© IJCIRAS | ISSN (O) - 2581-5334
August 2019 | Vol. 2 Issue. 3

PC AND PIC BASED ELECTRONIC DEVICES CONTROLLER USING SERIAL COMMUNICATION

Hnin Ngwe Yee Pwint[1], Thae Thae Ei Aung[2], Thiri Kywe[3]

[1]*Lecturer, Department of Electronic Engineering, Technological University (Meiktila), Myanmar*
[2]*Lecturer, Department of Electronic Engineering, Technological University (Meiktila), Myanmar*
[3]*Assistance Professor, Department of Electronic Engineering, Technological University (Meiktila), Myanmar*

Abstract

Serial communication is that the most commonly used to send data between data processing devices and other peripheral devices. In general, communication means interchange of data between individuals through written documents, verbal words, audio and video lessons. Personal computer or mobile device runs on serial protocol system. The protocol is the secure and reliable form of communication having a set of rules addressed by the source. In embedded system, serial communication is the way of transferring information using various methods in the type of serial digital binary. Some of the most widely used interface types for the data transfer are RS-232, RS-485, 12C, SPI.etc. In this system, serial communication using PIC16F876A is the process of sending data one bit at a time for controlling the electronic devices. The PIC are widely used in many household an industrial electronics devices. This system is mainly used PIC to control the electronic devices with PC by using RS232 connector and MAX232 IC.

Keyword: PIC16F876A, Serial Communication, RS232 (DB9) Connector, MAX232 IC

1.INTRODUCTION

In serial communication, transmitting and receiving information are in the type of binary pulses form. In other words, binary one represents a logic HIGH or 5Volts, and zero represents a logic LOW or 0 Volts. Serial communication will take several forms with respect to the type of data transmission mode. The data transmission modes are classified as simplex, half-duplex, and full-duplex. There will be a source and destination for each transmission mode. It is taken by processing the Universal Asynchronous Receiver Transmitter (UART) feature within the PIC microcontroller. UART could be a serial communication interface that is employed for sending and receiving information.

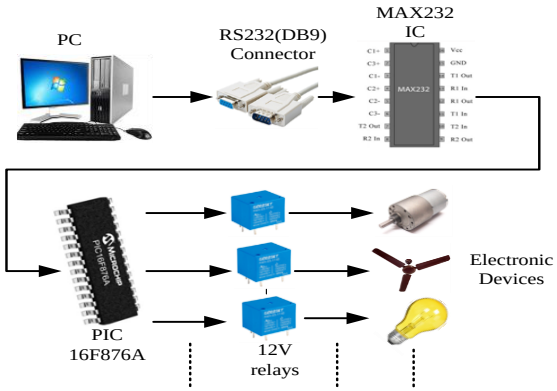

Figure 1. Block Diagram of the PC and PIC Based Electronic Devices Controller

The components of this system can be divided into three main sections as shown in figure 1. The three main sections are data input section, data processing section and output section. The data input section is the PC. The PC controls the whole system by using the Visual Interface software. The PC controls the electronic motors, bulbs and fans by sending the data to the PIC. The PC connects to the data processing section by using RS232 (DB9) connector. The data processing session includes MAX232 IC and PIC microcontroller. MAX232 IC is a level converter which convert the +12V digital pulses coming from PC into 5v which fed to the PIC microcontroller and vice versa.

2. MAJOR COMPONENTS OF THE SYSTEM

Major components used in this system are:

- PIC16F876A
- MAX232 IC
- RS232(DB9) Connector
- 12V Relay
- PC

The MAX232 IC is an interface between PC and PIC. MAX232 IC is connected to the PC with DB9 connector. In this system, the main controller is PIC. The PIC performs the switch direction and subsequent relay triggering. It receives the signals from MAX232 IC and extract the commands send to the relay control circuits. The output section includes relay control circuit, motors, bulbs and fan. The relays control circuit controls the electronic devices by receiving signal from the PIC.

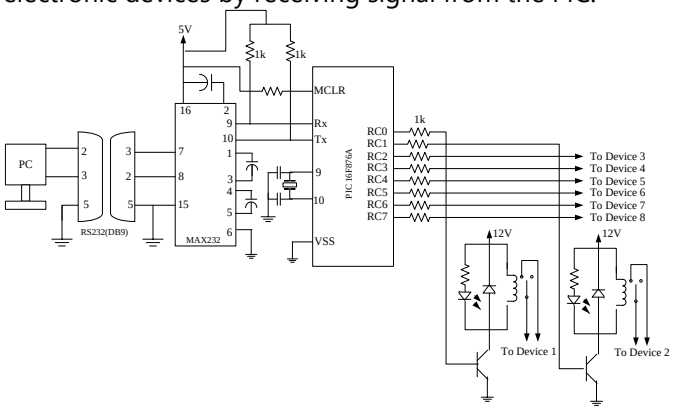

Figure 2.Overall Circuit Diagram of the System

In order to make the communication between PC and PIC, a female DB9 connector is used and whose male part is connected to the PC. Unlike the UART the voltage levels of RS232 protocol are HIGH=+12V and LOW=-12V. In order to use the RS232 protocol, it needs a level converter. IC MAX232 level converter will convert the ±12V coming from PC into 5V which can be fed to the controller and vice versa. Figure 2 shows the overall circuit diagram of the PC and PIC based electronic devices controller using serial communication. RB2 and RB1 pins of the microcontroller are connected to the T2IN and R2OUT pins of the IC MAX232 respectively. Similarly, the T2OUT and R2IN pins of MAX232 are connected to the DB9 pins 3 (TX) and 2 (RX) respectively. Pin 5 of the DB9 connector is grounded. A virtual terminal is connected to the RX and TX pins of the microcontroller to display the transmitting and receiving data.

3. ELECTRONIC DEVICES CONTROL PROCESS

PC and PIC based electronic devices control steps can easily be understood by the algorithm below. Figure 3 shows the system flow chart of the electronic devices control process.

Input: Setting the key one to eight for controlling the output devices and key nine for Emergency stop

Output: Controlling the electronic devices

Step 1: Power offer to the circuit

Step 2: Begin the serial communication

Step 3: Check the key pressed

Step 4: If the key one pressed, device one changed from the OFF state to ON state and return to the step three

Step 5: If the key one repeat pressed, device one changed the OFF state and return to the step three

Step 6: If the key nine pressed, all devices are OFF and return to the step three

Step 7: End the system process

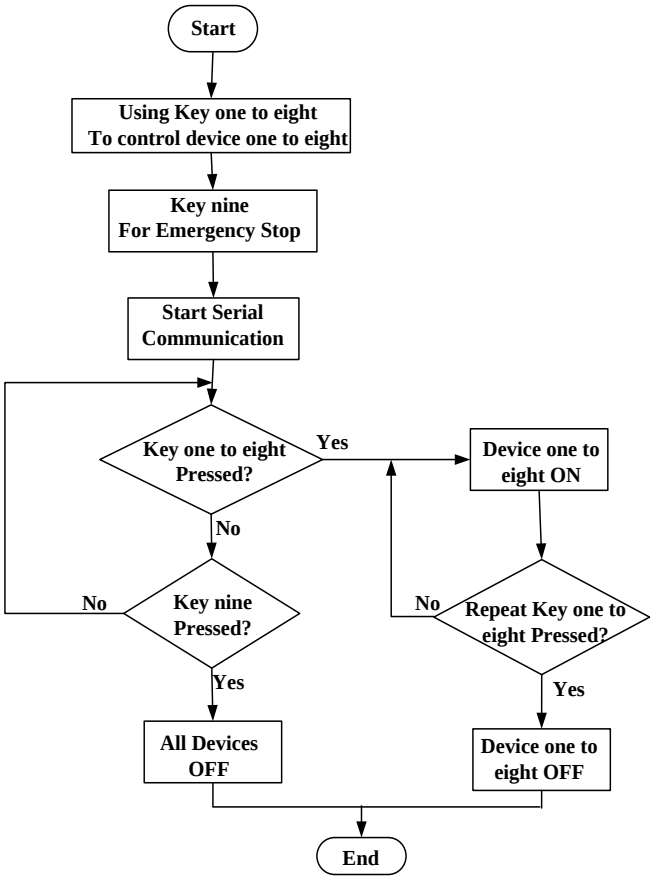

Figure 3.Flow Chart of the System

4.SERIAL COMMUNICATION

Unlike parallel communication, where several bits are sending at one time, serial communication is a process of transmitting data bit by bit. In this system, serially communicate a PC with a PIC microcontroller. Figure 4 shows the serial communication between two peripheral devices. In addition, the use of a communication component UART present within the microcontroller.

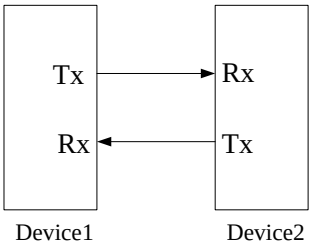

Figure 4.Serial Communication between two devices

4.1. Serial and Parallel Transfer

Two ways of serial communication and parallel communication are used in computers for data transferring. In serial communication, a single wire is needed to transfer n bits data from a transmitting device to a receiving device. In parallel communication, n wires are needed to transfer n bits of data. Serial mode is used to transfer data to greater distances and parallel only works for short distances. Since additional hardware is needed in parallel communication mode, hence, serial communication is preferred. In data transmission, if data can both be transmitted and received, it is a duplex transmission. In compare, a simplex transmission only sends data from one device to the other such as from computer to printer. Duplex transmission can be half or full-duplex depending upon whether the data transfer is simultaneous or not. If data is transmitted one way at a time, then it is half duplex. If data can go both ways at the same time then it is full duplex. PIC microcontroller includes a full-duplex, serial mode of communication.

4.2. Data Transfer Rate – Baud Rate

In serial data communication, the rate of data is known as bits per second (bps). But it is usually used baud rate. This is because baud rate is a modern terminology and is defined as the number of signal changes per second. In modems, sometimes a signal change of signal transfers several bits of data. So there is small difference between bit rate (bps) and baud rate.

4.3. Different Serial Communication Protocols

In data communication, different protocols are used for efficient transfer of data between different devices. Some of the serial protocols are RS232, Ethernet, I2C, I2S, PCI, PCI Express and USB etc. In this system, the RS232 standard protocol is used.

4.4. PC Serial Port and Microcontrollers Serial Port

This system of serial communication is used by a microcontroller. It is referred to as TTL serial (transistor-transistor logic). At a TTL level, the serial communication will always remain between the limits of 0V and VCC, which is often 5V or 3.3V. A MAX232 IC is that the most widely used to interface between the two devices. Most modern computers are not equipped with a serial port. So it uses a USB to RS232 convertor to give them serial communication capability. The Voltage levels of RS232 are different from UART of a microcontroller, so it is also need a voltage level translator like MAX232 in between RX and TX of PC and Microcontroller. Figure 5 shows the USB to RS232 communication cable.

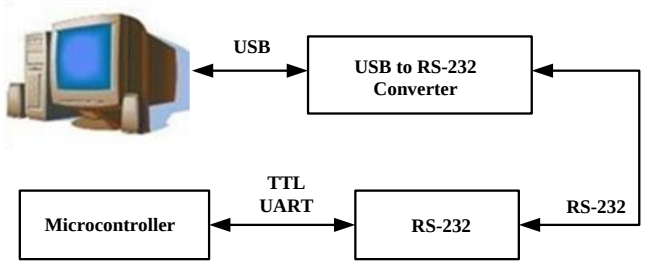

Figure 5.USB to RS232 Communication Cable

5.SOFTWARE TOOLS

By using dedicated serial port monitor software, get the ability to thoroughly test a serial port

5.1. Serial Communicator

This software able to easily to read, record and display data transmitted through any real or virtual serial port

available in computer system. Figure 6 shows the serial communicator software for PC.

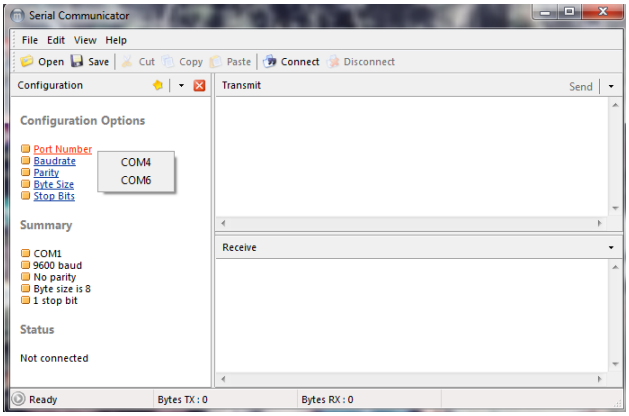

Figure 6.Serial Communicator Software

5.2. Virtual Terminal

In Proteus software, the virtual terminal tool is used to know the data output from RS232 serial port. In addition, it is also used to send the data to interface device. A virtual terminal is a special software package that emulates a physical COM interface in software, which allows adding serial ports to the PC without using additional physical hardware. A virtual COM port is a solution if there's a lack of real serial ports in the system. Figure 7 shows the virtual terminal edit box in software system.

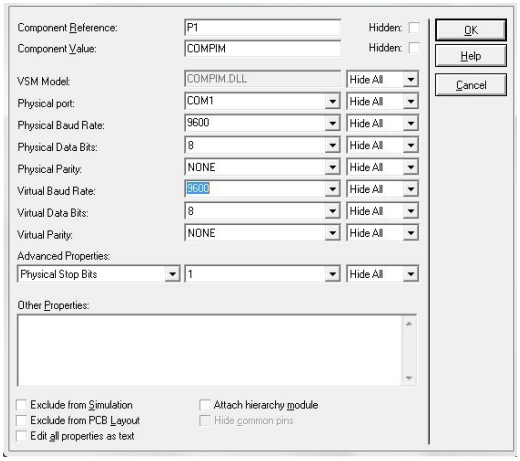

Figure 7.Virtual Terminal Edit Box

6. SIMULATION AND RESULT ANALYSIS

This system is analyzing the PC and PIC based electronic devices controller. This is the serial communication system by controlling via PC to the PIC microcontroller 16F876A. In this system, Proteus software is used to simulate the circuit design because this is very easily to design and simulate any circuits instead of using other software's. The overall circuit design in Proteus is shown below. If the key one, two, and seven pressed from PC, the output results of the system are shown in figure 8, 9 and 10.

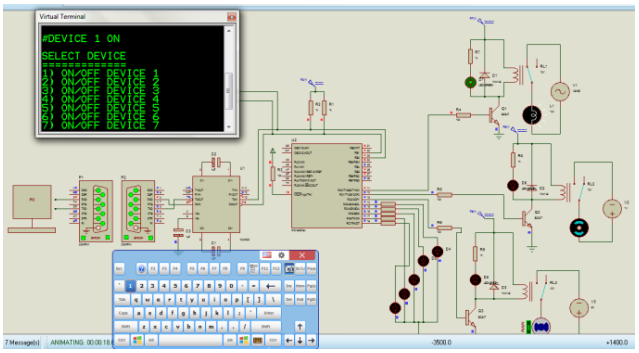

Figure 8.ON State for Electronic Device One

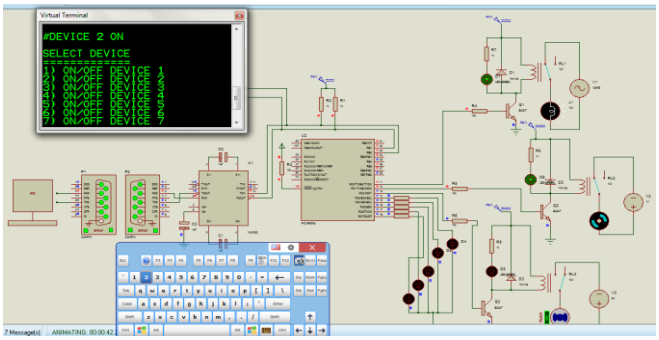

Figure 9.ON State for Electronic Device Two

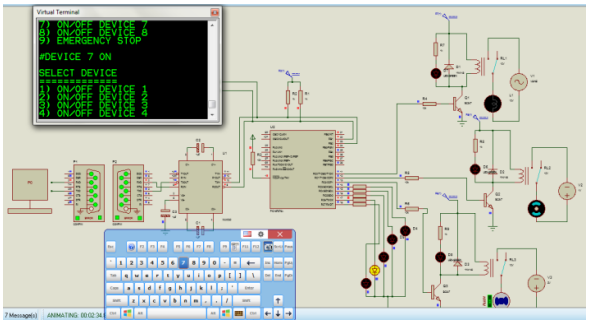

Figure 10.ON State for Electronic Device Seven

If the key one to eight pressed from PC, the output result of the system is shown in figure 11 and pressed key 9 from PC, the output result of the system is shown in figure 12.

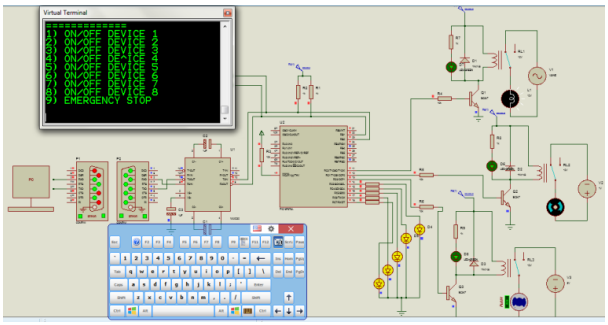

Figure 11.ON State for All Devices

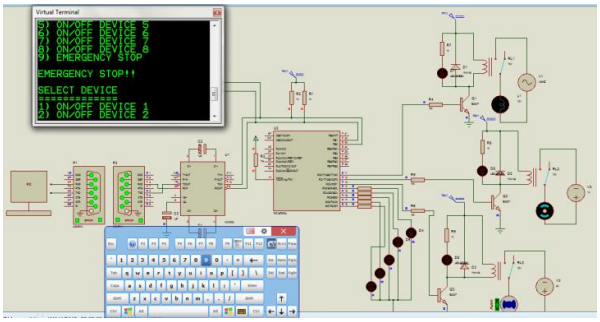

Figure 12.Emergency Stop

7.CONCLUSION AND DISCUSSIONS

In this system, the architecture used for introduce electronic devices controlling computer technology. The control process of many devices was successfully carried out by using serial communication via PC to PIC microcontroller. In this system, PIC 16F876A and MAX232 are used to control the electronic device with a PC. Using PIC in this system is more low cost than the other programmable devices such as Arduino and Resbery Pi. This system can be used in many applications such as guest house, hotel and industries.

REFERENCES

[1] http://topelectronicpro.blogspot.com/2016/04/pc-based-equipment-controller.html?m=1
[2] https://freevirtualserialports.com/
[3] https://www.elprocus.com/pic-microcontroller programming-using-c-language/
[4] http://user.ece.utexas.edu/valvano/Volume1/EBook/C11_SerialInterface.htm
[5] https://www.allaboutcircuits.com/projects/
[6] http://. en.m.wikipedia.org>>wiki>pic16f876a
[7] 'PC Controlled Home Appliances' from Laxmi Soni et at Int. Journal of Engineering Research and Applications ISSN: 2248-9622,Vol.4,Issue 5(Version 1), May 2014,pp.51-53
[8] 'Implementation of Serial Communication between Host Computer and PLC based on Host Link Protocol' from International Journal of Advancements in Computing Technology(IJACT) Volume4, Number18, October,2012, doi:10.4156/ijact.vol4.issue18.10