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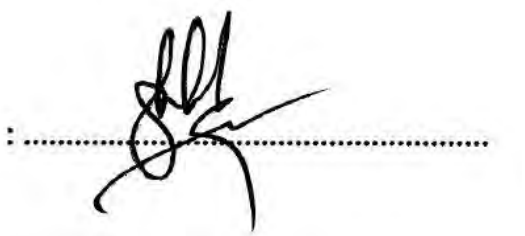
Signature : 

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Date : **JULY 2, 2012**

MNEMONIC CODE TO LADDER DIAGRAM CONVERTER

NORIZAN BIN MAHMUD

A Report Submitted in Partial Fulfillment of Requirements for the Degree
Of Bachelor in Electrical Engineering (Control, Instrumentation and Automation)

Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

JULY 2, 2012

STUDENT DECLARATION

"I hereby declared that this report is a result of my own work expert for the excerpts that have been cited in the references"

Signature :  .....

Name : **NORIZAN BIN MAHMUD**

Date : **JULY 2, 2012**

To my beloved mother and father

ACKNOWLEDGEMENT

In The Name of Allah the Most Merciful and Most Compassionate

First and foremost, I would like to thank to my supervisor of this project, Mr. Shahrudin Bin Zakaria for the valuable guidance and advice. He inspired me greatly to work in this project. His willingness to motivate us contributed tremendously to our project.

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ABSTRACT

„Programmable Logik Controller“ (PLC) is a big industry. The support and development of PLC and its programming software still continues and increase. This project is to explore more about this support industry. Knowledge will gain and more understanding will developed on this subject. Therefore, this software will develop to become learning tools in learning PLC. Today, a lot of PLC programming has been developed for programming the PLC module device. It includes a program to upload and download the data programming between the computers with the PLC programming module. Different with this converter software project, it is very simple software which is converts the mnemonic code typed to the ladder diagram. In this project, program that uses to develop the converter software is Visual Basic. This software project is developed based on existing PLC programming software and also used in UTeM. The PLC programming software is Omron CX Programmer.

ABSTRAK

„Programmable Logik Controller" (PLC) adalah industri yang besar. Pembangunan PLC dan perisian pengaturcaraan masih berterusan dan berkembang. Projek ini adalah bertujuan untuk meneroka lebih lanjut mengenai industri PLC ini. Pengetahuan dan pemahaman akan dapat ditingkatkan semasa proses membangunkan perisian ini. Oleh itu, perisian ini akan dibina untuk menjadi alat pembelajaran dalam pembelajaran PLC. Hari ini, banyak pengaturcaraan PLC telah dibangunkan untuk pengaturcara peranti PLC modul. Ini termasuk program untuk memuat naik dan memuat turun data pengaturcaraan di antara komputer dengan modul pengaturcaraan PLC. Berbeza dengan projek perisian penukar ini, ia adalah perisian yang sangat mudah yang mana menukarkan kod mnemonik yang ditaip kepada gambarajah tangga. Dalam projek ini, program yang digunakan untuk membangunkan perisian penukar ini adalah Microsoft Visual Basic. Projek perisian ini dibangunkan berasaskan perisian pengaturcaraan PLC yang sedia ada dan juga digunakan di UTeM. Perisian pengaturcaraan PLC itu ialah Omron CX Programmer.

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PLC	-	Programmable Logic Controller
VB	-	Visual Basic
GUI	-	Graphic User Interface
UTeM	-	Universiti Teknikal Malaysia Melaka
NO	-	Normally Open
NC	-	Normally Close
TIM	-	TIMER
CNT	-	Counter

CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter describes the introduction and purpose of this project, which is to develop the converter software. This project involves Visual Basic programming as a programming language and user interface. Introduction about the project includes the background of the study, the statements of problem, the objectives of the project, and scope of the project are explained.

1.2 Background

The title of this project is a Mnemonic Code to Ladder Diagram Converter. The purpose of this project is to design and develop Programmable Logic Controller (PLC) method converter which is ladder diagram and mnemonic code. Visual Basic 6 use to design the interface converter software.

1.3 Problem Statement

In the learning PLC, students face difficulty to understand the internal technique in converting process. Normally the technique used is hidden to users of this CX Programmer software. Therefore, the purpose of this software was developed to explore the technique used in this software. Hopefully the future development of this software will be much understood to the common user.

1.4 Objective

The main objective of this project is to develop and design the converter software by using Visual Basic which is able to convert the mnemonic code to ladder diagram for the PLC learning purpose. The software will display the ladder diagram according mnemonic code typed by the user. The specific objectives that are needed to accomplish the main goal are listed as follows:

1) To build the graphical interface using Visual Basic 6.
2) To create the education tool for students to improve their understanding the fundamental of the PLC.

1.5 Project Scope

In an effort to achieve the goal of this project, some scopes are outlined. The main scope of this project is to produce software that can convert mnemonic code to the ladder diagram. Then this software will automatically display the ladder diagram when the code mnemonic is typed.

This software will be developed based on existing programs that is Omron Cx Programmer. The process starts with understanding the technique and method used in this software as guidance for design this converter software. This software is comparable logical to Cx Programmer converter on Omron model only.

1.6 Summary

This chapter gives an introduction to the project, which is the development of Converter Software consist the objective and scope of the project that should be achieve at the end of this project.

CHAPTER 2

LITERATURE REVIEW AND THEORY

2.1 Programmable Logic Controller (PLC)

A Programmable controller is a solid state user programmable control system with functions to control logic, sequencing, timing, arithmetic data manipulation and counting capabilities. It can be viewed as an industrial computer that has a central processor unit, memory, input output interface and a programming device. The central processing unit provides the intelligence of the controller. It accepts data, status information from various sensing devices like limit switches, proximity switches, executes the user control program store in the memory and gives appropriate output commands to devices like solenoid valves, switches, sensors, motor, indicator lamp more [1]. There were stipulated five programming languages in PLC programming language standard IEC6113 1-3:

1) Ladder Diagram (LD)
2) Instruction List (IL)
3) Sequential Function Chart (SFC)
4) Functional Block Diagram (FBD)
5) Structure Text (ST) [1].

In this project just will involve only two method which is ladder diagram and mnemonic code (Instruction list). Ladder diagram language is a programming language that expresses control relationship by graphical symbols and their mutual relations in diagram; it is evolved from relay circuit diagram, visual and easy to control by engineering staff. While the mnemonic code is a program that can be inserted and read by the PLC. The PLC processor reads or scan ladder diagram rung from top to bottom and from left to right side [2].

2.1.1 The Conversion of Ladder Diagram to Instruction List

Though ladder diagram has the image intuitively in programming, yet it is composed by icons, it is a great difficulty in compiling ladder diagram directly and complex design. Therefore, it should convert ladder diagram to instruction list before compiling, due to the instruction list is similar to the assembly language and in accordance with the certain logic order by statement instruction, this form is easy to compile. Ladder diagram is connected in accordance with certain rule by symbol elements, thus it can map the elements of ladder diagram to the nodes of tree, the connecting line mapped to the connecting branch of tree [2].

2.1.2 The Conversion of Instruction List to Ladder Diagram

The relationship between instructions in instruction list and symbols of ladder diagram is one to one in PLC programming language; therefore the conversion of instruction list to ladder diagram is the inverse process of ladder diagram converts to instruction list. Ladder diagram is a kind of visual image symbol, instruction list is a kind of descriptive statement, and the key to transformation is extract relevant information from descriptive statement of instruction list to draw symbols of ladder diagram. For example, OR/ORB in instruction list and the parallel structure of ladder diagram, AND/ ANB and the tandem structure of ladder diagram in a corresponding relationship with one to one respectively [2].

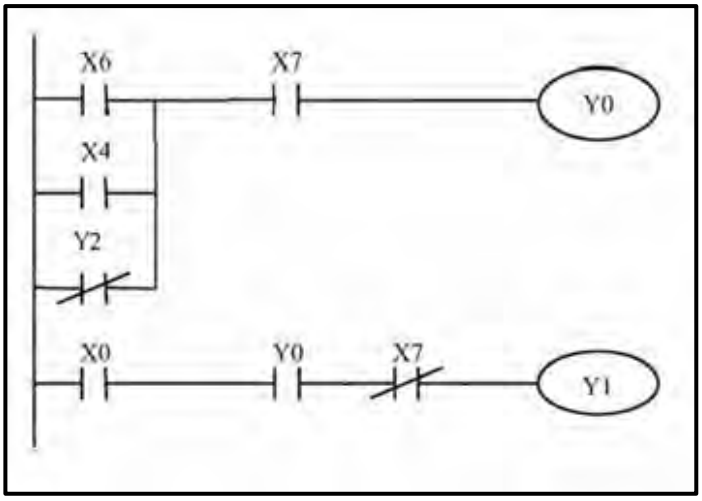

Figure 2.1: Ladder Diagram [2].

Mnemonic Code

LD	X6
OR	X4
ORNOT	Y2
AND	X7
OUT	Y0
LD	X0
AND	Y0
ANDNOT	X7
OUT	Y1

2.2 Microsoft Visual Basic 6.0

Visual Basic is a tool that allows user to develop Windows applications like Graphic User Interface (GUI). By using Visual Basic 6, users can create any programs depending on their objectives. Many programs can be creating with visual basic such as educational programs like program to teach science, mathematics, language, and history. An additional, users also can create a game program if they like those programs. The Visual Basic environment is shown in Figure 2.9 [7, 8].

Programming in VB is a combination of visually arranging components or controls on a form, specifying attributes and actions of those components, and writing additional lines of code for more functionality. Since default attributes and actions are defined for the components, a simple program can be created without the programmer having to write many lines of code. Performance problems were experienced by earlier versions, but with faster computers and native code compilation this has become less of an issue.

As a conclusion, Visual Basic is the most user friendly GUI application to be used in the development of converter software. Visual Basic provides most simple coding type compared to other programming such as Visual C++ and also JAVA. Therefore it was the most suitable GUI application for the development of converter software [9].

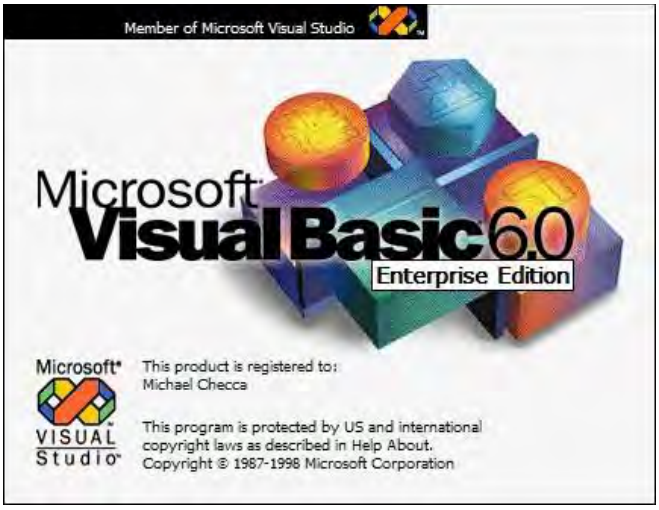

Figure 2.2: Visual Basic [9].

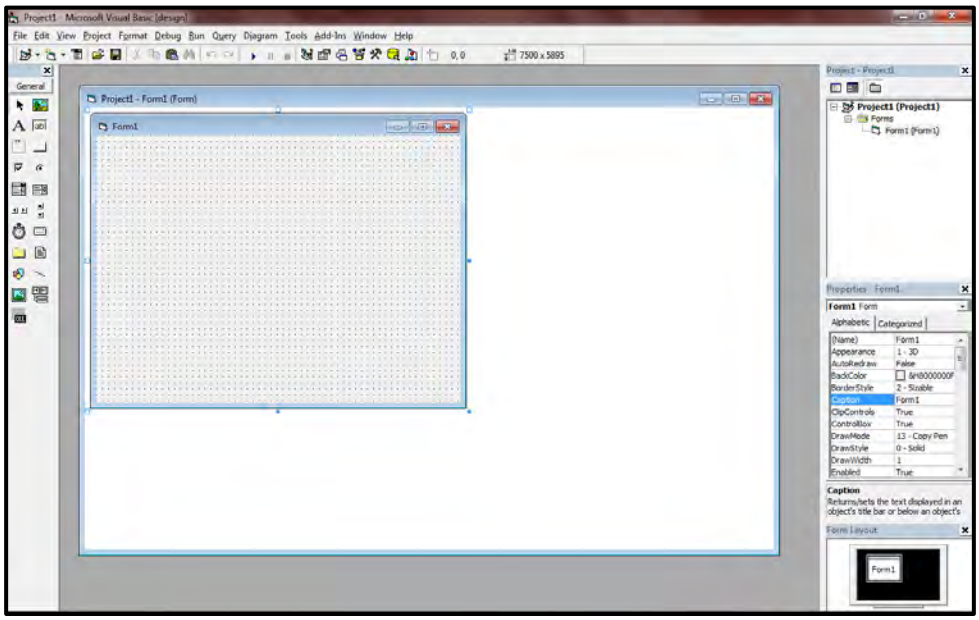

Figure 2.3: The Visual Basic Environment [9].

The Visual Basic Environmental consists of the follows:

1. Toolbox is contains the object component which is can be added to forms.
2. Form Design is a window used in application as platform to create program.
3. Project Explorer window view the lists of files used to build an application.
4. Properties window view lists the property setting parameter the selected form or control component toolbar that can be modified while the program is being edited.
5. Code Editor Window also known as the code window [9].

2.3 Omron Cx Programmer Software

Figure 2.4: Omron Cx Programmer Version 9

The Omron CX Programmer is a tool that allows user to program circuit and send into the PLC module. The program can be downloaded to the PLC module (CPU) either in ladder diagram or mnemonic code depends on user requirement. With CX programmer, users can create any ladder diagram circuit or write mnemonic code programs depending on their objectives. Besides that, user can convert their ladder diagram to mnemonic code or mnemonic code to equivalent ladder diagram. The Omron Cx Programmer environment is shown in Figure 2.5 [12].

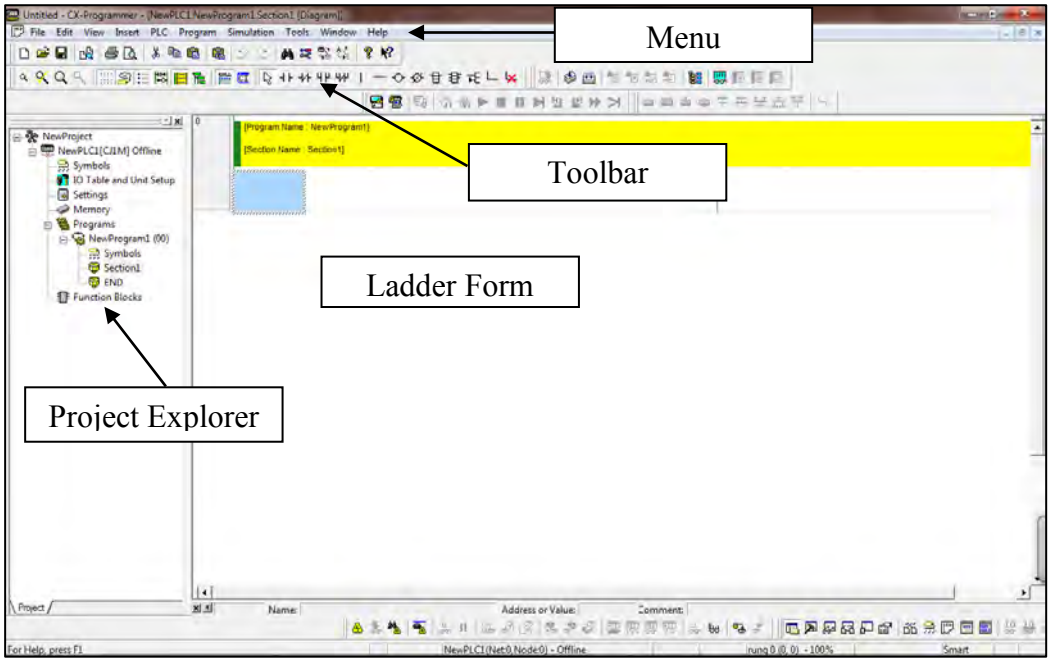

Figure 2.5: The Omron Cx Programmer Environment

The Menu bar of the Cx Programmer screen displays the commands that can be used when working with Cx Programmer like File, Edit, View, Insert, PLC, Program, Window, Simulation, and Tool to provide commands specific programming. The Project explorer window is used to view the type of PLC CPU and file project.

A Toolbar is a collection of icons that carry out the standard symbol of ladder diagram when clicked. It includes normally open contact, output, timer, counter and so on. To program the ladder, components are chosen and type the address in command window controls as shown in Figure 2.6. The component will display depends to parameter that the user type controls as shown in Figure 2.7 [12].

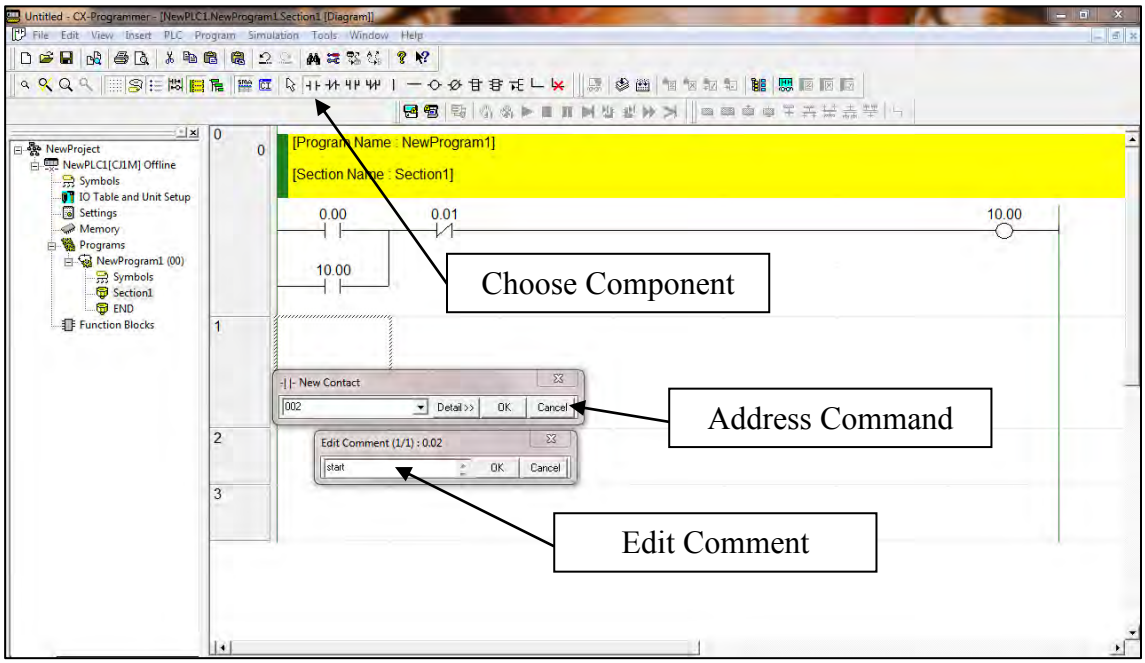

Figure 2.6: Writing the Ladder