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**Stepper Motor Control and Drives - A PC Based Approach**

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**B010410168**

**MAY 2009**

# **Stepper Motor Control and Drives - A PC Based Approach**

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**This Report Is Submitted In Partial Fulfillment of Requirements for the Degree  
of Bachelor in Electrical Engineering  
(Power Electronic & Drive)**

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“I hereby declared that this report is a result of my own work except for the  
excepts that have been cited clearly in the references.”

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For my beloved father and mother  
**Wan Yusof Bin Wan Awang and Ani binti Zakaria**  
In appreciation of supported and understanding.

**WAN KHAIRI**  
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## ACKNOWLEDGEMENT

Alhamdulillah, praise be to Allah, the Cherisher and Sustainer of world, most Gracious, most Merciful Lord.

Praise be to Allah for enabling me to completed this analysis and research for Stepper Motor Control and Drives - a PC Based Approach project and report for my final year project report.

I would like to thank En. Muhammad Nizam Bin Kamaruddin as my supervisor, for his invaluable help, supports and ideas to me through achieving my final year project report goals. His countless contributions in this project will remind forever in my heart

Finally, I would like to honor my parent, for supporting me steadfastly and their appreciated advice through my project completion.

## ABSTRACT

Using the latest visual basic software, I have come up with an idea to control motor not just any motor but movement of the stepper motor. Stepper motors are special direct-current (DC) motors, Stepper motors are very different from regular DC motors. Instead of spinning like DC motors do stepper motor steps at a specific resolution for each pulse applied to its coils [1]. As a connection to the computer I will be using the parallel port. The reason that I use this kind of connection because is easier than the serial port when doing the wiring.

A parallel port is a socket found in personal computers for interfacing with various peripherals such as printers, scanners and even some webcams. On many computers, particularly laptops, the parallel port is omitted for cost savings, and is considered to be a legacy port [2]. Lastly the visual will create the controller in the computer so we can set up the desired movement of the stepper motor. Visual Basic (VB) is an event driven programming language and associated development environment from Microsoft for its COM programming model. Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using DAO, RDO, or ADO, and creation of ActiveX controls and objects(3).

## ABSTRAK

Menggunakan perisian Visual Basic terkini, saya telah medapat satu idea untuk mengawal motor dan bukan hanya sembarangan motor tapi pergerakan bagi motor berperingkat. Motor berperingkat adalah arus terus (DC) motor, motor ini adalah sangat berbeza daripada motor arus tetap yang lain. Daripada berputar seperti motor DC, motor berperingkat melakukan putaran pada satu resolusi khusus untuk setiap satu denyutan digunakan ke gegelungannya [1]. sambungan yang akan digunakan untuk komputer saya adalah menggunakan pengkalan selari. Saya menggunakan sambungan jenis ini kerana sambungan ini adalah lebih mudah daripada pengkalan bersiri bila untuk pendawaian.

Pengkalan selari adalah satu soket didapati dalam komputer peribadi untuk pengantaramukaan dengan pelbagai jenis seperti pencetak, pengimbas dan malah sebahagian kamera web. Pada kebanyakan komputer, terutama komputer riba, pengkalan selariitu dipakai untuk penjimatann kos, dan adalah dianggap menjadi satu pengkalann warisan [2]. Akhirnya visual akan mewujudkan pengawal ada dalam komputer supaya kita boleh menubuhkan pergerakan yang dihasratkan bagi motor berperingkat. VB adalah satu perisian bahasa pengaturcaraan dan perkembangansuasana bersekutu dari Microsoft untuk model pengaturcaraan komputernya. Visual Basic diperolehi daripada BASIC dan membolehkan RAD dari GUI aplikasi, akses untuk pangkalan data menggunakan DAO, RDO, atau ADO, dan penciptaan bagi kawalan-kawalan ActiveX dan benda-benda(3).



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## LIST OF SHORT FORM

GPS	-	Global Positioning System
VB6	-	Visual Basic 6.0
PC	-	Personal Computer
CPU	-	Central Processing Unit
PIC	-	Programmable Intelligent Computer
DAQ	-	Data Acquisition
GUI	-	Graphical User Interface
QBASIC	-	Microsoft Quick BASIC
DC	-	Direct Current
AC	-	Alternating Current
I/O	-	Input/output
TTL	-	Transistor–Transistor Logic
CMOS	-	Complementary Metal–Oxide–Semiconductor
IC	-	Integrated Circuit
LED	-	Light-Emitting Diode
CCTV	-	Closed-Circuit Television

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# CHAPTER I

## INTRODUCTION

### 1.1 Overview

All kinds of technology nowadays, begin with just a simple idea and then the basic theory and basic design were applied on this idea for a start. Later on some more idea were added on it to make it greater. This is what am I try to do with my project for the past few months. The project is all about creating a new technology that will take human to a new step. It mainly about to design a newly, not so costly, and easy to handle a stepper motors controller and driver using your own personal computer at the comfort of your home.

Generally, this project is developing due to create a controller that can connect with a computer can works as functional, more effective and reliable as any controller in the market. The most important purpose of this project is to make life easier with the programming software as the drivers that used for this project is a lot simpler than any other software in the market. As additional, maybe I might add a few more function to make it more interesting for the user out there. This is all about allowing you to control speed, direction, and step size of a stepper motor. To make it simpler, how the stepper motor works depend on your hand.

Basically this stepper motor controller technology will be using visual basic as the software for the drives. This visual basic software will involve the usage of graphical user interface so that people will easy to learn how to control it. , this project will also teach us how to interact between PC and external devices likes parallel and serial port. Parallel port will be use a medium of connection between the software and the hardware. That mean all the data from the computer will be transferred by this port to electrical parts.

## 1.2 Problem statement

There are some problems that lead to me that make me want to do this project. Without these problems there will be no stepper motor control and drives - a PC based approach project. Sometime we need this problem to motivate us to do something that good for the mankind. The problems are:

- ✓ Conventional control using microcontroller and PLC is expensive, moreover microcontroller based require high level programming skill.
  
- ✓ The solution is come up with PC-based which is cheaper and require low level programming using Visual Basic.
  
- ✓ Industries required PC-based for SCADA (Supervisory Control and Data Acquisition). Therefore a PC-based system can be expanded for SCADA later.

### 1.3 Project objectives

\*To create a pc-based control of a stepper motor this is using parallel port as a communication medium.

\*To perform user friendly interface for stepper motor control using visual basic.

\*To make sure that the hardware and software well connected.

### 1.4 Scope of project

The main goal of the project is about to design and create a system that control stepper motor using an interface with computer. The other scope of the project are:

- Main focus controls the stepper motor to move when we want it.
- The system will use Visual Basic 6.0.as the PC-Based software
- Using parallel port as interface between software and hardware.

## CHAPTER II

### LITERATURE REVIEW

This chapter contains information and older research that related with the project to be made that I have choose. Furthermore, this chapter contains about the theory of the components that were used in this final year project.

#### **2.1 First study: Interface Parallel circuit for computer control using double stepper motor. [4]**

**(Mike J. Johnson & Guru Subramanyam, Universiti of Northen Iowa, 1997)**

One interface parallel circuit had been design, made and test for programming double stepper motor controller that was used in robotic arm and linear position table. This robotic arm has four degree of freedom by using four stepper motor and a stepper motor were used at position schedule for linear transmission. This interface circuit was build to involve buffer tristate buffer driver, encoder circuit, generator phase network circuit, and power output circuit. . Apart from that, this interface circuit also used parallel port connector DB 25's type as in figure 2.1. This parallel port connector contain data line (D0-D7), status line (S3-S7), control line (C0-C3) and earth line (G18-G25). Data format to DB 25 data's line is as in figure 2.2.

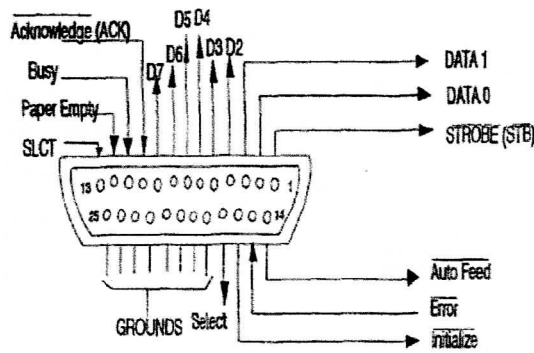


Figure 2.1: DB-25 connector for PC [4]

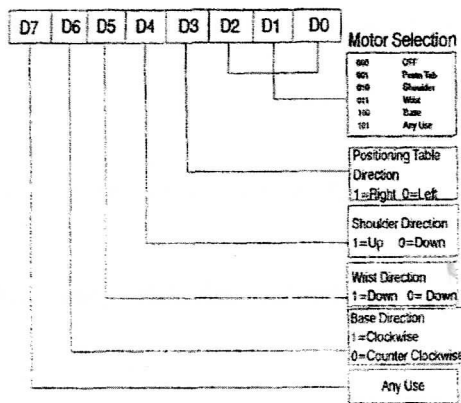


Figure 2.2: Data format for data line DB-25 [4]

QBASIC is the software that was used to control this robotic arm and position schedule. This software was chosen because easy to use. This program menu contains choices whether to control position schedule or manipulator arm. When this program stop, it will be showing current position robotics arm and position schedule. Full circuit and program can be seen in figure 2.3.



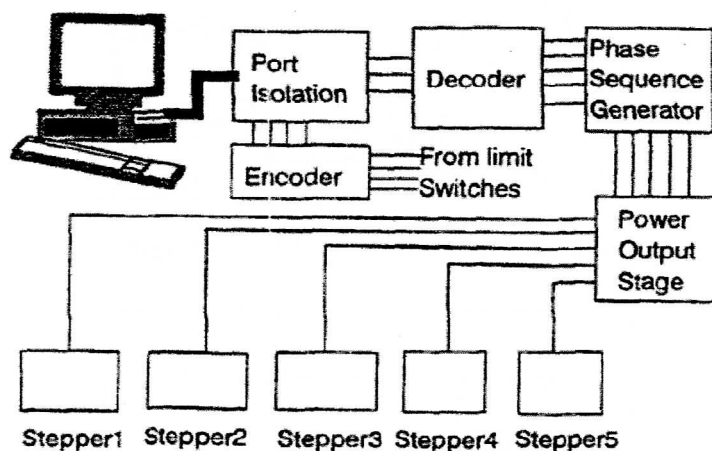


Figure 2.3: Block diagram digital control system [4]

## 2.2 Second study: Control the movement using Parallel Port in a personal computer (PC) and its application. [5]

(T.H.Woo, G.S.Zhang, M.Wang, B.Z.Xu, B.Gang, C.Li, Kim Il Sung University and Tianjin University, 2007)

This project is to control movement of stepper motor or servo-motor through drive and parallel port from personal computer. Total procedure perceives in figure 2.4. This procedure enable the control on motor that use well-performed resolution high with accuracy exceeding 1 microseconds. Many hardware in personal computer and algorithm for controlling movement do not have any additional hardware to control movement such as guard card border movement component extension (PCI). The procedure to control this trapezium movement was described with detailed for movement, constant-speed and deceleration process. Several projects which involves DAQ's card and movement control system through parallel port have been developed previously by various hardware and software combination. That studies emphasize how digital product and data entry through parallel port with using various types of software. Figure 2.5 show connection between parallel port and servo-motor drive. To Window XP, variation range pulse frequency from parallel port was from 0 to 40 kHz. Each pulse period is control based on acceleration value or speed which is given. The software used was Visual C . This project will be applied to turntable laser welding.

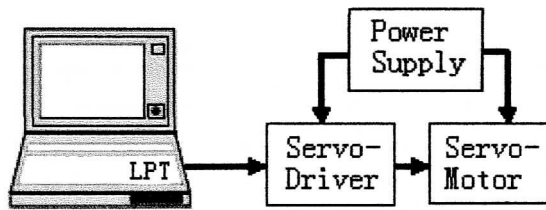


Figure 2.4: Block diagram system. [5]

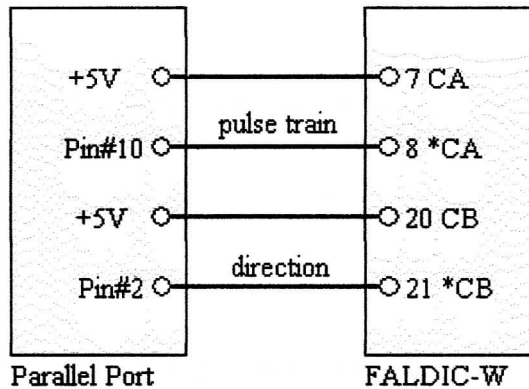


Figure 2.5: Diagram connection between parallel port and servo motor drive. [5]

### 2.3 Third Study: PC bases on equipment in beginning measurement and analysis of a current motor. [6]

(Lei Shaochong, Shao Zhibao, Guo Zhonglin and Wang Faliang, Xi'an Jiatong University)

A device was designed and implemented to measure and analyze current and instability real time voltage usually happens during the movement motor begins. This project would give algorithm to count mistake in estimated value rms and algorithm to replace voltage difference. Achieved data will be sent to PC through EPP (Enhanced Parallel Port) and DAQ's card, after that automatically saved in document. Each size measurement data be sent to PC can become as big as PC's memory capacity. Each rate measurement from this tool could increase to be as one-million per one second. This system flow total perceives in figure 2.6

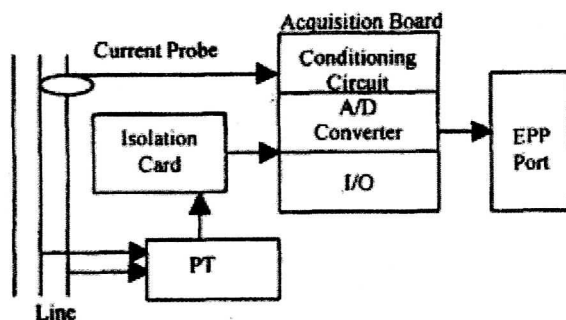


Figure 2.6: Block diagram system. [6]

## 2.4 Conclusions

These projects are suitable to make study material to generate interface parallel. The first study, that project could be developed more by using Visual Basic's software 6.0 because QBASIC's software already disused by the system developers. QBASIC's software need enough memory and quite fast CPU otherwise programme will operate in a speed which quite slow. Same as the second study where Visual C software's use pretty hard to furnish with graphical user interface (GUI). Through Visual Basic's software 6.0, graphical user interface (GUI) can be design easily and practicable in complicated applications with ease. For the third study, this project also involves only data transmission process from hardware and very depended to DAQ's card to analyse the data obtained from hardware.