ANEMOMETER: COMPUTER INTERFACING HARDWARE

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Abstract

The development of a computer-interfacing for a Digital-Propeller-Anemometer involves a few sets of instrumentation process. These processes include the process of capturing, transmitting and interfacing the data with a computer, and finally processing the data. The main objective of this paper is to design and build the RS232 terminal using PIC16F873. Hardware to RS232 interfaces for the personal computer or RS232 compatible devices. This routine converts input voltage from the circuit to speed and transmits them afterwards to the target device by using the RS232 transmission protocol. This implementation feature a computer display as visual interface. RS232 data transmission is carried out using a Visual Basic software routine.

Keywords
Computer interfacing, digital propeller anemometer, PIC16F873, RS232, Visual Basic

1.0 INTRODUCTION

This project is to design computer interfacing for the anemometer reading in meter per second as well as RS232 transmission to the RS232 target device. The appropriate software was developing in order to display the speed parameter on the personal computer. The output result of speed displayed on personal computer using interfacing unit.

1.1 Objectives

The purpose of this project was to design and develop hardware interface using easily available components that is simple to design, fabricated and programmed.

The main objectives of this project are:

- To use a PIC16F873 microcontroller as the control device for the whole system.
- To develop a program suitable for the display and analyzing the output in the computer using Visual Basic programming.

1.2 Project Overview

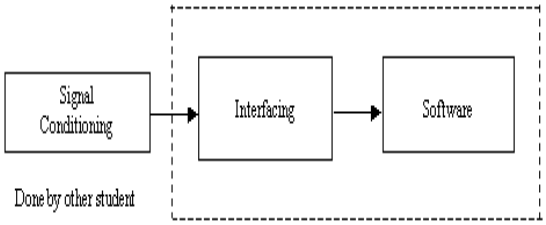


Figure 1.2: Block diagram of project progress

The project involves the development of software for the implication and interfacing circuitry and development of a program for the display. Figure 1.2 shows the block diagram of the project. A PIC16F873 microcontroller based circuit is used to control the output of signal conditioning circuit. RS232 serial is used as the interface link. The software in this project was designed to display the output signal of signal conditioning circuit via personal computer.

2.0 HARDWARE AND SOFTWARE DEVELOPMENT

2.1 Hardware and Software Requirement

The main process required in this project is divided into two:-

- Interfacing
- Display

2.1.1 Interfacing

2.1.1.1 Asynchronous communication of PIC16F873 (USART)

There are many types of Peripheral Interface Controller (PIC) in market. Each PIC has a specific number of inputs and outputs. This project is using the PIC16F873. The reason of choosing the PIC16F873 is because it has a special function called USART (Addressable Universal Synchronous Asynchronous Receiver Transmitter), which is one of the two communication ports equipped with PIC16F873. USART is also known as a Serial Communication Interface or SCI. The USART can be configured as a full duplex asynchronous system that can communicate with peripheral device such as personal computers.

In the asynchronous mode communication of USART, the RX port is used for receiving and the TX port is used for the transmission, so, it is possible to send and receive at the same time. (Full duplex)

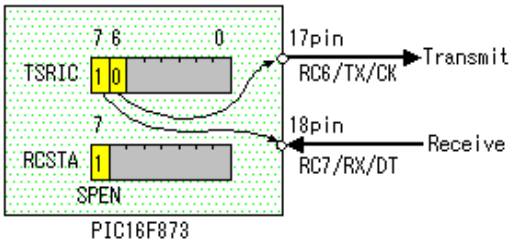


Figure 3.1.1.1: Transmit and Receive pin of PIC16F873

In the asynchronous mode, it uses RC6/TX/CK (17 pins) for the data transmission and RC7/RX/DT (18 pins) is used for the data receiving. The mode of the input/output of the TX port, the RX port must be set to the TRISC register to use a USART. Bit 6 of C port is set to output mode (0) and bit 7 is set to input mode (1). To use RC6 and RC7 as the USART port, the SPEN bit of the RCSTA register must be made "1".[1]

2.1.1.2 MPLAB IDE

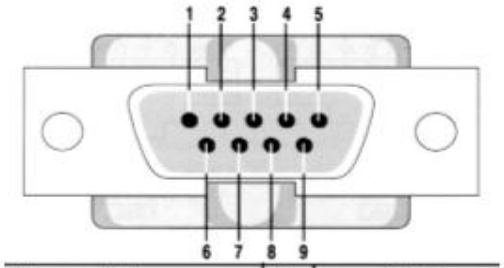
The PIC assembly language programming was developed using MPLAB IDE software. MPLAB IDE uses Integrated Development Environment IDE. The IDE provides the flexibility to develop and debug Firmware for PIC microcontroller families.

MPLAB IDE is a Windows based development platform for the Microchip Technology PIC microcontroller families and runs under Microsoft Windows operating system. MPLAB IDE offers a project manager, program text editor, a user configurable toolbar containing four predefined sets and a status bar, which communicates editing and debugging information. [2]

2.1.1.3 RS232

Serial communication links are those that utilize a single data line to transmit information. The standardization of the RS232 serial port as part of a computer system and it compatibility has led to this communication interface being use in this project to be interfaced to the computer.

The Electronic Industries Association RS232 standard was developed for serial data interface and defines the interface between the Data Terminal Equipment (DTE) and Data Communication Equipment (DCE) employing serial binary data interchange.[3] Figure 2.1.1.3 shows the serial 9 pins (PC) connector.



Pin	Signal	Pin	Signal
1	Data Carrier Detect	6	Data Set Ready
2	Received Data	7	Request to Send
3	Transmitted Data	8	Clear to Send
4	Data Terminal Ready	9	Ring Indicator
5	Signal Ground		

Figure 2.1.1.3: The serial 9 pins (PC) connector.

2.1.2 Display

Microsoft Visual Basic is good software for developing window interface; it involves fragments of Basic Code when the user performs certain operations on graphical objects. It is widely used for application program development and for prototyping.

One of members in Visual Basic is Microsoft Visual basic 6.0 Edition. . Visual Basic is used as an object oriented language and simplifies window programming. Visual Basic also supports event driven programming suited for graphical user interface. [4]

3.0 THE APPLICATION OF THE SOFTWARE AND HARDWARE

3.1 System Hardware

The hardware device is used in this project to control the whole operation**.** The hardware consists of several components, which are: DC power supply, Serial Port, RS232 Interface IC, PIC16F873. Figure 3.1 shows the schematic diagram of the hardware interface device used in this project.

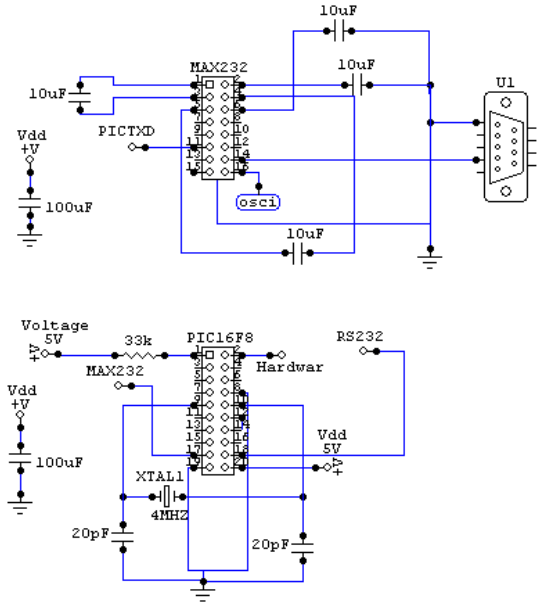


Figure 3.1: The schematic diagram of the hardware Interface device.

Basically, a range of 4.5V to 5.0V DC is fed to the hardware Interface device. This voltage will be used as the power supply for the RS232 interface IC and PIC16F873. The serial port used in the hardware interface device consists of 9 pins. This is the port that connected to the COM port of the personal computer for the data transmission. The data then will be transmitted to personal computer.

3.2 Visual Basic 6.0

In this project software development systems allow programs to be developing with assistant of special software and peripherals and later to be transferred into the application programming interface on which they will run. In this project, the develop program is running in real-time.

The interfaces and its coding had been created by using Visual Basic 6.0. The four steps in creating this project by using the Visual Basic 6.0 are:

a) Developing the flowchart
b) Creating the interface
c) Writing the code
d) Compiling a program.

4.0 RESULTS AND DISCUSSION

4.1 PIC program operation

The flow of the process involve in the program can be made clear by using a flow chart. It is possible to freely create the processing flow of the software to make the PIC work for its purpose. The steps in the construction of the PIC assembly program are:

a) The definition part of the hardware.
b) The definition part of the register files.
c) The initialization processing part.
d) The main processing part.
e) The source ending.

The main hardware interface PIC Software flowchart is shown as Figure 4.1a below. The program will start with the initialization of the hardware and RS232 port. Then the program will check the scan pattern reception flag. If Clear means scan pattern reception flag received ‘Low signal’ it will loop. If Set means scan pattern reception flag received ‘High signal’ it will go to hardware scan pattern decoding subroutine activities. At this stage, the program will detect any input on the hardware. Then the program will wait for any changing of the input at the hardware.

Then the hardware will send the input and the program will read the input. Before end the program will transmitted and displayed the input to the personal computer across RS232 serial link. Figure 4.1b shows the MABLAB IDE window

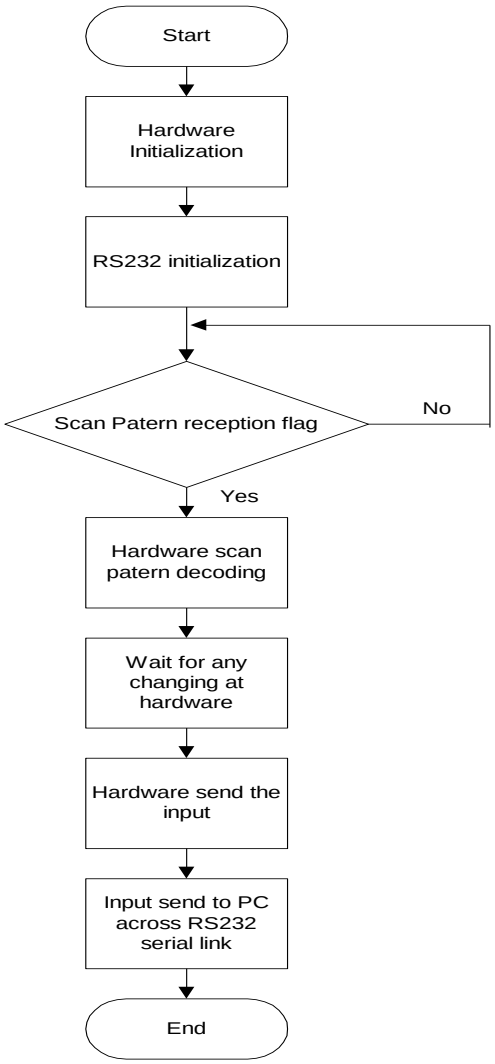


Figure 4.1a: The main Hardware Interface PIC Software flowchart.

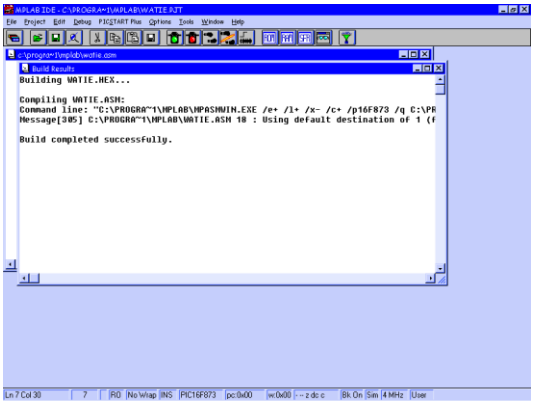


Figure 4.1b: The MPLAB IDE window

4.2 Display software operation

Figure 4.2a shows the flow chart of the display software of the program. The program will first makes a declaration of the variables. The program will set the timeout for the data to appear. Then it will detect the serial port for the transmitted signal. The programs then will check if the data has arrived or not. If the data is arrived it will convert PWM input to speed-reading in meter per second or otherwise the program will end.

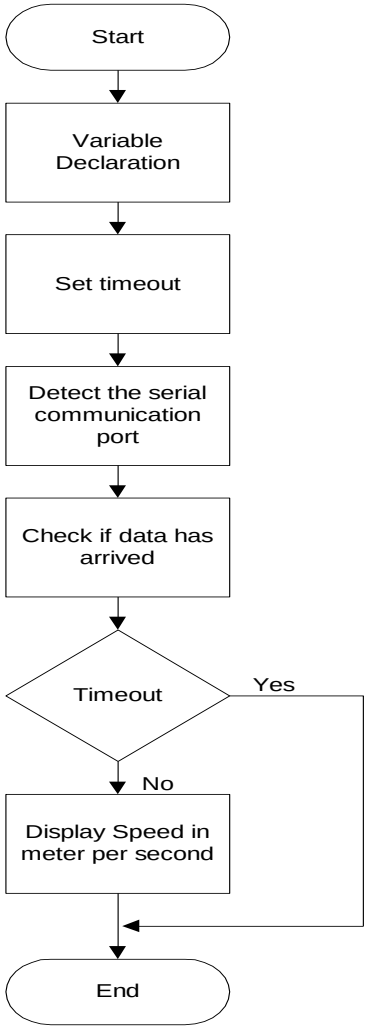


Figure 4.2a: The flowchart for the Visual Basic Display Software

The Visual Basic program will wait for the data transmissions from the interface device of the hardware. Then when the data is received it will triggered the program to operate. The result is shown as the Figure 4.2b below.

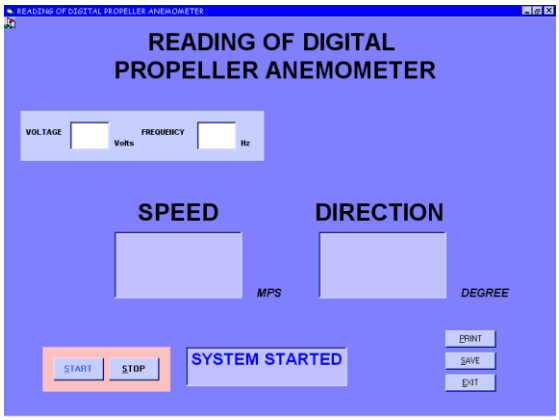


Figure 4.2b: The result of the Visual Basic programming when the microcontroller interface with computer through RS232 serial link.

5.0 CONCLUSION

The Digital Propeller Anemometer is an instrument used to measure the wind velocity. It is developed for purpose of studies; to study how the physical signal can be interfaced with the computer. For this purpose the software is developed, where Visual Basic is used as a language. The result of the speed is visualized on the screen of computer.

A few process of trial and error is done especially in developing the interface circuit terminal and the software. The advantage of this project is that it is using PIC microcontroller, which is multipurpose, multifunctional and can be reprogrammable.

Through the understanding of Hardware Interface concept, they will enable them to relate it with the real world and responsible for this matter.

6.0 FUTURE DEVELOPMENT

In the future development of this project, several options can be considered. This project can be developed by adding the program for displaying the direction of wind. This project also can be developed by link the program with other software such as Excel for graph plotting purpose.

Serial communications link are those that utilize a single data line to transmit information. The advantage of this method is the savings in wiring and interface circuitry while the disadvantage is the time taken to transmit a massage in sequence, bit by bit. Alternatively, parallel transmission is faster but requires more wiring and interfaces.[5]

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