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## A Computer Control System for Home Appliances

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*Abstract* - In this paper, we present a system to control home appliances from a computer. The system is designed for controlling the ON/OFF mode of different home appliances such as light, fan, TV, air-condition and so on. The appliances are connected to a computer through a programmed PIC16F73 microcontroller. An USB interface is used to connect the microcontroller with a computer. The program for the PIC16F73 has been written in micro C language. All the commands are carried out from a software layout running on a computer to control the home appliances.

*Keywords* : home appliance, microcontroller, computer control.

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# A Computer Control System for Home Appliances

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## I. INTRODUCTION

Home automation systems or smart home technologies are systems and devices that can control elements of home environment such as lights, fans, air conditioners, television sets, electronic doors, security cameras, audio/visual equipment, computer systems etc. Home automation focuses more on comfort. There are many different types of home automation systems available. These systems are typically designed and purchased for different purposes. In fact, one of the major problems of these systems is that these are neither interoperable nor interconnected. House hold appliances can be controlled from a centralized control unit in a typical home automation system. For the most commercially available home automation systems, these appliances usually have to be specially designed to be compatible with each other and with the control unit.

Most commercially available home automation systems are all-in-one solutions which require that all controllable appliances are from the same company, or must be approved as compatible with said company's system [1]. Moreover these systems normally come with a proprietary, dedicated device which acts as the control center. To control the system from multiple locations, additional control devices must be purchased. These complex systems usually need to be integrated when the building is constructed and must be planned in advance. They are also difficult to upgrade or replace once installed. The overall investment adds up considerably and is financially infeasible in most cases [2]. These drawbacks hinder the popularity of such systems. There are some home automation systems

has been implemented, some of which use internet to control home appliances [3-4], some use mobile phones [5-7], some use parallel ports [8], but all of these are costly and hard to implement.

The objective of the proposed system is to offer a low-cost solution for a home automation system that overcomes the above drawbacks. The system provides basic control of appliances at a fraction of the cost of commercially available systems.

The rest of this paper is organized as follows. In section 2, we introduce the design overview of our proposed system. In section 3, software layout to control home appliances from a computer is illustrated. Hardware implementation is presented in section 4, and finally we conclude this paper in section 5.

## II. DESIGN OVERVIEW

The design demonstrates a system that allows one to control home appliances and turn on or off any appliance that is connected to a computer. The appliances are connected to the computer via a microcontroller. The power supply for each appliance is wired through an electromechanical relay. A number of relays are used depending on the number of appliances to be controlled. All the relays are controlled by a microcontroller. The microcontroller is connected to the computer via a USB to RS232 Converter. In Fig 1. We show the block diagram of our proposed system and Fig 2 shows the flowchart.

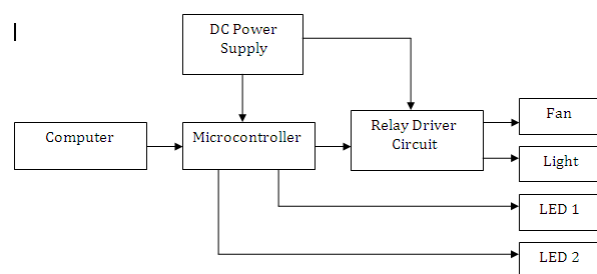


Figure 1 : Block Diagram of our designed system

Initially, all the switches are in the off state. When the ON button is clicked in the software interface to turn on the desired device, the software converts the ON command into hex code then sends the value to USB port address. It sends logic 1 (3.5-5V) to the microcontroller through RS232 converter. Then the microcontroller sends a 1 to the transistor. It will activate the transistor used to energize the relay. Inside a relay,

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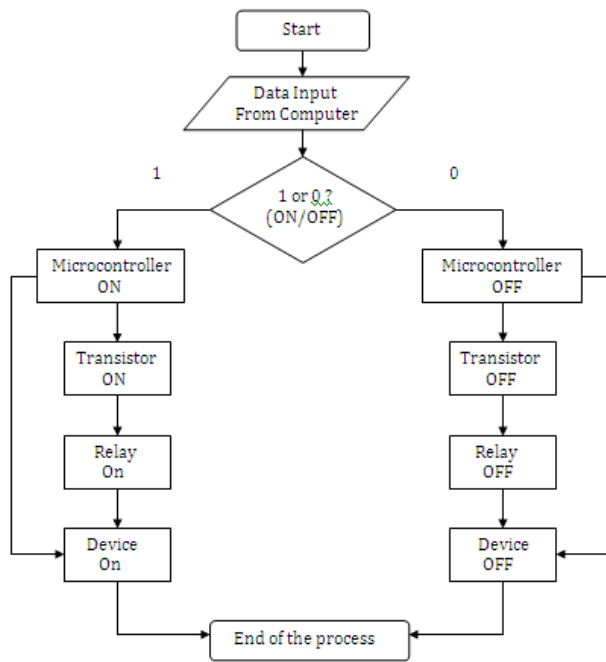


Figure 2 : The Flow chart of the designed system

there is an inductor (a wire coil), when energized with an electric pulse, will generate a magnetic field. The second part of a relay is a system of metallic arms, which make up the physical contact of the switch. When the relay is on, or an electric pulse is sent to the relay, the swing or switching arm of the relay moves to another contact of the relay (The relay we used has two contacts). The arm moves as the generated magnetic field pulls the swinging arm toward the inductor (or wire coil). And hence the AC circuit is completed and the electrical appliance is turned on.

When the OFF button is clicked to turn off a device, the software converts the OFF command into hex code then sends the value to USB port address. It sends logic 0 (0-1.5V) to the microcontroller through the RS232 converter. Then the microcontroller sends a 0 to the transistor. It will deactivate the transistor used to energize the relay. So the arm of the relay is swing back to another position, which makes the path of the current flow open. And hence electrical appliance is turned off. The terminal input of each appliances is wired across the Common and Normally Open terminals of the relays, thus the power to the appliances is switched on or off depending on whether the relay is active or not.

### III. SOFTWARE INTERFACE

The layout of the software used for controlling various home appliances is shown in Fig. 3. As an experimental basis; we have connected one light, one fan and two LEDs to our system which is shown in Fig 3. At First, a port number is set in the setCommPort field of the layout to activate connection between computer and microcontroller. If the connection is successful then we are able to control the appliances

from the computer .Each device can be controlled either as an on or off mode by pressing on or off button on the layout. A red button showing the indication that the light is on and the black button showing off. Although we have shown only four devices but any number of devices can be controlled from a computer with a slight modification in our designed system.

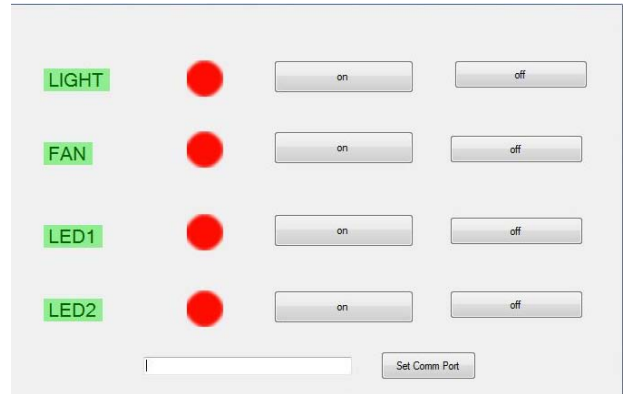


Figure 3 : Software layout

### IV. HARDWARE IMPLEMENTATION

The microcontroller used is a PIC16F73 manufactured by Microchip Technology Inc. The microcontroller is powered with +5V through the USB connection to a PC. A crystal oscillator is used for the functioning of the microcontroller. The microcontroller communicates with the computer using serial communication via an USB-to-Serial bridge. A RS232 USB-to-Serial Converter is used based on the Prolific PL2303 chip. It accepts 0 to +5V TTL voltages and outputs the signal on a COM port presented the PC. A MAX232N line driver is used to convert the 0 to +5V TTL levels to RS232 levels. The RS232 voltages are then sent through the PL2303 chip, which connects to the PC via USB. The microcontroller has multiple outputs that are used to control the relays. The relays require +6V DC power supply for operation. If the supply delivers low voltage than +6V, the relays may not function efficiently. Two overcome this, a 7806 voltage regulator is used to deliver a steady +6V. The microcontroller is programmed such that if it receives b, f, h, p it turns on the corresponding relays or appliances and if it receives a, e, g, o it turns off the corresponding relays or appliances. For

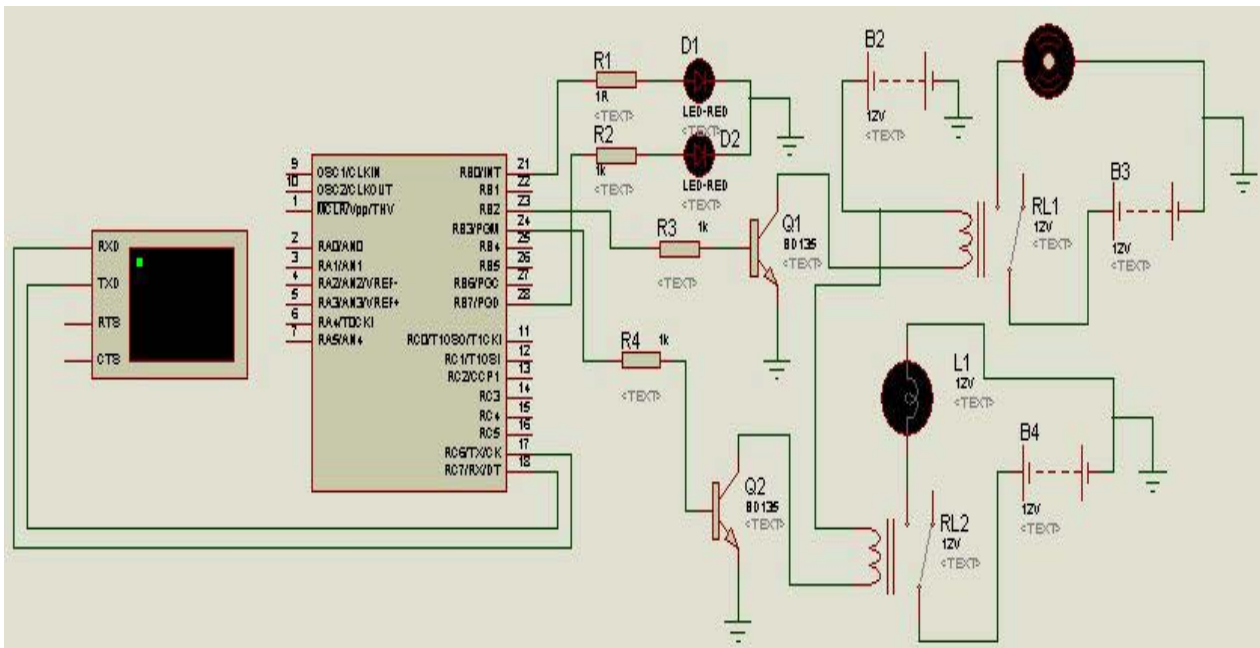


Figure 4 : Computer Control System for Home Appliances: Circuit Diagram

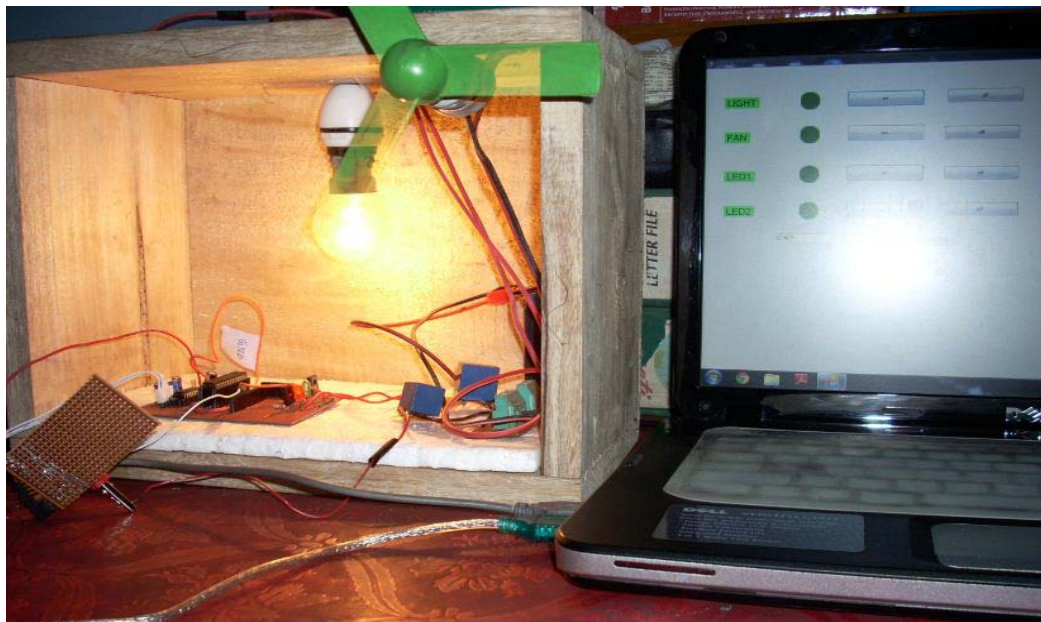


Figure 5 : Computer Control System for Home Appliances: Practical Implementation

convenience, we have designed a software layout from which we can turn on or off the relays or appliances. The software interface has many ON/OFF switches. The interface is such that when an ON/OFF switch is pressed it is the same as pressing the alphabets defined in the programming. In Fig. 4. We show the circuit diagram of our designed system in simulation environment and Fig 5. shows the practical implementation.

However, Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The protection diode allows the induced voltage to drive a brief current through the coil

(and diode) so the magnetic field dies away quickly. This prevents the induced voltage becoming high enough to cause damage to transistors and ICs

## V. CONCLUSION

The concept of a proprietary control device is done away with as the system can be controlled from a desktop PC or laptop. There is no need for a specialized server system. Nowadays most users already own the requisites such as a desktop PC or laptop. Hence the cost of the system is considerably reduced. The installation cost and hardware cost is minimum, as most users already own the requisite hardware. The system

can be easily integrated into an existing electrical system of a building because of its simplified design. It can be easily installed in a single room if one so desires. Modifications to the existing electrical system are minimal, thereby reducing installations costs. The scope of this work is huge with the modernization and advancement in computer fields. It can be used in home automation, street light management, hotel power management, high voltage grid control and industrial automation.

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