DEVELOPEMENT OF MODULAR VIRTUAL INSTRUMENT

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"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Power Electronic and Drives)"

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Date : MAY 2007

"I hereby declared that this report is a of my own work excepts that have been cited clearly in the references."

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Date : MAY 2007

My beloved father and mother

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ABSTRACT

The project of "Development of Modular Virtual Instrument" contains two parts which is hardware development and software development. This project consist a model that can interface with LabVIEW to measure current by replace normal ammeter and normal voltmeter. Data acquisition card measure, store, display, and analyze information collected from the hardware and transfer the data to the computer system. LabVIEW software is used to program and display the output virtually on the computer. In this project, virtual instrument is used to measure the voltage, current and power from the TNB system. In real word the traditional way to analyze the voltage are using the instruments like voltmeter and ammeter to measure current and oscilloscope to see the plot of DC voltage and current reading. But the new way of virtual instrument can be used to analyze the data. For easy understanding, virtual instruments are user defined and are programmable whereas traditional instruments have fixed functionality and are hardware controlled. The data acquisition board DAQ that acquires output signals in terms of voltage. Its serves as the communication bridge between the physical incoming signals and software installed in the personal .Then the LabVIEW code is written to communicate with the input signals via DAQ. Finally, VI of a dedicated application is developed using LabVIEW graphical programming language.

ABSTRAK

"Development of Modular Virtual Instrument" adalah projek yang mengandungi dua bahagian utama iaitu perkakasan dan perisian. Projek ini menggunakan model pengukuran arus dan voltage bagi menggantikan ammeter dan voltmmeter biasa. Manakala *Data acquisition card* pula berfungsi sebagai melakukan pengukuran, menyimpan data, membuat paparan dan menganalisis data yang diperolehi daripada perkakasan dan dipindahkan data kedalam sistem komputer. Perisian LabVIEW digunakn untuk membuat program dan memaparkan keluaran maya ke dalam sistem komputer. Bagi projek *virtual instrument* ini, ia bertujuan untuk mengukur voltan, arus dan kuasa dari bekalan TNB. Pada masa kini, kebanyakan pengukuran dilakukan secara tradisional dimana proses untuk menganalisis voltan dan arus dilakukan secara manual dengan menggunakan peralatan pengukuran ammeter dan voltmeter bagi mendapatkan bacaan, manakala bagi menganalisis data, *oscilloscope* digunakan. Tetapi melalui penggunaan *virtual instrument* sesuatu bacaan dapat diambil dan dianalisis. Untuk, mudah difahami, *virtual instrument* merupakan projek yang dibentuk dan ditentukan sendiri oleh pengguna manakala, peralatan tradisional, fungsi telah ditetapkan dan perkakasan dikawal. *Data acquisition board DAQ* pula diperlukan sebagai signal keluaran atau voltan keluaran. Selepas itu kod LabVIEW akan membuat bacaan untuk disambungkan dengan isyarat masukan melalui perantaraan *DAQ card.* Akhir sekali, virtual instrument akan memaparkan penggunaan melalui pembangunan *LabVIEW graphical programming language*.

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VI	-	Virtual Instrument
LabVIEW	-	Laboratory Virtual Instrument Engineering Workbench
NIDAQ	-	Data Acquisition
ADC	-	Anolog Digital Converter
I/O	-	Input / Output
TNB	-	Tenaga Nasional Berhad
PC	-	Personal Computer

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

1.1 Project Introduction

We take measurements with instruments. Instrumentation helps science and technology progress. Scientists and engineers around the world use instruments to observe, control, and understand the physical universe. They are used for control of devices, data storage, and data analysis. The control of instruments is increasingly changing; now, it is less dependent on instrument controls, but rely more on software control and multiple integrated instruments. Unfortunately, the graphical representation of controls and data makes it difficult for an individual with a visual impairment to independently operate laboratory instruments.

As a first step in understanding how instruments are built, consider the history of instrumentation. Instruments have always made use of widely available technology. In the 19th century, the jeweled movement of the clock was first used to build analog meters. In the 1930s, the variable capacitor, the variable resistor, and the vacuum tube from radios were used to build the first electronic instruments. Display technology from the television has contributed to modern oscilloscopes and analyzers. And nowadays, modern personal computers contribute to high-performance of computation and display capabilities at an optimal performance-to-price ratio.

Virtual instrumentation is defined as combining hardware and software with industry-standard computer technologies to create user-defined instrumentation solutions. National Instruments specializes in developing plug-in hardware and driver software for data acquisition (DAQ), IEEE 488 (GPIB), VXI, serial, and industrial communications. The driver software is the programming interface to the hardware and is maintained consistent across a wide range of platforms. Application software such as LabVIEW, LabWindows/CVI, Component Works, and Measure deliver a sophisticated display and analysis capabilities required for virtual instrumentation.

We can use virtual instrumentation to create a customized system for test, measurement, and industrial automation by combining different hardware and software components. If the system changes, we often can reuse the virtual instrument components without purchasing additional hardware or software.

1.2 Problem Statement

Normally the process of measurement is carried out by traditional processes which need a various kind of results such as the voltage, current and the other. This process can cause our productivity decrease because the process of measuring must be done by one person. By employing virtual instrumentation solutions, we can decrease capital costs, system development costs, and system maintenance costs, while improving time to market and the quality of your own products. At the same time, the other work can be done. Scientists and engineers everywhere need to measure, record, and analyze the world around them. Their environments range from analyzing the analog and digital signals of a circuit to measuring the vibration of an airplane's engine. Over the past several decades, the approach to solve these applications has evolved from the use of primitive instrumentation, such as analog meters and simple transducers, to a sophisticated architecture of today's instruments. Almost all modern instruments used for automated test systems can be categorized as either a modular instrument or a traditional instrument. This paper examines the four key components found in both traditional and modern instrumentation and discusses the benefits of these different approaches.

Except for the specialized components and circuitry found in traditional instruments, the general architecture of stand-alone instruments is very similar to that of a PC-based virtual instrument. Both require one or more microprocessors, communication ports (for example, serial and GPIB), and display capabilities, as well as data acquisition modules. What make one different from the other are their flexibility and the fact that you can modify and adapt the instrument to your particular needs. A traditional instrument might contain an integrated circuitry to perform a particular set of data processing functions; in a virtual instrument, these functions would be performed by software running on the PC processor. We can extend the set of functions easily, limited only by the power of the software used.

Depending on the particular application, the hardware we choose might include analog input or output, digital input or output, counters, timers, filters, simultaneous sampling, and waveform generation capabilities. The wide gamut of boards and hardware could include any one of these features or a combination of them.

1.3 Objective

This project produce job to take over traditional instrument by systematic instrument. In this case the modular virtual instruments are used. This instrument is produced to make circuit and graph analysis.

1.3.1 Project Objective

To achieve that objective and mission, a few criteria are defined:

1) To make a model that can interface with LabVIEW to measure current by replace normal ammeter
2) To make a model that can interface with LabVIEW to measure voltage by replace normal voltmeter.
3) To save all data into computer software by using interface with LabVIEW software.
4) To operate the instrumentation program
5) To control selected hardware
6) To analyze acquired data.
7) To display the results.

1.4 Project Scope

The scopes of this project are:

1) The Current Transducer LA 100-P or is current transformer used to convert the current signal into the voltage signal.

2) Try to get the signal information and compiled the signal into the LabVIEW using the simulation device.

1.5 Methodology Project

Project this part, this methodology is one of the important things in designing the project so that the objective will be achieved. In this project there are main parts as guideline:

1.5.1 Part one (Introduction)

For this part one, we are mentioned about the introduction, project objective, project methodology and project scope. These parts are important as reference and mission for this project.

1.5.2 Part Two (Background Study)

For background study, the topics all given to highlight are theory about this project. The information our knowledge is referring from magazine, journal, and reference books. Then, we are making a study and analysis to get early results. The background study for this project refers to research about measurement method.

1.5.3 Part Three (Hardware Design)

The measurement hardware of an instrument is responsible for performing the generation or acquisition of a specific signal. For example, the most common instrument in use today is an oscilloscope, whose measurement hardware includes an analog front end to receive, filter, and attenuate a signal and an analog-to-digital converter (ADC) to covert the signal into bits. These raw bits are then interpreted and analyzed by a processor.

Both modular and traditional oscilloscopes contain the same type of measurement hardware. This hardware dictates the key properties of an instrument, such as what measurement is performed and how accurate those measurements are. While both instrumentation approaches may include the same measurement hardware, relying on a PC-based host system to provide the other common components which can reduce the cost and complexity of these instruments.

1.5.4 Part Four (Software Design)

The role of software in instrumentation is to provide a layer of abstraction to the user that makes it easier to analyze the raw bit stream from hardware and to store instrument specific settings into the device's registers. Along with configuring the hardware, software plays a critical role in defining what measurement device is capable of performing and how the results of those measurements are presented. The main difference between the software on a traditional instrument and modular instrument is where the software is vendor-defined or user-defined.

Traditional instruments provide predefined software that is usually embedded in the firmware of the instrument. Historically, very few traditional instruments allow the user to manipulate or change this firmware, which meant that all of the capabilities of the instrument are fixed and predefined by the vendor. If additional analysis capabilities were necessary, then the user often had to purchase new software or rely on the vendor to develop additional functions.

A modular instrument system relies on user-defined software to control the hardware. User-defined software refers to custom applications that can be created in standard development environments, such as NI LabVIEW. The software of a virtual instrument usually consists of multiple layers.