Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF TRAINING MODULE FOR INDUSTRIAL AUTOMATION SYSTEM BASED ON REAL INDUSTRIAL AUTOMATION SYSTEM (MIRROR MANUFACTURING)

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Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

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DEVELOPMENT OF TRAINING MODULE FOR INDUSTRIAL AUTOMATION SYSTEM BASED ON REAL INDUSTRIAL AUTOMATION SYSTEM (MIRROR MANUFACTURING)

PRAKASH A/L SELVARAJ

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics)
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Date : 11/1/2022

Signature :

Co-Supervisor :

Name (if any)

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DEDICATION

To my beloved mother, Bathmavathiy A/P Andy, and father,
Selvaraj A/L Subramaniam,

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ABSTRACT

In the era of early industrial revolution 4.0, Internet of Thing (IOT) standpoint after 2015 has rapidly developed beyond any civilizations comprehension, ever since machine learning, deep learning and Artificial Intelligent (AI) was introduced to the world. Originally the idea of this project can be discerned from the movie star trek in 1979, where the characters configures and monitor reactors status through its user interface from a screen pad reassembling modern day IPad. With ushering the age of AI, interface interaction is expected to be implemented from industrial to household equipment where we can monitor and configure the status into our desire instead of adjusting manually. Thus, the objective of this project is development of Personal Computer (PC) based system Mimicking Programmable Logic Controller (PLC) programming sequence via creating Visual Studio in form of Graphic User Interface (GUI) as a Training Module for industrial automation system that is based on real system used in industry. The training module is based on using PC based system to control the training module which aims to improve and create an understanding, improvement and adaptation of the one of the upcoming industrial revolution changes. Thus Students or Trainee as able to simulate and navigate to the logic programmed and learn its sequences. The training module system is developed by designing its respective system architecture and followed by device settings and configuration which is obtained from a designated industry. With the goal of instilling in young professionals the belief that "opportunity to learn" is one of the most desirable benefits an employer can provide. To ensure the effectiveness of training, it is critical to provide learners with high-quality content.

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ABSTRAK

Pada era revolusi industri awal 4.0, sudut pandang Internet of Thing (IOT) setelah tahun 2015 telah berkembang pesat di luar pemahaman peradaban, sejak pembelajaran mesin, pembelajaran mendalam dan Artificial Intelligent (AI) diperkenalkan ke dunia. Pada mulanya idea projek ini dapat dilihat dari perjalanan bintang filem pada tahun 1979, di mana watak-watak mengkonfigurasi dan memantau status reaktor melalui antara muka penggunanya dari pad skrin yang menyusun kembali IPad moden. Dengan memasuki usia AI, interaksi antara muka diharapkan dapat dilaksanakan dari industri ke peralatan rumah tangga di mana kita dapat memantau dan mengkonfigurasi status menjadi keinginan kita dan bukannya menyesuaikan secara manual. Oleh itu, objektif projek ini adalah pengembangan urutan pengaturcaraan sistem berasaskan Personal Computer (PC) Mimicking Programmable Logic Controller (PLC) dengan membuat Visual Studio dalam bentuk Graphic User Interface (GUI) sebagai Modul Latihan untuk sistem automasi industri yang berdasarkan pada sistem sebenar yang digunakan dalam industri. Modul latihan didasarkan pada penggunaan sistem berasaskan PC untuk mengawal modul latihan yang bertujuan untuk meningkatkan dan mewujudkan pemahaman, peningkatan dan penyesuaian dari salah satu perubahan revolusi industri yang akan datang. Oleh itu Pelajar atau Pelatih dapat mensimulasikan dan menavigasi ke logik yang diprogramkan dan mempelajari urutannya. Sistem modul latihan dikembangkan dengan merancang seni bina sistem masing-masing dan diikuti dengan tetapan dan konfigurasi peranti yang diperoleh dari industri yang ditentukan. Dengan tujuan menanamkan dalam diri profesional muda kepercayaan bahawa "peluang untuk belajar" adalah salah satu faedah yang sangat diharapkan yang dapat diberikan oleh majikan. Untuk memastikan keberkesanan latihan, sangat penting untuk menyediakan pelajar dengan kandungan berkualiti tinggi.

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LIST OF ABBREVIATIONS

GUI	-	GRAPHIC USER INTERFACE
PLC	-	PROGRAMMABLE LOGIC CONTROL
AI	-	ARTIFICIAL INTELLIGENT
HMI	-	HUMAN MACHINE INTERFACE
ILM	-	INTRACTIVE LEARNING MODULE
PC	-	PERSONAL COMPUTER
VB	-	VISUAL BASIC
LD	-	LADDER DIAGRAM
AR	-	ARGUMENTED REALITY
VR	-	VIRTUAL REALITY
IDE	-	INTEGRATED DEVELOPMENT ENVIROMENT
OOP	-	OBJECT ORIENTED PROGRAMMING
IEC	-	INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CHAPTER 1

INTRODUCTION

1.1 Background

In today's world of global interaction, devices are managed in virtually every field and channel, and have become a vital part of our daily lives. At the industrial scale, machines are required to make things and provide services at a rapid speed in order to meet increasing demand for productivity while also providing high-quality services. During the previous revolution, machine operations were distinct and autonomous or more precisely, systems were insulated from one another by their disparate environments and lacked a simplified or effective means of learning. Regardless of how, the advancement of computer processors and internet applications allow the straightforward establishment of common protocols between devices, for example, between control PLC through HMI software. A remote operator can control the item or equipment from any location over the internet.

One Example of training module built back in the 90's was Programmable Logic Controller (PLC) Kit for Teaching and Learning was developed in response to the shortcomings of the existing PLC Trainer in terms of enhancing hands-on skill development through circuit design, installation, and troubleshooting. The Kit was later improved by increasing the number of input and output components, lowering the cost, and making it more user friendly. With this it increases overall performance and reducing learner's physical and mental stress from learning it through blackboard only. As a result, the technology like this is found in widespread application such as the electronics, entertainment, medical, and military sectors.

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Later is where it enables the integration of humans into more complex system like Augmented Reality based learning in near future.

This dissertation details the efforts in designing, programming, and constructing an Interactive Training Module (ILM) based on an example industry with designated GUI using Visual Studio.

1.2 Problem Statement

In comparison to the need for well-trained engineers and technicians, the difficulties associated with students' lack of enthusiasm in their area are astounding, prompting the suggestion of collaborative learning methods to make learning more engaging and effective, therefore meeting field demands. Collaborative learning in the classroom may increase students' engagement in the classroom by utilizing problematic solution activities to reduce drop-offs. To increase the effectiveness and appeal of classroom learning, interactive learning modules (ILMs) in the instructional setting will be strongly encouraged. These interactive learning modules convey issues and ideas visually, allowing students/trainees to see and execute the actions necessary to resolve the problem. For successful usage of these ILMs in a classroom setting, this research promotes awareness of the problems associated with ILM use in a classroom. It is anticipated that the usage of ILMs would assist instructors or trainers in making classroom instruction more engaging and will increase student interest in the area. Thus, the project's objective is to provide a better design concept, integration, and execution in line with the requirements for ILM system, thus presenting the most significant difficulties to work on.

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1.3 Project Objective

The main aim of this project is to propose few objectives that will achieved. Specifically, the objectives are as follows:

a) Create an interactive training module that is easier to be accessed with less hardware cost.

b) To create a teaching tool that is much more effective than old school training module using a book.

1.4 Scope of Project

To avoid any uncertainty of this project due to some limitations, the scope of the project is defined as follows:

a) CX-Programmer PLC Ladder diagram act as the proof for logic control executes without issue, interaction and monitor I/O status shown in training module.

b) User can control the simulation motion.

c) Training module is not focused on online monitoring of PLC activities through handshake protocol through Visual Studio.

d) Make the interface intriguing with videos to improve participant's curiosity.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This Chapter reviews the written materials related to this project and the area of study required in developing the training module. It gives the reader and overview of theory. Hence, this chapter provided an explanation of the project's problem and concept used to solve it. The primary sources of information are websites and similar studies. This selection of resources was made considering the project's focus on similar projects. Similar to E-learning protocol, Training modules is to ensure that the information in a training module is assimilated and retained, training modules should be designed and created. Learning is more efficient when training modules are combined into a step-by-step progression. As learners proceed through a course, module by module, each module forms one part of an overall topic, helping learners gradually advance toward their training goals. Using learning management systems to deliver training makes it easier to understand the material.

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2.2 Related Theory

2.2.1 Visual Studio 2017

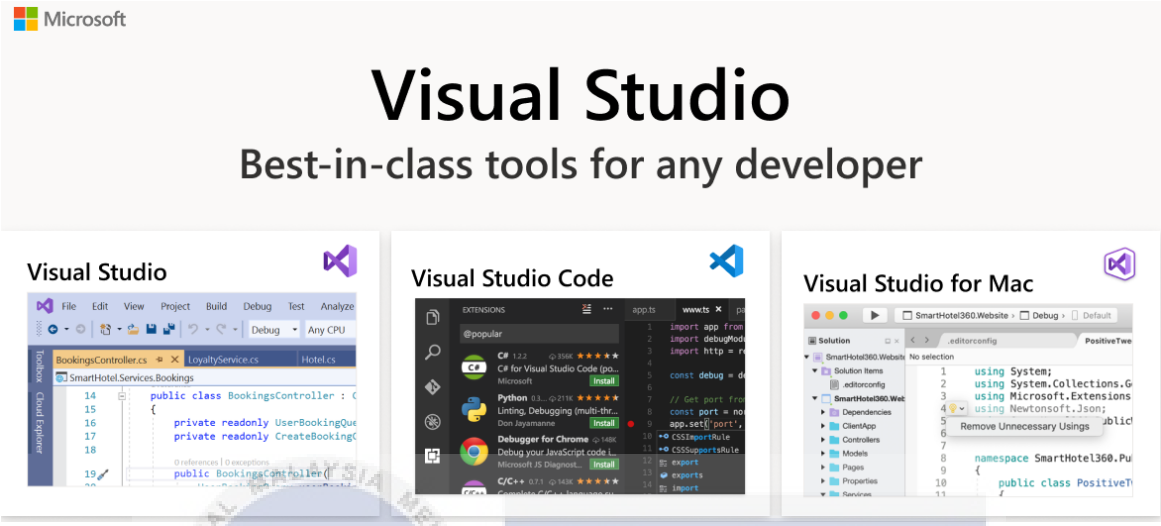

Figure 2.1 Microsoft's Latest Visual Studio

In 1997, Microsoft launched Visual Studio, which included a host of tools for developing software for the first time. Visual Studio 97 was available in two editions: Visual Studio Professional and Visual Studio Enterprise. The former contained Visual J++ 1.1 for Java programming and Active Server Pages for creating dynamically generated web sites, while the latter contained Visual InterDev for developing dynamic web sites using Active Server Pages. When the 1997 release of Visual Studio attempted to utilize the same environment for multiple languages, it was an ambitious goal. Earlier, all three of these Development Studios (Developer Studio, Visual J++, and InterDev) were using the same "*environment*" or more precisely a platform, called Developer Studio. The IDE(s) used for Visual C++, Visual Basic, and Visual FoxPro was also bundled with Visual Studio as part of the separate suite. Visual Studio, the most comprehensive for C# development environment (IDE), can be used to create programs for all of these platforms. In addition to writing, Visual Studio's integrated development environment (IDE) also includes features that allows to edit, debug, and build code, as well as to quickly publish an app. An integrated development environment

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(IDE) can be used for multiple facets of software development, such as program design, source code editing, and debugging. Visual Studio not only provides standard editors and debuggers, but also provides additional tools to make development tasks easier, such as compilers, code completion tools, and graphical designers. Finally, there is a streamlined version of Visual Studio that is primarily used by new developers and for educational purposes especially for student as a training module[1].

2.2.1.1 VB.Net

VB.NET is an acronym for Visual Basic.NET. It is a Microsoft-developed computer programming language and was released for the first time in 2002 to replace Visual Basic 6. The VB.NET programming language is an object-oriented language of programming. This means it supports object-oriented programming characteristics such as encapsulation, polymorphism, abstraction, and inheritance.

Due to ASP NET is built on the.NET framework, it has complete access to the.NET libraries. It is a highly productive tool for rapidly developing a variety of Web, Windows, Office, and mobile platforms using the.NET framework. The language was designed to be intuitive for both novice and advanced programmers.

And also due to the fact that VB.NET is built on the.NET framework, programs presented in the language have a high degree of reliability and scalability. With VB.NET, user can create fully object-oriented applications like those written in C++, Java, or C#. Additionally, VB.NET programs can communicate with programs written in Visual C++, Visual C#, and Visual J#. Everything in VB.NET is an object. While VB.NET is an evolution of Visual Basic 6, it is incompatible with it. If user write code in Visual Basic 6, it will not compile under Visual Basic.NET[2].

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