

# AN ANALYTICAL STUDY OF INFRA RED (IR) SIGNALS USED BY A SONY REMOTE CONTROL

Aye Chan Ko, Khin Kyu Kyu  
Computer University, Kalay, Myanmar  
ayechanko.ucsm@gmail.com, khinkyu28@gmail.com

## ABSTRACT

Now a day, people more use several wireless devices and wireless control system in houses and offices. Users control the computer with this device especially in Windows Media Player or Jet Audio running on the computer such as: Play, Stop, Pause, Forward, Backward, Next, Previous, Volume increase, Volume decrease and etc. Then to open the notepad and calculator. This system used SonyTV's remote control, Sony VCR's remote control or etc. This article tries to get some idea how to interface IR remote controllers to computer. This system also uses PIC16F84A for Digital Signal Processor in Digital Signal Processing System. This system is implemented by VB.Net for window programming and PICBasic for PIC microcontroller.

## 1. INTRODUCTION

As the use of wireless system is growing day by day; wireless mobile systems, wireless network systems, wireless control system such as TV, Satellites, CD Player and other electronic devices, remote controls are the major overwhelming perspectives of today's world. The operating system these days are suited to these requirements with, for example IR remote control, Computers Serial Port and dotNET frameworks.

## 2. DIGITAL SIGNAL PROCESSING

Digital Signal Processing (DSP) is one of the most powerful technologies that will shape science and engineering in the twenty-first century. Suppose

users attach an analog-to-digital converter to a computer, and then use it to acquire a chunk of real world data. Digital signal processing is concerned with the representation of the signals by a sequence of numbers or symbols and the processing of these signals. Digital signal processing and analog signal processing are subfields of signal processing. DSP includes subfields like: audio and speech signal processing, sonar and radar signal processing, sensor array processing, spectral estimation, statistical signal processing, digital image processing, signal processing for communications, biomedical signal processing, seismic data processing, etc.

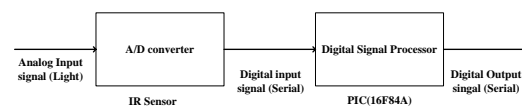


Figure 1. Block Diagram of a Digital Signal Processor with PIC16F84A

The signals are functions of a continuous variable such as time or space, and usually take on values in continuous range. DSP provides an alternative method for processing the analog signal. DSP to perform the processing digitally is a need for an interface between the analog signal and the digital processor. The digital signal processor may be a large programmable digital computer or a small microprocessor programmed to perform the desired operations on the input signal.

## 3. REMOTE CONTROL IR SIGNALS

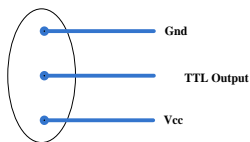
The light waves are modulated with a 40 KHz carrier frequency, so for transmission or reception of the signal, the appropriate demodulation and modulation must take place. The demodulated signal itself has a basic frequency which varies from manufacturer to manufacturer, but must not

necessarily be exclusive to one make. Therefore, there is also a signal address, identifying the target device before an instruction is sent. In itself, this is quite simple, but there are a couple of other signal variations which this paper has identified in writing the capture software. One is what that have called 'hi/lo bias', that is the difference in length between signal highs and lows, and the second is the 'repeat' factor, i.e. how many times the signal is repeated. Some controllers repeat every signal, others do not.

This paper has tried to allow for exact reproduction of the input signal, and a bit of experimenting has shown for example, that a repeating signal is in fact a bit more reliable on a device expecting that, but produces strange results on one not expecting them [3].

### 3.1 Infrared Receiver Module

The standard infrared detector module (one of those 3 pin devices) as the main input.



**Figure2.**Infrared Receiver

The infrared remote control receiver is a miniaturized receiver for infrared remote control and IR data transmission. It has PIN diode and preamplifier assembled on lead frame. The demodulated output signal can directly be decoded by a microprocessor. The main benefit is the operation with high data rates and long distances.

Infrared Remote Control Receiver's Features

- Photo detector and preamplifier in one package
- Internal band filter for PCM frequency
- Internal shielding against electrical field disturbance
- TTL and CMOS compatibility
- Output active low
- Small size package

Application

- AV instruments such as Audio, TV, VCR, CD, DVD, MD etc

- Home appliances such as Air conditioner, Fan etc
- The other equipments with wireless remote control
- CATV set top boxes
- Multi-media Equipment
- Sensors and light barrier systems for long distances

IR Receiver Codes

- Best works:RC6 Code, Rcm Code, Sony 15bit Code
- Also suitable for :Gruding Code, Nec code, Rc5 Code, R-2000
- Not recommended for: Rcs-80 Code, High Data Rate Code [4].

### 3.2 Remote Control IR Communication

The data link layer is implemented by using binary pulses. Some of the common encoding standards are Pulse coded, Space Coded, and Shift coded. In addition to this headers are used to initiate a transmission. Pulse coded used by Sony remote control. The network layer is implemented by dividing the code into two parts. These are Address and Command. Address specifies the target device and Command specifies the command to be sent to the device. When the remote control transmits the signal, each packet has 12 bits and a header. The first 7 bits represent the address (remote control). The last 5 bits represent the command (remote control's function) [5].

## 4. SERIAL PORT

The serial port is a workhouse of PC communications. The PCs and many microcontrollers have a component called a UART (universal asynchronous receiver and transmitter) that handles most of the details of sending and receiving serial. In PCs, the operating system and programming languages include support for programming serial links without having to understand every detail of the UART's architecture. To open a link, the application selects a data rate and other settings and enables communications at the desired port. To send a byte, the application writes the byte to the transmit buffer of the selected port, and the UART

sends the data , bit by bit, in the requested format, adding the Stop, Start and Parity bits as needed. In a similar way, received bytes are automatically stored in a buffer. The UART can trigger an interrupt to notify the CPU, and thus the application, of incoming data and other RS-232 (Recommended Standard 232) is a standard for serial binary data signals connecting between a DTE(Data Terminal Equipment) and a DCE (Data Circuit-terminating Equipment). It is commonly used in computer serial ports [1].

### 5. PIC MICROCONTROLLER

Microcontroller is essentially an inexpensive single-chip computer. Single chip means the entire computer system lies within the confines of a silver of silicon encapsulated inside the plastic housing of an integrated circuit. The microcontroller contains a CPU (central processing unit), RAM (random access memory), ROM (read only memory), I/O(input/output) lines, serial and parallel ports, timers, and sometimes other built-in peripherals such as analog-to-digital (A/D) and digital-to-analog(D/A).

The key feature, however, is the microcontroller's capability of uploading, storing and running a program. So, microcontroller is also called a computer on a chip. Being inexpensive single-chip computers, microcontrollers are easy to embed into a larger electronic circuit designs. Then ability to store and run unique programs makes them extremely versatile. Microcontrollers are incorporated in consumer electronics and are responsible for the "intelligence" in these smart electronic devices [2].

#### 5.1. PIC16F84A

The PIC16F84A microcontroller belongs to the mid-range family of the PIC micro microcontroller devices. PIC16F84A microcontroller is Harvard architecture. It is flash memory. In this type, microcontroller's memory is divided into program memory and data memory. This IC is appropriate for repeated writing and deleting program. The program memory contains 1K words, which translates to 1024 instructions since each 14-bit program memory word is the same width as each

device instructions. The data memory (RAM) contains 68bytes. Data EEPROM is 64 bytes [6].

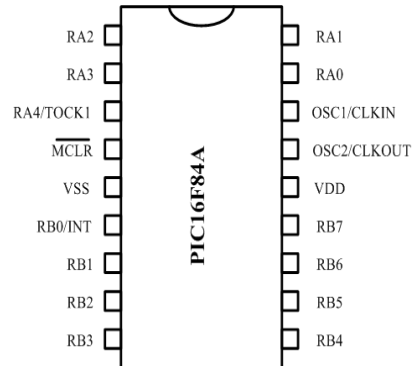


Figure3.Pin Diagram of PIC16F84A

#### High Performance RISC CPU Features:

- Only 35 single word instructions to learn
- All instructions single-cycle except for program branches which are two-cycle
- Operating speed: DC - 20 MHz clock input  
DC - 200 ns instruction cycle
- 1024 words of program memory
- 68 bytes of Data RAM
- 64 bytes of Data EEPROM
- 14-bit wide instruction words
- 8-bit wide data bytes
- 15 Special Function Hardware registers
- Eight-level deep hardware stack
- Direct, indirect and relative addressing modes
- Four interrupt sources:
  - External RB0/INT pin
  - TMR0 timer overflow
  - PORTB<7:4> interrupt-on-change
  - Data EEPROM write complete

### 6. CONCEPTS OF THE SYSTEM

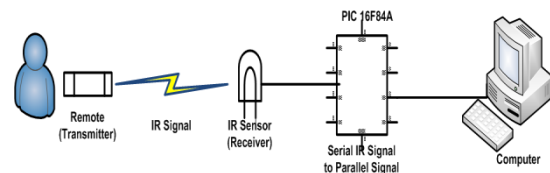


Figure4.Overview of the System

A serial infrared transmitter (SIT) capable of generating the infrared codes used by most current equipment that incorporates an infrared remote control. It is operated by a computer through an asynchronous communications port.

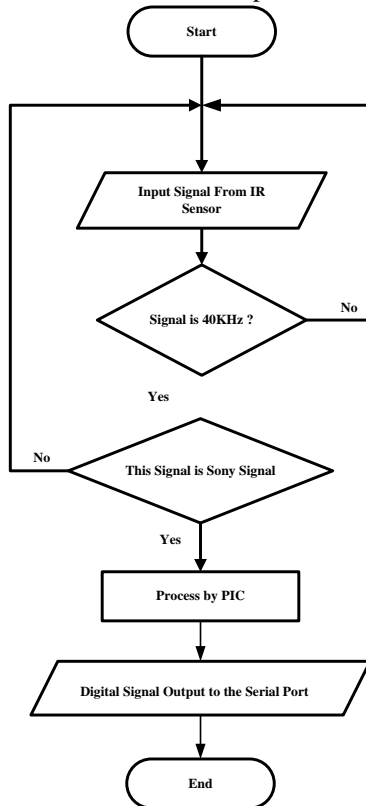


Figure 5. Flow Chart of PIC Program

Driver software for a computer with such a port can use the SIT to issue commands to remote-controlled equipment, and can thus act as a Sony infrared remote control. In figure 5 shows for PIC program of this system.

Since most current equipment uses a 40 KHz carrier, this is not serious problem. Also, the device does not record the output of remote controls. In figure 6 shows for Windows based program of the system. In figure 7, PIC uses two outputs and one input. Two outputs are implemented with TRISA registers (RA0) for LED display, TRISB registers (RB0) for computer's serial port. One input is implemented with TRISB register (RB7) for IR signal from IR remote sensor.

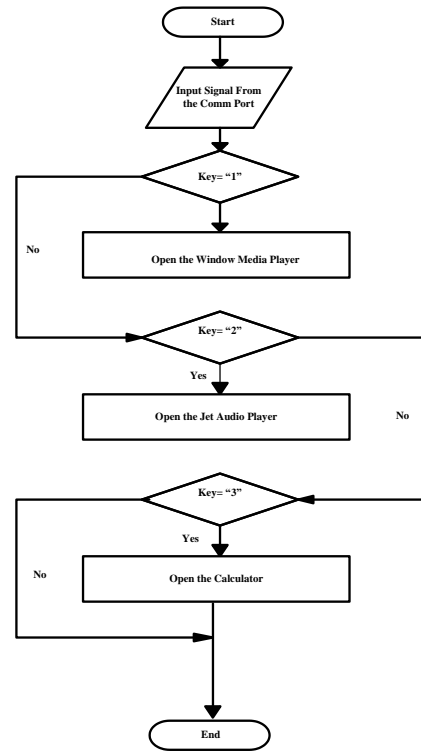


Figure 6. Flow Chart of Window Based Program

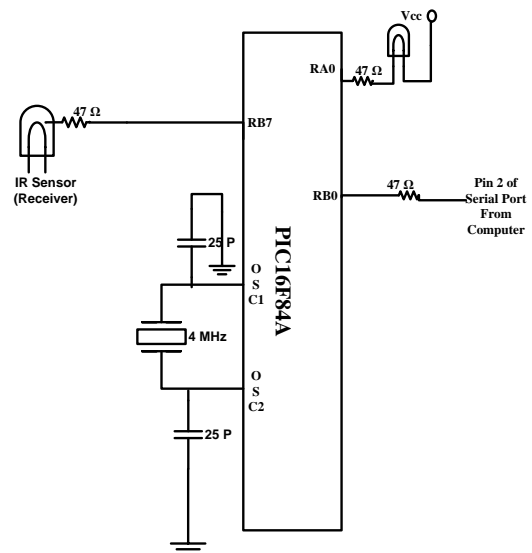
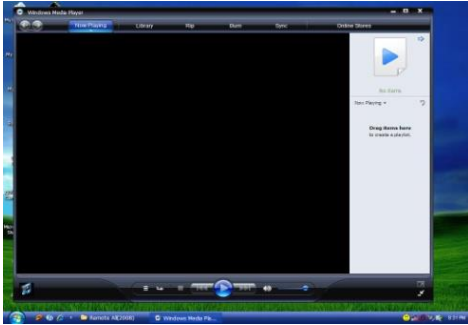


Figure 7. Complete Circuit Diagram of the System

The major limitation in application of the SIT is that it can only produce one carrier frequency.

## 7. IMPLEMENTATION OF WINDOW BASED PROGRAM RUNNING

When running window based application, if user presses the “1” key of Sony’s TV remote control, Windows Media Player will open.



**Figure8.**Open Windows Media Player

If user presses the “2” key of Sony’s TV remote control, Jet Audio will open.

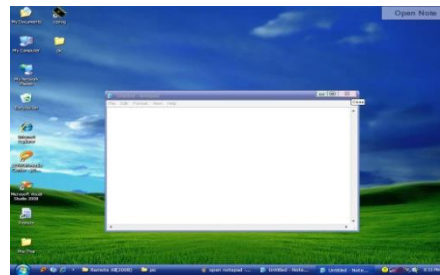


**Figure9.**Open Jet Audio Player

If user presses the “3” key of Sony’s TV remote control, Calculator will open. If user presses the “4” key of Sony’s TV remote control, Notepad will open. If user presses the “Play” key of Sony’s VCR remote control, Jet Audio or Windows Media Player will play. If user presses the “Pause” key of Sony’s VCR remote control, Jet Audio or Windows Media Player will pause track. If user presses the “Vol+” key of Sony’s VCR remote control, Jet Audio or Windows Media Player will increase volume. If user presses the “Vol-” key of Sony’s VCR remote control, Jet Audio or Windows Media Player will decrease volume.



**Figure 10** Open Calculator



**Figure 11** Open Notepad

If user presses the “CH+” key of Sony’s VCR remote control, Jet Audio or Windows Media Player will play Next track. If user presses the “CH-” key of Sony’s VCR remote control, Jet Audio or Windows Media Player will play previous track.

## 8. CONCLUSION

In this paper, this system trends to develop controlling devices from anywhere by the Infrared Remote Control. So, I have come up with some ideas to control applications in Operating System by using computer system, PIC, IR sensor and Sony Remote Control. In this system, this software can be used in Windows 7, Windows Vista, Windows 2003, Windows 2000, Windows XP and Windows Me, but not use in other operating system. This system’s circuit must only uses serial port. When the system uses Sony Infrared Signal Processing coding, user must use only Sony remote control. The platform independent languages, such as JAVA, should also be used to implement the system for further analysis. By so means, the further system will fit with the any Operating

System. By the further extension, the system communication will use USB connection and will also use any Remote control.

#### **REFERENCES**

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[5] <http://www.best-microcontroller-projects.com>

[6] [www.microchip.com](http://www.microchip.com)