"I declare that I have read this thesis and in my opinion, it is suitable in term of scope and quality for the purpose of awarding a Bachelor Degree in Electronic Engineering (Industrial Electronic)"

Signature : .....

Supervisor : EN. NORIZAN BIN MOHAMAD

Date : MARCH 25, 2005

DIGITAL OSCILLOSCOPE USING PERSONAL COMPUTER

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This Report Is Submitted In Partial Fulfillment Of Requirements For The Bachelor Degree of Electronic Engineering (Industrial Electronic)

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Kolej Universiti Teknikal Kebangsaan Malaysia

March 2005

"Hereby, I declare that the thesis entitled, Digital Oscilloscope Using Personal Computer is a result of my own research idea except for works that have been cited clearly in the references."

Signature : 

Name : SAIDATUL ASYIKIN BINTI MOHAMED

Date : MARCH 25, 2005

Special dedicated to my dearest parents , sisters and friends

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Thank you.

ABSTRACT

Digital oscilloscope is a device that will take voltage-time measurement and very important device to the college students because this device is often needed to solve the kinds of problems presented in most electronic laboratories and at-home electronic projects. Nowadays, the traditional oscilloscope was built in a big size and high cost. It can only measured and display the signal but can't save or record the data. Therefore, this project can give an alternative to user to solve the problems as an oscilloscope and output the result to a personal computer (PC). The user will interface with device via a custom designed compatible application through the parallel port direct to the computer. The custom software will present the digitized voltage measurements to the user in the form of a real-time waveform display. This device also becoming more popular and demanding nowadays for its ability to save the data or waveforms for future reference or record. It has been divided into two parts. It contains a hardware design and development which includes probe and I/O card interface circuit and also focus on programming and software development such as Visual Basic which displayed the data. This project describes the development of a low-cost, PC based digital oscilloscope

ABSTRAK

Osiloskop digital adalah sebuah peranti yang membuat pengukuran voltan-masa dan amat penting terutamanya kepada pelajar kerana peranti ini diperlukan bagi menyelesaikan masalah berkaitan elektronik. Di pasaran kini, osiloskop dibina dalam saiz yang besar dan kos tinggi. Ia juga hanya boleh mengukur dan memaparkan data tanpa menyimpan rekod tersebut. Oleh yang demikian, projek ini dihasilkan seperti sebuah osiloskop dan memaparkan keputusan keluaran pada computer peribadi (PC). Pengguna akan di antaramuka dengan peranti dengan menggunakan satu aplikasi serasi yang direka khas melalui pangkalan selari terus kepada komputer. Perisian aplikasi tersebut akan memaparkan pengukuran voltan digital kepada pengguna dalam bentuk paparan bentuk gelombang masa benar. Peranti ini juga akan menjadi popular dan amat diperlukan pada masa kini kerana keupayaannya untuk menyimpan data atau bentuk gelombang bagi tujuan rujukan pada masa akan datang atau penyimpanan. Projek ini terbahagi kepada dua bahagian. Bahagian pertama adalah rekaan dan pembangunan perkakasan termasuk prob dan litar antaramuka I/O serta mengambilkira pengaturcaraan dan pembangunan perisian seperti Visual Basic yang mana ia akan memaparkan data. Projek ini menggambarkan penghasilan sebuah osiloskop digital berasaskan komputer kos rendah.

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CHAPTER I

INTRODUCTION

1.1 Overview

The aims of developing this project, namely Digital Oscilloscope Using Personal Computer, is to provide practical experimental and learning more productive and efficient by harnessing modern technology. This project is created and developed to make works easy and smooth.

In this project, Visual Basic 6.0 has been selected as the programming language because it is user friendly. Visual Basic is simple, easy to use, read and write especially to design Microsoft Windows graphics user interface (GUI).

In this chapter will cover title and objective, scopes, project overflow and the work schedule of this project.

1.2 Objectives

The main aim of this project is to develop hardware and software to interface data. The software is developed to become simple, easy and user friendly. Therefore, the objectives of this project are to study the basic oscilloscope functionality, the concept of digital storage data and input/output interface. It is also to design a digital oscilloscope using personal computer. This device does the functions to develop a data acquisition system by using combination between hardware and software.

This project serves as a compact, low cost and complete digital measurement device that operates on the personal computer that is often needed to solve the kinds of problems presented in most electronic laboratories and at-home electronic projects. It will create a product that will be very useful to the typical college student and the electronic hobbyist

1.3 Scopes

The scopes of this project are:

a) Design a data acquisition circuit using Analog to Digital Converter (ADC).
b) Using Visual Basic 6.0 as the programming language to develop software to interface data.
c) Design a device combination of hardware and software by using parallel port.
d) Data will be recorded and graph will be plot in real time.

1.4 Organization Of The Thesis

The thesis is organized into 6 chapters namely introduction, literature review and project background, hardware development, software development, result and discussion, and lastly conclusion and future development.

Chapter 1 discusses the general idea of the project, briefly introducing the important aspects of the project and the practical usage of it. Besides that the objective and scope of the project and the organization of the thesis are presented too. Chapter 2 introduces the relevant literature review for the project. Firstly the history and background of the oscilloscope are briefly mentioned. Chapter 3 is about the hardware development of the project. Parts by part of the hardware design are discussed thoroughly here.

Then, in chapter 4 the software development of the project is discussed. The functionality and features of the software interface program are discussed in this chapter. Chapter 5 shows the results obtained from the digital oscilloscope using personal computer. The validity of the results is also proven in this section. Discussions are made based on the results obtained. Lastly, chapter 6 is a about the recommendation on new or extra features that can be added to the project to enhance its functionality and accuracy. The limitations of the project and conclusion are also discussed here. It concludes all the information in this thesis.

1.5 Project Workflow

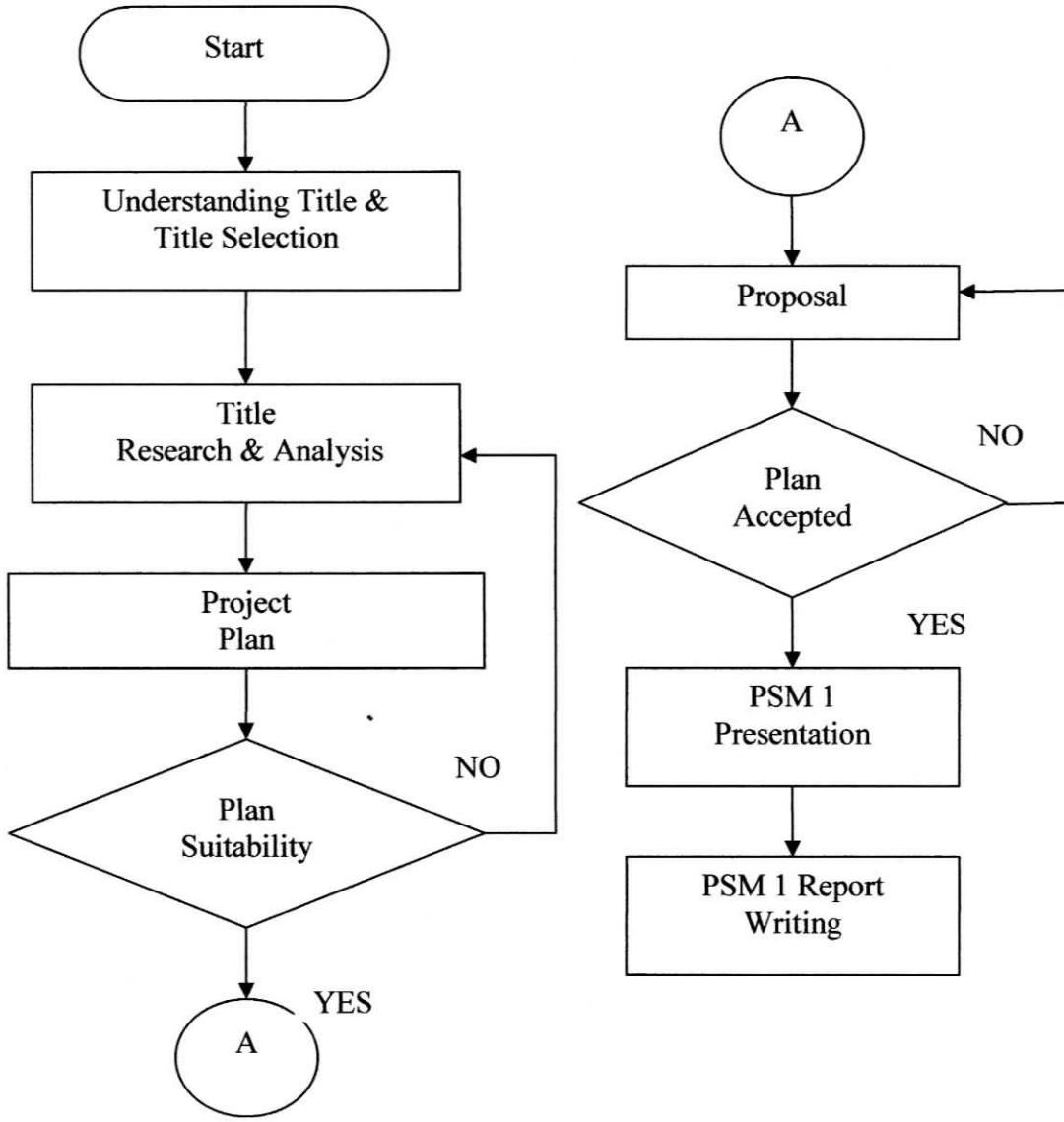

Figure 1.1: Flow chart of PSM 1

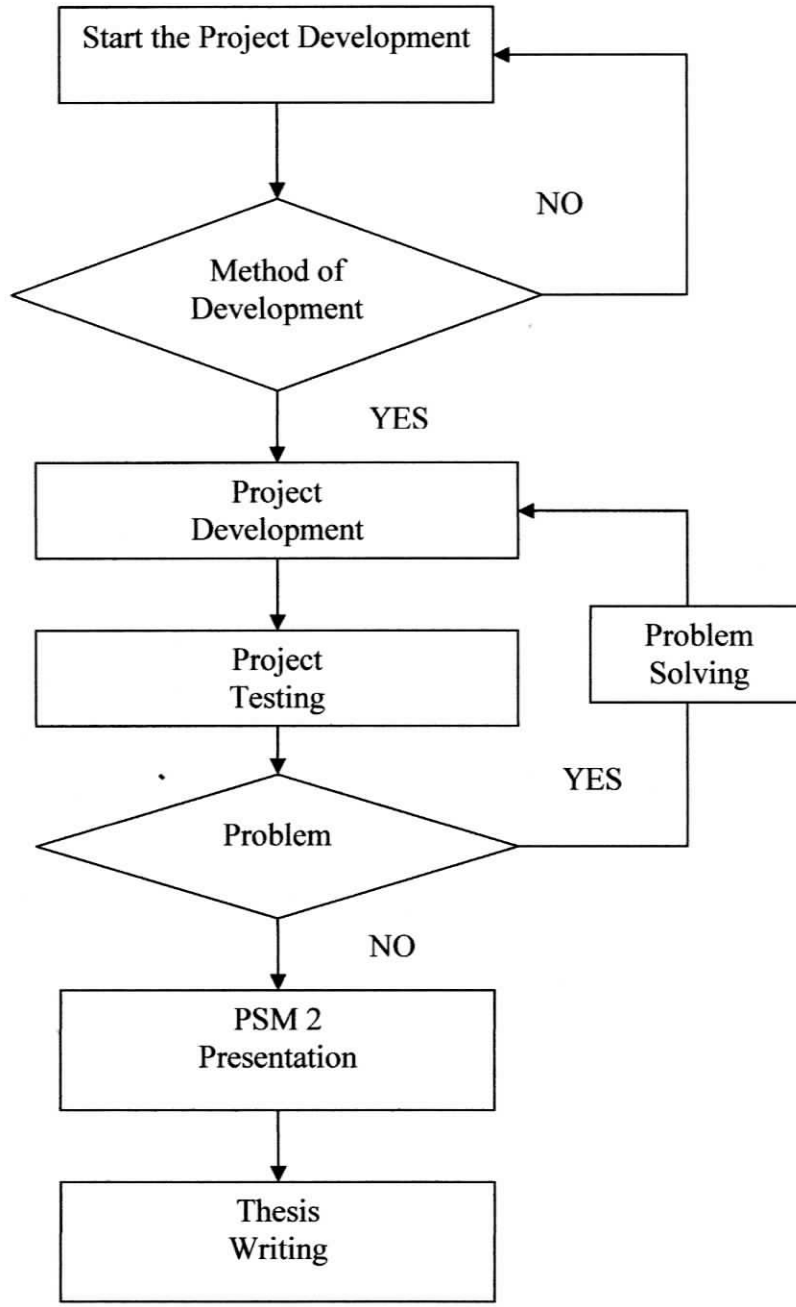

Figure 1.2: Flow chart of PSM 2

CHAPTER II

LITERATURE REVIEW AND PROJECT BACKGROUND

2.1 Overview

Progress in application of computer system to the purposes of data acquisition, digital control and communications functions has been widespread following the first time real-time minicomputer implementation for process measurement and control. Since the integration of these systems may be defined with respect to the design of their computer interfaces, it make remarkable that such designs continue to be based essentially on empirical methods and circuit considerations. However, economic and performance accountability requirements have recently prompted the search for improved interface understanding in pursuit of a more quantitative methodology.

Data acquisition in general sense is a process of collecting information from real world. Most of the real world data are not in the form that can be directly recorded by a computer. These quantities such as pressure and electrical energy must be converted to an electrical quantity to be understood by a computer. When interfacing with real world, inputs and outputs are usually analog. To deal with this, skilled is needed in both analog and digital techniques in order for a data acquisition system really meet performance criteria and still be cost-competitive.

2.2 Literature Review

2.2.1 History of oscilloscope

The cathode ray oscilloscope is an instrument designed to display the voltage variations, periodic or that are met with in electronic circuits. There are other types of oscilloscope beside those using cathode ray tubes. For example, pen recorders, ultra-violet chart recorders and XY plotters

The basic principle of oscillography is the representation, by graphical means, of a voltage that is varying. The voltage is plotted or traced out in two-dimensional Cartesian coordinates. Figure 3.1 shows the general scheme for the representation of any two related variables. Both positive and negative values of each variable can be represented. The vertical axis is called the Y axis and the horizontal, the X axis. The point where the axes cross, where both X = 0 and Y = 0, is called the 'origin'.

An oscilloscope draws its 'trace' with a moving spot of light on the screen of a cathode ray tube. The screen is approximately flat and coated on the inside with a powder that emits light where it is struck by a beam of electrons. Some oscilloscopes use an LCD display. The screen of an oscilloscope is often equipped with vertical and horizontal rulings called 'graticule'. 'Trigger' circuitry in the oscilloscope ensures that the trace shown always starts at the same point on the waveform.

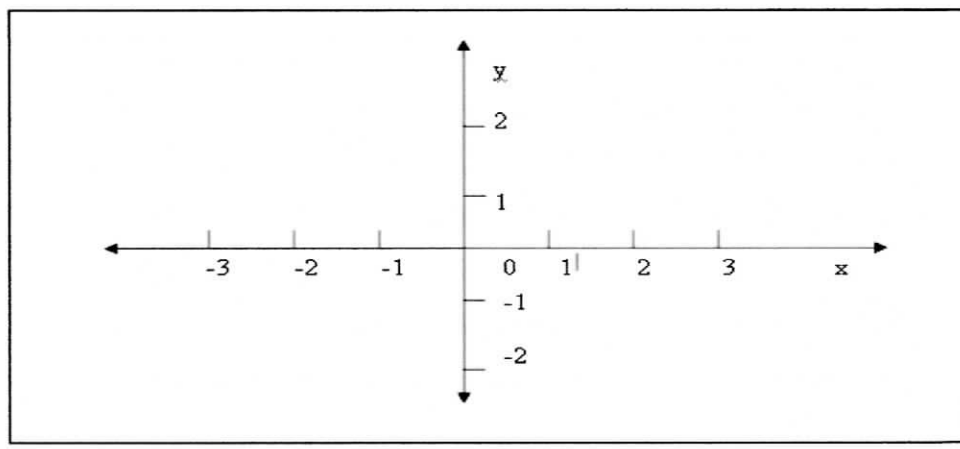

Figure 2.1: Cartesian or graphical coordinates

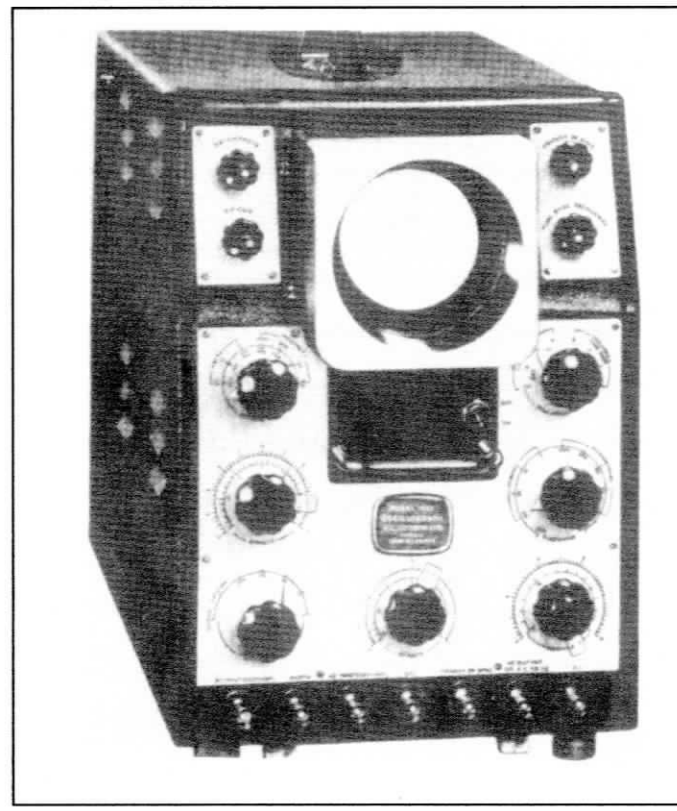

Figure 2.2: An advanced oscilloscope of the 1940s. The Cossor model 1035 Mk11A was a true dual beam oscilloscope with a maximum bandwidth of 7 MHz (Y1 amplifier), 100 kHz (Y2 amplifier) and a fastest sweep rate of 15 μs per scan, with repetitive, triggered and single-stroke operation (courtesy Cossor Electronics Ltd)

2.2.2 Sampling oscilloscope models and calibrations

The digital sampling oscilloscope is used for capturing a repetitive, very high frequency waveform and enable to clear up aliasing. The sampling oscilloscope avoids the limitations by not attempting to deal with the whole signal in real time. Instead, it takes samples of the instantaneous voltage of the input signal on successive cycles and assembles these samples to form a picture of the complete waveform. It can only operate in this way if the signal goes on repeating from cycle to cycle for as long as it takes to build up the display. Hence, the sampling oscilloscope is limited to displaying repetitive waveforms.