

Interfacing a Microcontroller based Remote Controller System with a Personal Computer (PC)

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Abstract— This With the rapid technological advances, an increasing number of computer users begin to realize that constantly Operating the computer sitting in front of it could not match with certain application like an educational or multimedia teaching mode or in a conference environment. Although there are some wireless mouse, keyboard and remote control devices in the market, they are not well enough to meet all the necessity. Here a design is proposed whereby using a simple remote of RC-5 protocol the whole computer system functions like opening and closing folders or files, opening media player and doing its operations, pressing any key from keyboard etc. can be done from a distance except typing and multiplexing operations. An integrated Infrared Receiver is used to receive the infrared signal from the remote control handset, and send a bit stream to the 8 bit Microcontroller AT89C2051. The Details of the switch pressed was sent to the PC through its serial port. In the PC, Visual Basic (VB) was used to control the Personal Computer (PC) through the windows Application Programming Interface (API) functions. Therefore, this paper presents the design and implementation of a low-cost electronic circuit based on Microcontroller which is used to interface the remote and the computer, and also describes the windows application developed to control the computer.

Keywords—Visual Basic (VB); PC Control; Signal Decoder; RC-5 Protocol; Microcontroller (MCU)

I. INTRODUCTION

The convenience of selecting TV channels and then pointing the same remote to computer to control the whole system, a controller is needed with some software and hardware implementation. The proposed design makes the remote usable to control a computer using the remote that assuage the consumption of time and increases the effectiveness in educational environment and also increases comfort of everyday life. Again it is an important device for the experts physically unable to move but needs PC for different tasks.

An integrated Infrared Receiver (IR) is used to receive the infrared signal from the remote control handset. The 8 bit Microcontroller AT89C2051 unit (MCU) is used to control the whole operation. And this IR receiver sends a bit stream to the microcontroller unit (MCU). Because of the wide availability of cheap remote controls, the RC-5 protocol from Philips used to decode the bit stream by using the program, which was written on the Read Only Memory (ROM) of the Microcontroller. The code segments are flashed on the ROM area of the Microcontroller using a universal loader. The Flash memory is a type of EEPROM (Electrically erasable programmable ROM). The Details of the switch pressed sends to the PC through its serial port and visual basic used to control the Computer through windows Application Programming Interface (API) functions. The user can set the remote key and the task to be performed by using the application. This design is useful for presenters and teachers

in multimedia teaching environment and for the people physically unable to move but needs to use PC and also for everyone as an important technological amenity.

II. RELATED WORKS

The infrared remote control is one of the most widely-used means of control in recent time. However, the current computer control only includes several simple operational functions but not the control of whole computer system. Qadeer et al. [1] designed a Bluetooth enabled remote control system to control home appliances which can also be used as a pointer while presenting slides. Tan et al. [2] describes a universal remote controller (URC) that is able to control different devices like electronic appliances such as televisions, video cassette recorders and audio systems at one time. This work interfaces the universal remote controller and a personal computer (PC) to develop multimedia database applications on a PC to retrieve desired video clips on a video cassette tape and play them on a TV using the universal remote controller. Rudrappa et al. [3] uses RC5 protocol to create a remote controlled environment to address every device with a unique id. XiLin et al. [7] presented the remote control system for computer and describes the IR encoding, decoding and have developed an application to control the PC. They focused on the multimedia teaching mode. But their software interface is not much user friendly. Also they have used the NEC protocol of remote. But these works not focuses on controlling the functions of a PC with a remote using RC-5 protocol. Considering these, the design

shown here aims to control the whole computer system using a single remote and a low cost electronic circuit.

III. HARDWARE IMPLEMENTATION

A. Signal Encoding

The RC-5 protocol uses 5 bit address and 6 bit length command Bi-phase Manchester coding at a Carrier frequency of 36kHz and a Constant bit time of 1.778ms (64 cycles of 36 kHz). A typical pulse train of an RC-5 message [9] is shown in Fig. 1. The first two pulses are the start pulses, and are both logical "1". The start bits must be high. Each bit may be logic zero or one depending on the RC5 estimation technique. According to RC5 protocol if the first half of a bit interval is low and rest half is high then it is in level 1 and level 0 for inverse.

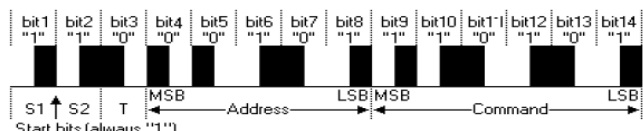


Fig. 1 Frame format of RC-5 protocol

The 3rd bit is a toggle bit. This bit is inverted every time a remote key is released and pressed again. In this way the receiver can distinguish between a key that remains down, or is pressed repeatedly. The next 5 bits represents the IR device address, followed by a 6 bits command. Both address and command bits sent with MSB first. An RC-5 message consists of a total of 14 bits, which adds up to total pulse duration of 25ms. As long as a key remains down the message will be repeatedly sent every 114ms bit interval. The toggle bit will retain the same logical level during these repeated pulses.

B. The IR Receiver Module

IR receiver has three pins in which two pins are for +5v supply and ground while the third pin is for data output.

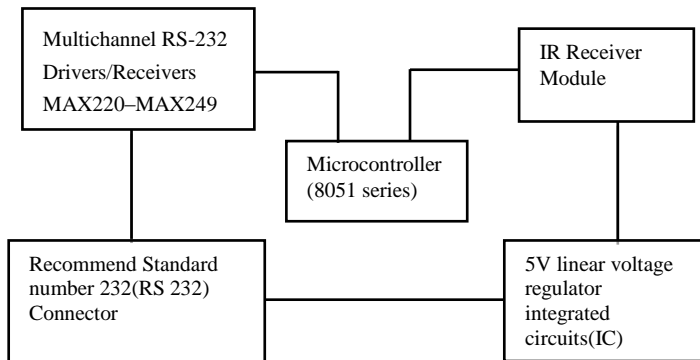


Fig. 2 Block Diagram of Electronic Circuit part of PC Remote Controller

It is a sensor which senses the presence of IR (Infra-Red) of a specific IR frequency (30 to 40 kHz) and gives pulses with the presence or absence of infrared signal. When there is no infrared remote control signal, the level of the

integrated IR receiver is high. On the other hand, the level turns to be low when the signals are received [7]. The integrated IR receivers are suitable for all kinds of remote controlling and data transferring of the infrared rays. The block diagram of the electronic circuit is shown in fig. 2.

C. Signal Decoding

The main part of the hardware is a signal decoder to obtain the transmitted data from the bit stream to serve the desired task. A microcontroller of 8051 series (AT89C2051) acts as a signal decoder which is programmed with decoding code of RC5 protocol shown in fig. 3. This code operates the microcontroller to search for the corresponding bit sequence of the protocol. The integrated infrared receiver in the IR receiver section initially detects a high-level in the presence of infrared signal. If there is no IR signal the receiver will turn to high-level. For the interrupt program of MCU, measures on anti-interference through identification of the cited codes are used [10]. In this code interference in some situations can be resolved effectively because when the cited codes cannot keep the high level for long, the program would give up sampling. The MCU program begins with an infinite loop and as soon as a falling edge is detected, the running program will be interrupted and microcontroller will turn to execute interrupt instructions [12].

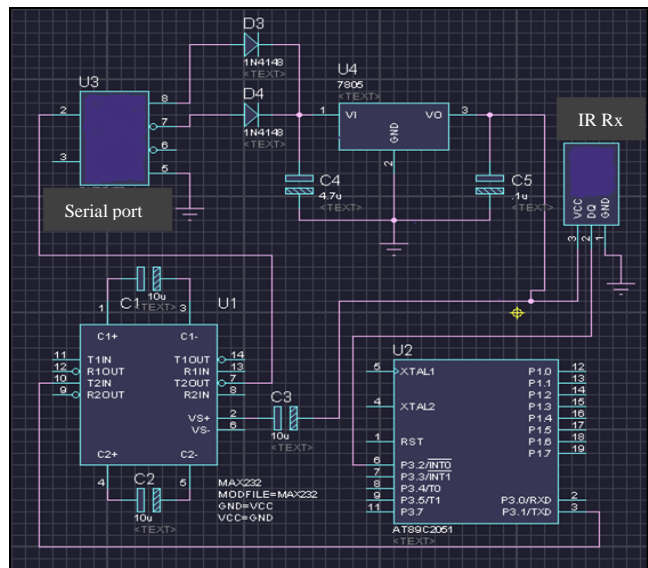


Fig. 3 Schematic Diagram of PC Remote Controller

After decoding the received bit stream the decoder sends it to computer (PC) through the serial port. At first the decoded data is passed through a driver MAX 232 which typically converts the RX, TX, CTS and RTS signals. MAX 232 converts the data levels to standard 5V TTL levels and finally sends it to the pc. The block diagram of the complete system design is shown in Fig. 4.

TABLE I
EXPERIMENTALLY MEASURED RESULT IN SOME IMPORTANT POINT OF THE ELECTRONIC CIRCUIT

Measurands	Measured Value
Input Current	8.9mA
Input Power	42.98mW
Output of regulator IC	4.88 V
Output current of Regulator IC	15.3mA
IR receiver output voltage before receiving signal	4.83V
IR receiver output voltage after receiving signal	4.26V

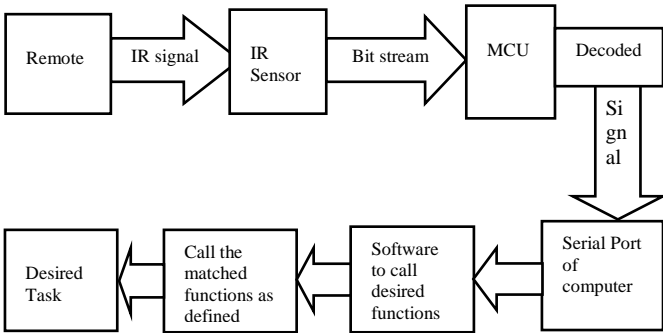


Fig. 4 Block diagram of the complete PC remote controller system

IV. SOFTWARE IMPLEMENTATION

A. Communication of MCU and PC

The Microsoft Communications Control component facilitates the serial communication between microcontroller and PC. In order to use the Comms component the files MSCOMM16.OCX (for a 16-bit module) or MSCOMM32.OCX (for a 32-bit module) must be present in the WINDOWSSYSTEM directory. The class name is MSComm. To receive the Key code through the MSCOMM component for the Com port control Microsoft Visual Basic 6.0 is used. Basically there are two methods, polling the port and responding to communications events for MSComm control to receive data from the serial port [9]. By firing the OnComm() event the MSComm control will tell when data is there in the serial port. Implementation of The process through which computer will receive the decoded remote signal [9] is explained as follows:

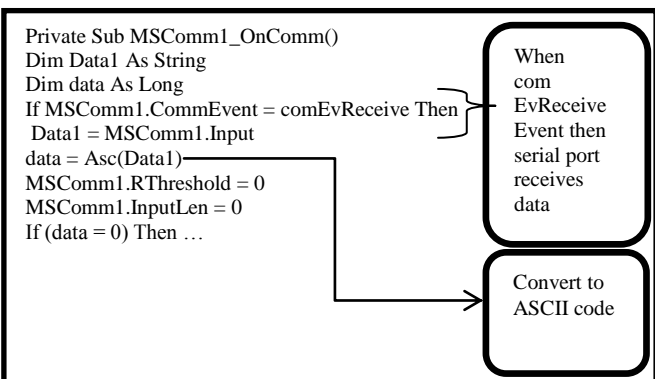


Fig. 5 Implementation of serial communication between MCU and PC

When the OnComm() event is fired the value of the CommEvent property is checked to see what exactly happened. The CommEvent property contains a different value for each different kind of communication event occurs [9]. The comEvReceive constant is fired when data is available in the buffer. And then the input from MSComm is taken into data1. The Asc function converts the first character in a string to ANSI code, and returns the result. The RThreshold=0 property tells the MSComm control not to fire the comEvReceive event when there is one bytes available in the buffer.

B. Applications Design

To design an application in visual basic environment, different forms are needed for different type of task and then link between forms are build. Fig. 6 explains the basic approach of software design in VB development environment. For example, if in the main window of software interface key 4 is selected by user for opening notepad. Firstly using serial port computer will receive data=4. As the variable [task=frmmain.Combo7.text] 'task' will go to the main function. In the main function [combo7.text=combo2.text]. Using the combo box control of visual basic [combo2.text=notepad] is taken by the user. In the decoding section now the value of 'task' is received as key. And then it is compared whether if key is notepad then simply call notepad and as a result notepad will open.

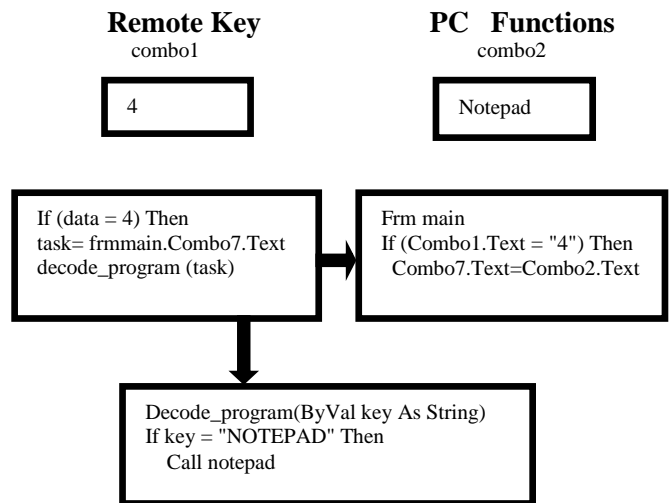


Fig. 6 Procedure of the software design showing necessary links among different forms

In the similar manner after getting this key code of the Remote control the program compare the key code with the code present in the program and if they are equal then the corresponding function was done. The main window of the software interface is shown in Fig. 7.

V. EXPERIMENT OF CONTROL

To control the PC using the system designed Firstly the electronic circuit should be connected to the serial port of the computer. Secondly executing the application the circuit receives power and from the main window user may choose the remote key number and desired function. Command box will record the information and then controlling the PC can be effectively done using the remote.

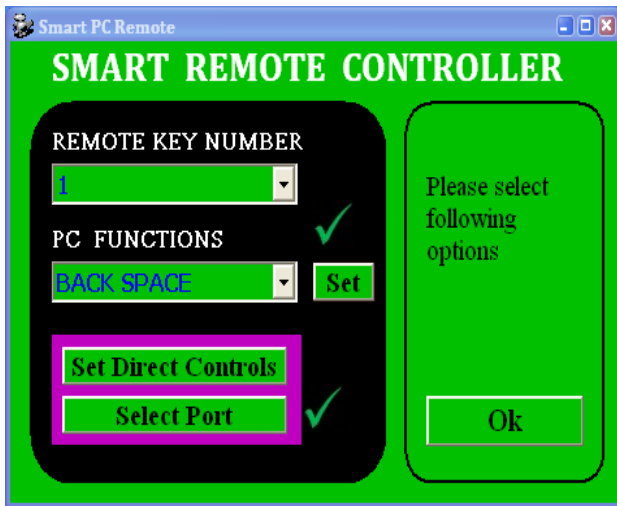


Fig. 7 Software interface of the remote control system

VI. FUTURE IMPROVEMENTS

The complete design has two different part i.e. hardware and software. Future improvements will include a combination of the two parts in a single device. That will need a memory device with the hardware and while connecting the hardware it will automatically activate the software. The designed system works only with the remote using RC-5 protocol. Moderation of the work in a generalized form so that it can be used with remotes that use any other protocol will be another important development. Including multiplexing operation that needs two or more keys of the keyboard will be amelioration with this scheme.

VII. CONCLUSIONS

In this paper the design of a remote control system to control a Personal Computer is presented. In this design the power is taken from the desktop, as it is not more than 50mW, so it will not hamper anything of the Computer. The software section is very user friendly. And of course the complete system is an important improvement of the present remote control system.

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