

DATA AND SIGNAL ACQUISITION SYSTEM

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“I hereby declare that this report is the result of my own work except for quotes as cited in the references.”

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To my beloved mom and dad

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ABSTRACT

Data and signal acquisition system used to collect information to document or analyze some phenomenon. The data collected may vary in different forms such as waveforms and power line-carrier. Although the data acquisition is very important in this modern world but it is very hard to collect and analyze different type of data in a single data and signal acquisition system and demonstrate it in an appropriate visual. Hence, a data and signal acquisition system is developed in this final year project that can display the data collected in Graphical User Interface (GUI).

The objectives of this project are to receive the data and transmit it to PC by using Bluetooth module. In this project, the Bluetooth module plays the main role to receive the data from the PIC and transmit it to PC. Besides that, a PIC16F877A was used as the ADC to converts the analog signal to digital and send the data to Bluetooth module. While the data transmitted using Bluetooth module will be monitored in PC using GUI.

ABSTRAK

'Data and signal acquisition system' digunakan untuk mengumpul untuk mendokumentasikan atau menganalisis beberapa fenomena. Data yang dikumpul mungkin berbeza dari segi bentuk, contohnya gelombang dan isyarat elektrik. Walaupun 'Data and signal acquisition system' penting di zaman moden ini, ia adalah susah untuk mengumpul dan menganalisis pelbagai jenis data dan isyarat dalam satu sistem dan mempamerkan dalam gambaran. Oleh itu, demi menyelesaikan masalah ini, satu 'data and signal acquisition system' yang mempamerkan data dan isyarat yang dikumpul dalam 'Graphical User Interface (GUI)'.

Objektif projek sajana muda ini adalah untuk menerima data dan menghantar ke komputer dengan menggunakan modul 'Bluetooth'. Di dalam projek sajana muda ini, modul 'Blueooth' memainkan peranan penting bagi menerima data dari 'PIC' dan menghantar ke komputer. Selain itu, PIC16F877A digunakan sebagai 'ADC' untuk menukar isyarat 'analog' kepada isyarat 'digital' dan menghantar ke modul 'Bluetooth'. Data yang dihantar melalui modul 'Bluetooth' akan dimonitor di komputer melalui 'GUI'.

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LIST OF ABBREVIATIONS

PIC	-	Peripheral Interface Controller
PSM	-	Project Sarjana Muda
DSP	-	Digital Signal Processing
ADC	-	Analog to Digital Convertor
DAC	-	Digital to Analog Convertor
I/O	-	Input or Output
GUI	-	Graphical User Interface
VB	-	Visual Basic
PC	-	Personal Computer
CPU	-	Central Processing Unit
UART	-	Universal Asynchronous Receiver Transmitter
EPROM	-	Erasable Programmable Read Only Memory
ICSP	-	In Circuit Serial Programming
LVP	-	Low Voltage Programming
MAC	-	Multiply Accumulate
RAM	-	Random Access Memory
ROM	-	Read Only Memory

CHAPTER 1

INTRODUCTION TO PROJECT

1.1 Introduction

Wireless system is the transfer of information over a distance without the use of electrical conductors or wire. The distances involved may be short as few meters in television remote control or very long as thousands or even millions of kilometers in radio communications. Bluetooth also included in the wireless system category in term of the information transfer.

Bluetooth is a wireless protocol utilizing short-range communications technology facilitating data transmission over short distances from fixed and/or mobile devices, creating wireless personal area networks (PANs). Bluetooth uses a radio technology called frequency hopping spread spectrum. It chops up the data being sent and transmits chunks of it on up to 75 different frequencies. [8] (Adam Prybil. 2002)

At the moment there is no device or support tool has been designed to monitor the data and signal using graphical user interface (GUI). Therefore, one model of wireless data and signal acquisition system controlled by a control system (Programmable Intelligence Computer, PIC) will be developed to monitor the data and

signal and monitored in PC using graphical user interface, developed using Visual Basic. The main aim of this project is to provide a suitable interfacing system that can monitor the data and signal using Bluetooth module.

1.2 Objectives

Following are the objectives set in this project:

- To study the characteristic of Programmable Intelligence Computer, PIC and the control system for the Bluetooth module.
- To develop a suitable PIC circuit diagram simulation to transfer the data from the signal generator to the computer. Several circuit diagram will designed and tested before the best circuit diagram is selected.
- To develop the model of the control system based on the PIC circuit diagram selection result.
- To develop a user-friendly GUI interface design

1.3 Problem Statement

At the moment, there is no support tool involves in real-time computer interfacing system that can monitor the data and signal to be conducted much more easily and more efficiently using graphical user interface (GUI). Besides that, this data and signal monitoring is usually conducted manually by collect the data and calculate the properties of the signal. Thus, a support device can be applied to facilitate the users to monitor the data and signal and to assign the amplitude, frequency, and the period of the time that the system send the details to the computer. In other words, an automatic wireless system will replace the conventional manual system.

1.4 Scopes

The scopes of the project are as follow:

1. Study on PIC16F877A to send data and signal to PC.
2. The control system is design specially to produce a user friendly GUI interface and able to receive data from the power line using the Bluetooth module and transfer the data into the GUI interface.
3. Development will be carried out until working model stage.
4. Use of IVT BlueSolei Software to interface the Bluetooth module with computer.
5. This project focuses on development of a PIC circuit diagram.
6. Use of LabVIEW to build graphical user interface (GUI) in PC.
7. Signal from function generator to test the system, Amplitude = $\pm 10V$ and Frequency = 0 – 3000Hz.
8. Focus on low frequency range and not on high frequency.
9. Data transmitted: 800 bit/sec.

1.5 Content Overview

Chapter One describes the project aim and its scope of study. In Chapter Two, there is a complete literature study on electrical as well as electronic system of a Bluetooth module. Chapter Three explains thoroughly about the method used to achieve the project objective and Chapter Four is the preliminary result obtained from the method used. Chapter 5 explains about the project description while Chapter 6 is the project process flow. The discussion of the product and the problem encountered is explained in Chapter 7. Conclusion and recommendation for future works are explained in the final chapter.

1.5.1 Work Flow Description

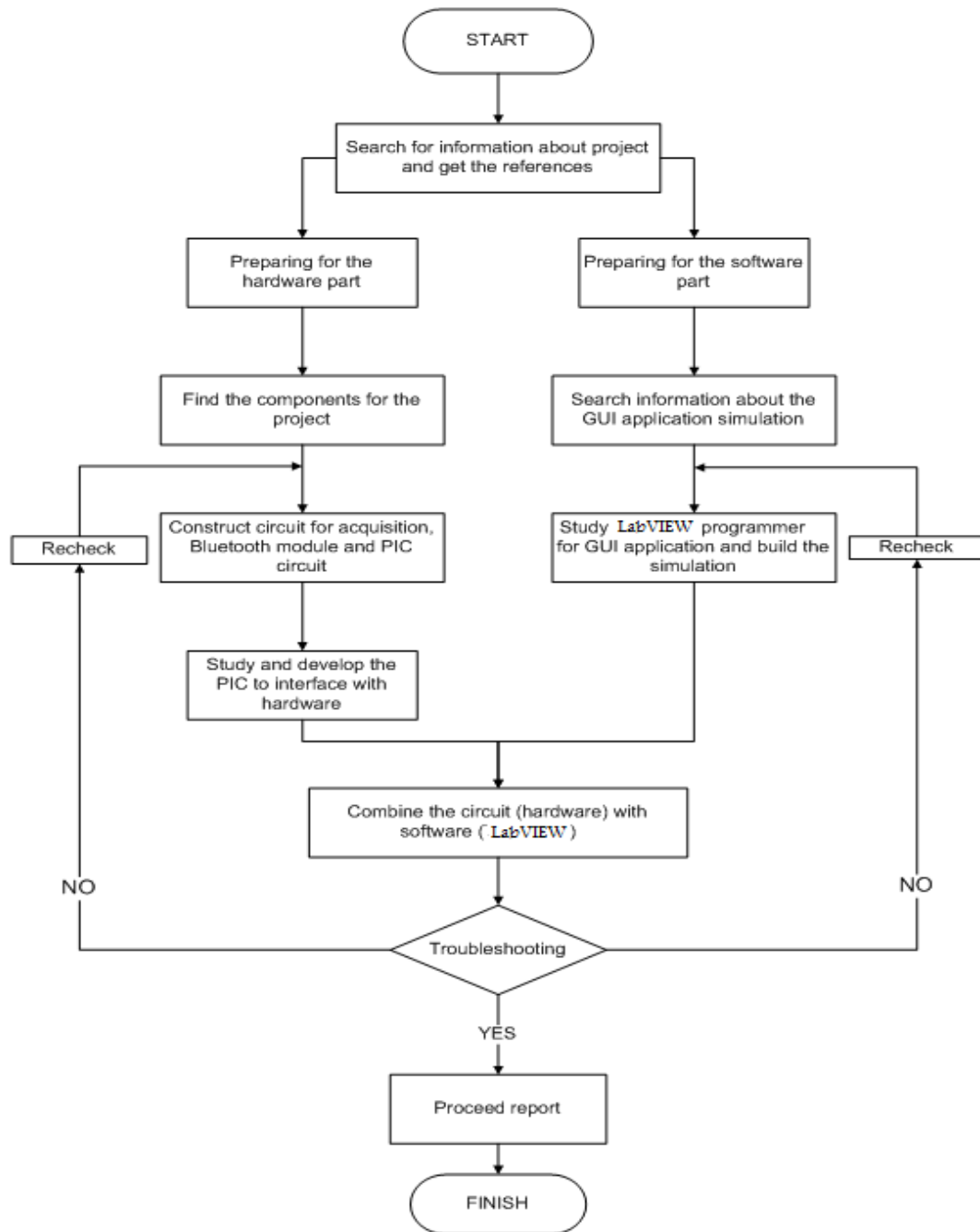


Figure 1.1: Flowchart of methodologies used in this project

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature search was performed to study, design and analysis the wireless data and signal acquisition system. It also includes the investigation of what others have done in this area. This study included the areas of electric, electronic and BlueSolei software as a guide to design the circuit for the retractor.

2.2 Data Acquisition

Data acquisition is the sampling of the real world to generate data that can be manipulated by a computer. Sometimes abbreviated DAQ or DAS, data acquisition typically involves acquisition of signals and waveforms and processing the signals to obtain desired information. The components of data acquisition systems include appropriate sensors that convert any measurement parameter to an electrical signal, which is acquired by data acquisition hardware.

Acquired data are displayed, analyzed, and stored on a computer, either using vendor supplied software, or custom displays and control can be developed using various general purpose programming languages such as BASIC, C, Fortran, Java, Lisp, Pascal. While the specialized programming languages used for data acquisition include, EPICS used to build large scale data acquisition systems, LabVIEW, which offers a graphical programming environment optimized for data acquisition and MATLAB provides a programming language but also built-in graphical tools and libraries for data acquisition and analysis. (W. R. Leo, 1994)

2.2.1 Data Acquisition System

A data acquisition system is a device designed to measure and logs some parameters. The purpose of the data acquisition system is generally the analysis of the logged data and the improvement of the object of measurements. The data acquisition system is normally electronics based, and it is made of hardware and software. The hardware part is made of sensors, cables and electronics components (among which memory is where information is stored). The software part is made of the data acquisition logic and the analysis software (and some other utilities that can be used to configure the logic or to move data from data acquisition memory to a laptop or to a mainframe computer). An example: Data logging, carried out by a data acquisition system (DAS), can be used to measure parameters such as temperature and humidity in storage facilities with perishable products; the measurement data are then stored for analysis to improve quality assurance. Another example: a data acquisition system can be placed on a race car to measure RPM and vehicle speed to analyze car's behavior once it's back to pits and improve the car setup. [13] (Wikipedia, 2006)

2.2.2 The Way Data is Acquired

Data acquisition begins with the physical phenomenon or physical property of an object to be measured. This physical property or phenomenon could be the temperature or temperature change of a room, the intensity or intensity change of a light source, the pressure inside a chamber, the force applied to an object, or many other things. An effective data acquisition system can measure all of these different properties or phenomena.

A transducer is a device that converts a physical property or phenomenon into a corresponding measurable electrical signal, such as voltage, current, change in resistance or capacitor values, etc. The ability of a data acquisition system to measure different phenomena depends on the transducers to convert the physical phenomena into signals measurable by the data acquisition hardware. Transducers are synonymous with sensors in DAQ systems. There are specific transducers for many different applications, such as measuring temperature, pressure, or fluid flow. DAQ also deploy various Signal Conditioning techniques to adequately modify various different electrical signals into voltage that can then be digitized using ADCs.

Signals may be digital or analog depending on the transducer used. Signal conditioning may be necessary if the signal from the transducer is not suitable for the DAQ hardware to be used. The signal may be amplified or deamplified, or may require filtering, or a lock-in amplifier is included to perform demodulation. Various other examples of signal conditioning might be bridge completion, providing current or voltage excitation to the sensor, isolation, linearization, etc.

Analog signals tolerate almost no cross talk and so are converted to digital data, before coming close to a PC or before traveling along long cables. For analog data to have a high signal to noise ratio, the signal needs to be very high, and sending +-10 Voltages along a fast signal path with a 50 Ohm termination requires powerful drivers. With a slightly mismatched or no termination at all, the voltage along the cable rings