UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AN IMPROVEMENT ON POSITIONING TECHNIQUE ON CURRENT XY-TABLE

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

by

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I hereby, declared this report entitled "An improvement on positioning technique on current XY-Table" is the results of my own research except as cited in references.

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APPROVAL

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ABSTRACT

This project is an improvement on positioning technique on current XY-Table. A good safety system performance based on sets of positioning test for limit switch and proximity sensor is very important for XY-Table. XY-Table is a fundamental equipment that is widely used in industry area, which can apply in machine tool, laser welder, and measurement equipments and so on. This project will include the research regarding the safety system and analysis about the performance of XY-Table using limit switch and proximity sensor in term of accuracy, reliability and percentage error. Data collection for both devices is observed theoretically and experimentally since it is important for the system and positioning technique. Besides, various types of graphs are drawn to show the analysis comparison between both devices also included in this project. Proximity sensor has a higher safety performance compared to limit switch based on the positioning test conducted.

ABSTRAK

Projek ini merupakan suatu penambahbaikan di teknik kedudukan semasa di "XY-Table". Keselamatan sebuah sistem pengendalian yang baik prestasi berdasarkan beberapa ujian kedudukan untuk "limit switch" dan "proximity sensor" adalah sangat penting untuk "XY-Table". "XY-Table" adalah peralatan asas yang digunakan dengan luas dalam kawasan industri, yang boleh digunakan dalam pengendalian alatan mesin, pengimpal laser, dan peralatan-peralatan pengukuran dan sebagainya. Projek ini akan termasuk penyelidikan mengenai cara pengawalan sistem keselamatan dan analisis berkaitan dengan perlaksanaan "XY-Table" menggunakan "limit switch" dan "proximity sensor" dalam ketepatan, kebolehpercayaan dan peratus ralat. Pengumpulan data untuk kedua-dua jenis alatan masih perlu diperhatikan dari segi teori dan secara eksperimen kerana langkah ini adalah mustahak untuk sistem dan teknik kedudukan berkenaan. Selain itu, pelbagai jenis graf dilukis untuk menunjukkan analisis perbandingan antara kedua-dua jenis alatan juga termaksud di dalam projek. "Proximity sensor" mempunyai keselamatan sistem penendalian yang lebih tinggi berbanding dengan "limit switch" berdasarkan ujian kedudukan yang dijalankan.

DEDICATION

To my beloved family and friends.

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LIST OF ABBREVIATIONS

CNC	-	Controlled Numerical Computer
CNS	-	Control Nervous System
Com	-	Command
DIR	-	Direction
EL	-	End Limit
GND	-	Ground
GUI	-	Graphic User Interface
I/O	-	Input/Output
MEL	-	Meinus (-) End Limit
NC	-	Normally Close
NO	-	Normally Open
OUT	-	Output
P	-	Poles
PEL	-	Plus (+) End Limit
PLC	-	Programmable Logic Controller
RBFs	-	Radial Basic Functions
T	-	Throws
VB	-	Visual Basic

CHAPTER 1

INTRODUCTION

1.1 Background

Generally, precision machines are widely used in many modern manufacturing processes; a large proportion of these machines require the accurate positioning of some sort of tools or probes with respect to a work piece. Thus, much challenges in the technology behind machine tools and measuring machine metrology is concerned with the accurate measurement of this absolute position and then subsequent reduction of errors in this position. (Tan, 2005)

However, reducing the geometrical error in a machine typically raises the cost of the machine. Hence, industry needs to produce a high quality product and at the same time can be affordable in order to fulfill the requirement of customers. (Tan, 2005) Therefore, manufacturers had made some changes by using several tools to produce an extremely high quality production with low cost.

Automation in manufacturing had become a fundamental development due to the global manufacturing competition that increased drastically. Numerical controlled X-Y Table that using conventional lead screw often applied at industry for the purpose to achieve a greater position of accuracy. Figure 1.1 is the example for general view of X-Y Table.

Figure 1.1: Example of X-Y Table (Velmex, 2007).

1.2 Problem Statement

X-Y Table is one of the fundamental instruments that usually used in industry area to suit the requirement of automation in machining application. Any accident can occur during the movement of XY-Table's axis if the safety device installed is malfunction. A precise safety device must be develops to prevent or reduce the probability of collision between workpiece with the end of axis from happening unexpectedly. The current safety system of X-Y Table, which used limit switch for the safety purpose should be replace with proximity sensor device. The safety system and positioning of axis should be improves in order to achieve a better outcome in term of accuracy, reliability and percentage error. For this project, an analysis is carried out to study and improve performance of X-Y Table in order to produce a better safety system.

1.3 Objectives

The main objective of this final year project included:-

(a) To improve the safety system and positioning of X and Y axis.

(b) To study the performance of X-Y Table in term of safety system.

1.4 Scope

The area of research in this project is focus on analysis the performance of X-Y Table using limit switch and proximity sensor in term of accuracy, reliability and percentage error. Data collection for limit switch and proximity sensor is also essential due to enhancement for the system and positioning technique. Experiments precede to analysis the performance of both devices and subsequently comparison data using various graphs are drawn. However, other mechanical device is not included in this project.

1.5 Contents

There are totally six chapter needs to be completed as shown in below, except Chapter 1 that had described detail in this chapter.

Chapter 2 includes literature research, where all journal findings or previous research about the title is review and any important point is summarized. Finally, an investigation is done for all information obtained to achieve entire aim of project.

Chapter 3 illustrates flow-chart that carried out for whole process of the methodology. The data collection that consists of main resources is includes in this part in order to complete the analysis.

Chapter 4 describes about the design and development of the XY-Table using proximity sensor instead of limit switch. Any necessary method or step applied to connect all the components used to improve the safety system of XY-Table will be cover in this chapter. Besides, experiment designed to show the performance of both devices is also included as well.

Chapter 5 consists of outcome from the design and development of proximity sensor, data collection that obtained according the analysis performance of X-Y Table via limit switch and proximity sensor, graphs to show differentiate between these two devices. Any necessary calculation or outcome obtained through the analysis is also shown in this part. Data analysis based on the observation gained either theoretical or experimental investigation is also included in this chapter. Moreover, any difficulty encounter in achieving the aim of project when proceed with the experiment is recorded for further reference.

Chapter 6 concludes all the findings for the project. In the same time, some recommendation for the further analysis that related to improve safety system and positioning technique on current X-Y Table will be proceed.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Workpiece or tool positioning has been a major consideration in industry of all time. Motion requires transport of item or tool from one point to another point respective to a given reference point. In general, for any manufacturing operation to be successful, workpiece must be located and held to remain in a desired position and orientation when subjected to external forces during manufacturing operations while tools have to be accurately directed to desired points. For its importance in manufacturing industry, people strived to obtain better controlling system that directly affected the quality and cost of the product and consequently the survival in the industry. Generally, a modern motion control system typically consists of a motion controller, a motor drive, an electric motor, and feedback sensors. (Sclater & Chironis, 2007). Motion controller can be a stand-alone programmable controller, a personal computer containing a motion control card, or a programmable logic controller (PLC). All of the components of a motion control system must work together seamlessly to perform assigned functions. Motion control system can be found in such diverse applications as material handling equipment, machine tool centers, inspection stations, robots, and injection molding machines.

2.2 Positioning System

Positioning system is a system that helps to locate an item to a desired point based on a reference point. Many positioning systems are widely used in manufacturing machinery or products, which automatically positions the work piece or work head by means of carriages, templates and so on. Systems can be designed to control the positioning of the article or work piece electrically by means of servomotor systems, and mechanical by means of power-driven shaft screws. (John, 1970) Each type of system possesses some limitations, which have proven to be detrimental to the efficiency as well as the accuracy of manufacturing and to assembly operations.

Devices controlled by servomotor are effective and efficient in obtaining approximate locations of a work piece with respect to a tool. However, servomotor performs inherent hunting operation that is time consuming for obtaining a definite location. Conventionally, the driven threaded shafts or screws are usually driven at high speeds for a rough positioning. Meanwhile, it is driven at low speed for a final or accurate positioning of work piece. The system often exhibits hunting characteristics caused by inadequate positioning means or components in order to arrive at the final exact position. In addition, either power driven shafts under or overdrives the work piece past the desired final reference position. (John, 1970).

2.3 XY Table Positioning System

A XY-Table is a versatile device, which has a very useful movement that is required when working on several projects. XY Tables are utilized in high-performance applications in industrial robots, fiberoptics and photonics, vision systems, machine tools, assembly, semiconductor equipment, medical component laser machining, electronic manufacturing, and other industrial automation applications. Figure 2.1 is the examples of some applications that applied XY-Table in the industry area.

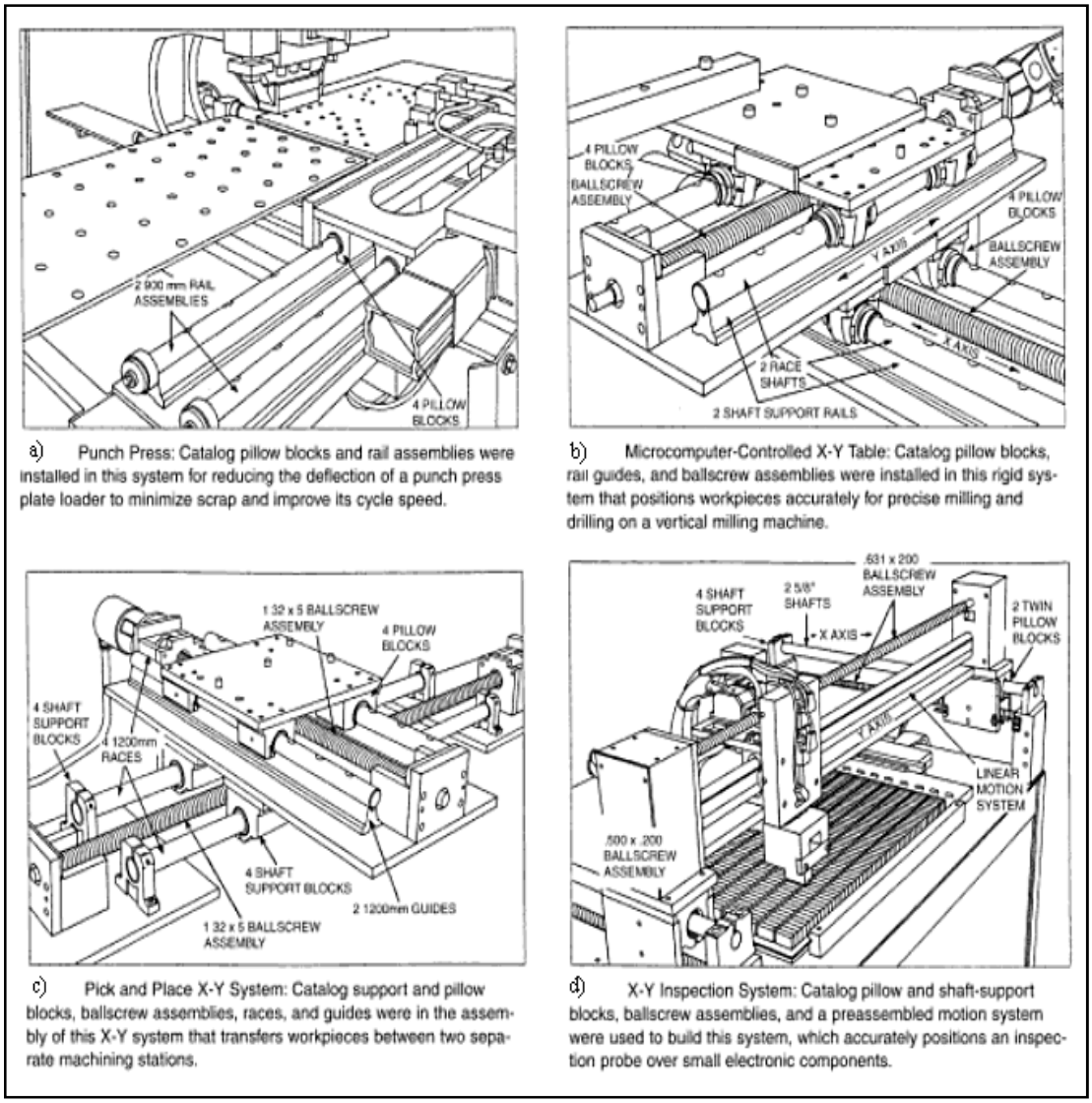

Figure 2.1: Various application example of XY table. (Sclater & Chironis, 2007)

A XY-Table is usually consists of three different layers of components. On the top of the XY-Table, there is a work surface used to clamp the desired work. The work piece is always clamped in good condition because it is supposed to remain stationary on the XY-Table workspace. Besides, two layers at bottom of the work surface of the XY-Table that has very similar purposes. Each layer will travel the work surface in linear means. One of the layers will move the work surface in a horizontal linear motion (x-axis). Meanwhile, the other layer will move the work surface in a vertical motion (y-axis). Hence, a work piece can moved freely either in vertical or horizontal direction on the XY-Table surface provided with the functioning of these two layers.