UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF LAB KIT FOR CONTROL OF PNEUMATIC SYSTEM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotic & Automation) with Honours.

by

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I hereby, declared this report entitle ñDevelopment of Lab Kit for Control of Pneumatic Systemò is the results of my own research except as cited references.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic & Automation) with Honours. The member of the supervisory committee is as follow:

é é é é é é é é é .....

Supervisor

ABSTRAK

Sistem pneumatik mengunakan tekanan gas untuk menghantar dan mengawal tekanan gas ke seluruh sistem. Sistem pneumatik biasanya menggunakan udara sebagai medium bendalir, kerana udara adalah selamat, kos yang rendah, dan mudah didapati. Pembangunan kelengkapan makmal yang mengawal sistem pneumatik dalam projek ini adalah untuk mereka bentuk dan menilai satu persekitaran lain untuk memberi latihan dalam sistem pneumatik. Ia adalah beasaskan konsep *graspable interface* yang mana digunakan dalam alam maya. Di dalam projek ini, perisian Panel Master dan Automation Studio akan digunakan untuk kelengkapan makmal sistem pneumatik. Untuk menjelaskan aplikasi sistem ini, *Automated Vase Maker* dipilih untuk menunjukkan sistem pelaksanaan dengan menggunakan kedua-dua perisian dalam projek ini. Bagi mereka dan melaksanakan litar untuk projek ini, Automation Studio 5.0 telah digunakan. Untuk mereka sistem realiti maya, perisian Panel Master digunakan untuk mereka *Automated Vase Maker* ke dalam sistem maya. Pengguna boleh mereka dan menghasilkan sistem pneumatik dengan menggunakan perisian ini tanpa menggunakan perkakasan untuk kelengkapan makmal pneumatik. Sistem ini akan digabungkan untuk mensimulasi kedua-dua perisian secara serentak. Keputusan yang dijangka dari projek ini ialah, kedua-dua perisian dapat diintegrasikan dan dijalankan serentak untuk membina litar sistem pneumatik dengan pensimulasi sebagai medium latihan interaktif kepada pengguna.

ABSTRACT

Pneumatic system use pressurized gases to transmit and control power of system. As the name implies, pneumatic systems typically use air as the fluid medium, because air is a safe, low cost, and readily available fluid. The development of laboratory kit to control pneumatic system in this project aims to design and evaluating a different environment for hands on training in pneumatics system. It is based on the concept of graspable interfaces which is allows modeling in virtual worlds. In this project, 2D Panel Master software and Automation Studio software will be use to operate the pneumatic system laboratory kit. To illustrate the system application, the Automated Vase Maker was chosen to shows the implementation system by using both software in this project. In term of designing and implement the circuit for this project, Automation Studio 5.0 was used. For design the virtual reality system, the Panel Master software was used to transfer the Automated Vase Maker into virtual system. The user can designed and developed the pneumatic system by using this software without using the hardware for pneumatic laboratory kit. The system will be integrated for simulate both software simultaneously. The expected result from this project is, both software can be integrated and run simultaneously to build pneumatic circuit system with digital simulator as an interactive training medium for the user.

DEDICATION

I would like to thank my family and friends for being there and supporting me. Their concern and compassions for me during this project was greatly appreciated, and I could not have endured this final year project without them. A special thank you is extended to my supervisor, Mr. Khairol Anuar bin Rakiman, lecture of Faculty Manufacturing Engineering (Robotic & Automation), who has patiently guided and supervised me during this final year project. I also wish to express my appreciation to my panels, Dr. Zamberi bin Jamaludin, Mr. Muhd Nazrin bin Muhammad, Mr. Ahmad Yusairi bin Bani Hashim and Mr. Najib for providing time to judge me for this project during the presentation session and giving me advices, comments and recommendations.

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First of all, I would like to express my gratitude to Faculty of Manufacturing Engineering of UTeM for giving me an opportunity to undergo this final year project as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic & Automation) with Honours.

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Finally, I also would like to thank my family and friends for being there and supporting me. Their concern and compassions for me during this project was greatly appreciated, and I could not have endured this final year project without them.

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LIST OF ABBREVIATIONS

HMI	-	Human Machine Interface
PLC	-	Programmable Logic Controller
DCV	-	Double-acting Cylinder Valve
DVC	-	Directional Valve Control
V	-	Valve
PC	-	Personal Computer
BREVIE	-	Bridging Reality and Virtually with a Graspable User Interface
MET	-	Mechanical Engineering Technology
2D	-	Two Dimension
NO	-	Normally Open
NC	-	Normally Close
CNT	-	Counter

CHAPTER 1
INTRODUCTION

1.1 Project Background

This project is development of laboratory kit for control of pneumatic system. This project aims to design and evaluating a different environment for hands on training in pneumatics. It is based on the concept of graspable interfaces which is allowed modeling in virtual worlds. At the end of this project, the interactive pneumatic circuit should be able to build with digital simulator and to make use a simulator for experimenting with pneumatic parts and circuit.

The main objectives of this project are to design a practical pneumatic circuit system and build interactive mechanic of pneumatic simulator. Then, integrate both pneumatic circuit and simulator system for user.

The concept of this project is using the simulator which is use Panel Master software and Automation Studio 5.0 software to control the pneumatic circuit. This project only designs the pneumatic circuit by using the Automation Studio software and the graphic simulation to control pneumatic system by using Panel Master software. Overall activities during this project are including in Gantt chart at Table 1.1 and Table 1.2.

1.2 Problem Statement

The problems that spark the initial idea for this project are very rare usage of real-graphic simulation software for pneumatic system in the laboratory session. Normally in the laboratory session, the students use the pneumatic lab kit to learn the theory about the pneumatic system. In fact, the pneumatic lab kit is costly to buy especially for the technical and vocational school and difficult to make the programming for control the pneumatic system. By using the Automation Studio and Panel Master software, students can learn the pneumatic system in the effective way. Panel Master HMI (Human Machine Interface) software friendly-user compare to the other software. It is much easier to use and can attract the user with the graphic simulation and can help student to learn the graphic simulation for control the pneumatic system.

1.3 Aim & Objective

This project aims to design and evaluating a different environment for hands on training in pneumatics. To fulfill the aims of this project, there are two objectives that must be achieved:

a) To design a practical pneumatic circuit system.
b) To build interactive mechanism of pneumatic simulator.
c) To integrate both pneumatic circuit and simulator system.

1.4 Scope

This proposal addresses only to development of laboratory kit for control pneumatic system by using the Automation Studio software. This laboratory kit is to build interactive pneumatic circuit with digital simulator and to make use a simulator for experimenting with pneumatic parts and circuit. Furthermore, design the desired culture or characteristic of pneumatic system also include in this project than design the pneumatic circuit and PLC system for related task or experimental work. This project is used to create user friendly of real-graphic pneumatic component by using Panel Master software.

1.5 Project Planning

The important part in this project is project planning. The project planning starting to find the project title, then problem statement, introduction, and literature review, methodology, result and discussion and lastly is conclusion of the project. The Gantt chart at Table 1.1 and Table 1.2 shows the project planning activities during PSM I and PSM II.

1.6 Expected Outcome

The expected outcome for this project is to build interactive pneumatic circuit with digital simulator and make use a simulator for experimenting with pneumatic part and circuit by using the Automation Studio 5.0 software and Panel Master (Human Machine Interface) software. This laboratory kit can help the student to improve their skill during the laboratory session. The student not only learns the subject theoretically in the class but also has experience on the real world or system.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter focuses on the related field and knowledge pertaining to the project. Source of the information include the reference book, finding from the journal articles, papers, website, and conference article that relevance with the project title. It can help the student to learn from the author findings then apply it into the project and make the comparison with the system used. Many types of software used in laboratory to help the student learned and apply the theoretical knowledge.

2.2 Fluid Power

Kokernak (1999) mentioned that, the expression fluid power may be used to describe any process, device or system that converts, transmits, distributes or control power through the use of pressurized liquid or gas. Hydraulic systems use a liquid as the working fluid, while pneumatic systems operate using a gas. Esposito (2003) state that, fluid power is the muscle that moves industry depends on the process. This is because fluid power is used to push, pull, regulate, or drive virtually all the machines of modern industry.

There are two types of fluid system which are fluid transport and fluid power. Fluid transport systems have their sole objective the delivery of a fluid from one location to another to accomplish some useful purpose. Fluid systems are designed specifically

to perform work. The work is accomplished by a pressurized fluid bearing directly on an operating fluid cylinder or fluid motor.

Figure 2.1 shows the powerful hydraulic systems are used to produce the enormous forces required on many types of construction equipment. Cylinders such as the ones shown on these wheeled loaders may be used to lift, position, extend, and retract the various blades, bucket and booms commonly found on such equipment.

Plastic parts are often formed by injecting molten plastic at high pressure into a mold consisting of two or more sections. Figure 2.2 shows the molding machines such as contain hydraulic pistons that exert clamping forces to prevent the mold from opening during the injection process.

Figure 2.1: Wheeled loader (Kokernak 1999).

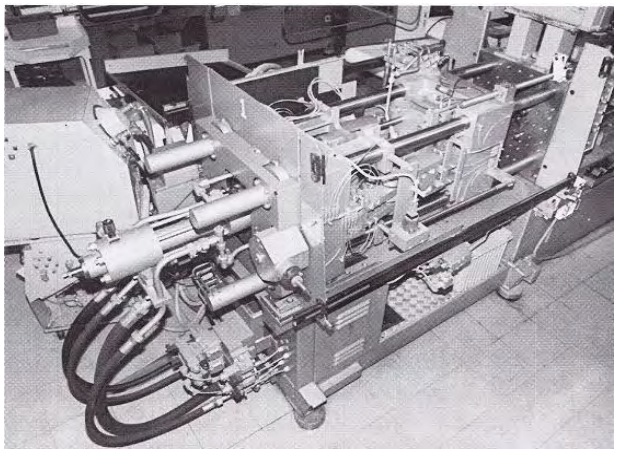

Figure 2.2: Molding machine (Kokernak 1999).

2.2.1 The Advantages of Fluid Power

There are three basic methods of transmitting power: electrical, mechanical and fluid power. Most applications actually use a combination of the three methods to obtain the most efficient overall system. Fluid power has several advantages over electrical or conventional mechanical systems.

a) Multiplication and variation of force. Linear or rotary force can be multiplied from a fraction of an ounce to several hundred tons of output.

b) Easy, accurate control. Can start, stop, accelerate, decelerate, reverse or position large forces with great accuracy. Analog (infinitely variable) and digital (on or off) control are possible. Instantly reversible motion-within less than half a revolution-can be achieved.

c) Multi-function control. A single hydraulic pump or air compressor can provide power and control for numerous machines or machine functions when combined with fluid power manifolds and valves.

d) High horsepower, low weight ratio. Pneumatic components are compact and lightweight. Can hold a five horsepower hydraulic motor in the palm of your hand.

e) Low speed torque. Unlike electric motors, air or hydraulic motors can produce large amounts of torque (twisting force) while operating at low speeds. Some hydraulic and air motors can even maintain torque at zero speed without overheating.

f) Constant force or torque. This is a unique fluid power attribute.

g) Safety in hazardous environments. Fluid power can be used in mines, chemical plants, near explosives and in paint applications because it is inherently spark-free and can tolerate high temperatures.