plot machine by using recycle item.

### 1.4 Scope of Research

This project is focus on how the Arduino can operate the machine well by drawing or writing the input that be add. Also, to create a low cost portable plot machine by using some recycle item.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Literature review is one of the important parts about the whole project idea. Related researches and study cases with different concept of portable plot machine provide the information in this section. Study and research the materials and components used from different sources is very vital in order to develop the project. The study materials are taken from journals, articles, books, articles and internet resources.

#### 2.2 History

A plotter is a one of the computer hardware device that is known as very similar to a printer that used for a multiple application such as drafting blueprints, graphing data, or drawing large format maps. Plotters draw multiple or continuous line into paper by use a pen, pencil, marker, or another writing tool. They were once widely used for computer-aided design, these devices have more or less been phased out by wide-format printers. Plotters also use to produce a hard copy of a schematics diagram and other applications. (Computer Hope, 2017)

The first plotter was made in 1953 by Remington-Rand and it had been utilized in conjunction with the Universal Automatic Computer (UNIVAC) to created technical drawings. In the early year, pen plotters, the Calcomp 565 in 1959, worked by placing the paper over a roller that moved the paper forth and back for X motion, while the pen was moved back and forth on a track for the Y motion. The paper was keeps in the roll form and

had perforations along both edges that were engaged by sprockets on the rollers. (Sher Minn Chong, 2019)



Figure 2.1: Calcomp 565

In the 1958, Hewlett-Packard (HP) made its first appearance when it bought the F Mosley company of Pasadena, California. Mosley made graphics recorders for instruments. This business gradually became the San Diego Division which made HP's pen plotters. In the 1970s, pen plotters were the only drawing machines that can plot a high-resolution hardcopy graphics output from the computers. The resolution of output from graphics printers generally were varied between 72 dpi and 100 dpi. Even though HP's is the earliest digital pen plotters it can only produce a line resolution equivalent to 1000 dots per inch. Until 1987, pen plotters were also the only way for the cost-effective method of getting colour output from computers. (HP Virtual Museum, 1965) (HP Virtual Museum, 1965)



Figure 2.2: HP's First Pen Plotter

Compared to the modern colour inkjet and laser printers, pen plotters were very slow and cumbersome for working usage. Users had to constantly worry about a few pens that will running out of ink. Even if one pen ran dry at the process of a plot, the whole plot had to do again from the start. HP plotters were also limited to a maximum of eight different colours, without having to vary pens within the middle of a plot. Lastly, plotters can only draw a lines and vectors. They can't produce photographic images. Even with these limitations, the high resolution and colour capability of pen plotters made them the colour hardcopy output device of choice until the late 1980s. During this time, HP had a worldwide market share of over 50%. (HP Computer Museum, 2016)

Plotters were a good but not a magnificent to be long term business for HP through the end of the 1970s. Then, the business expanded rapidly due to three factors. First factor, HP introduced a paper moving plotters to replace the old flatbed type plotter. This made the machines smaller and not expensive compared to the old one. Second, HP entered the large format plotter business which had previously have been domain by companies like Calcomp and Versatec. Third, connection of HP pen plotters to non-HP systems grew drastically. The connection to non-HP systems was driven by the use of business graphics on the IBM and compatible PCs. (HP Computer Museum, 2016)



Figure 2.3: Paper Moving Plotter

These products were developed at the HP's San Diego Division. The Pen plotters were product line 30 for the division until the product lines were split in 1989. The large format plotters retained the PL30 designation while the Paint Jets and small plotters and have become the product line 5M (Color Graphics Imaging). (HP Computer Museum, 2016)

Table 2.1 : History of other types plotter and when they were build

Year	Event
1953	The first high-speed printer was developed by Remington-Rand in 1953. It was designed to be used with the UNIVAC computer.
1957	IBM developed and marketed the first dot matrix printer in 1957.
1968	Shinshu Seiki Co., which later became Epson, developed the first electronic mini-printer in 1968.
1970	The first dot matrix impact printer was developed by Centronics in 1970.
1971	Gary Starkweather, while working at Xerox, developed the first laser printer by modifying a Xerox model 7000 copier. Development on the laser printer was completed in 1971.
1972	The first thermal printers became available on the market around 1972, designed for use with portable machines and in retail stores.
1976	The first inkjet printer was developed by Hewlett-Packard in 1976. However, inkjet printers do not gain popularity until the mid-1980s.

1976	IBM introduced the IBM 3800 Printing System, the first high-speed laser printer, in 1976.
1977	Siemens developed the first DOD (drop-on-demand) inkjet printer in 1977. The DOD printer sprays ink where it is needed on the piece of paper.
1979	Canon introduces the LBP-10, the first semiconductor laser beam printer and their first printer unit.
1984	Hewlett-Packard introduced their first laser printer, the HP LaserJet, in 1984. The same year, Hewlett-Packard introduced the first thermal inkjet printer, the HP ThinkJet.
1988	The HP DeskJet inkjet printer was introduced by Hewlett-Packard in 1988 and sold for \$1000. It is considered the first mass-marketed inkjet printer and became a very popular and widely used series of printers.
1988	Many modern 3D printers use a technology called FDM (fused deposition modeling), which was developed and patented by Scott Crump in 1988.
1992	Stratasys, Inc. made available their first 3D printer in 1992, which is based on FDM (fused deposition modeling) technology, developed and patented by company co-founder S. Scott Crump.
2009	S. Scott Crump's patent on FDM (fused deposition modeling) expired in 2009, opening the door for an open-source development community, called RepRap, to use the FDM technology. RepRap, along with other commercial companies, use FDM to develop new 3D printers.