Embedded Web Server for Home Appliances

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Abstract —
Main aim of this paper is to describe how to connect a micro-controller to LAN or Internet and use it as a web server. This paper offers a new approach to control home appliances from a remote terminal, with an option from a local server, using the Internet. This system is accomplished by personal computers, interface cards, microcontroller, along with window-type software and microcontroller control software. The system is designed to control home appliances' on/off, to regulate their output power, and to set their usage timing. The microcontroller which is used in this project is the Philips P89C51RD2BN microcontroller.

Keywords **–** Microcontroller, Microcontroller 89C51, Telnet, C programming language.

I. INTRODUCTION

The vision of the system is to provide an efficient internet based system to control everyday home appliances. The system offers users an easy & effective means of controlling their various home appliances from a remote location i.e. without physically being present at home. The system makes use of the internet to enable remote access to the various home appliances. Apart from merely turning the appliances ON & OFF, the scope of the system can be extended to regulate their output power & set their usage time[1].

II. ARCHITECTURE

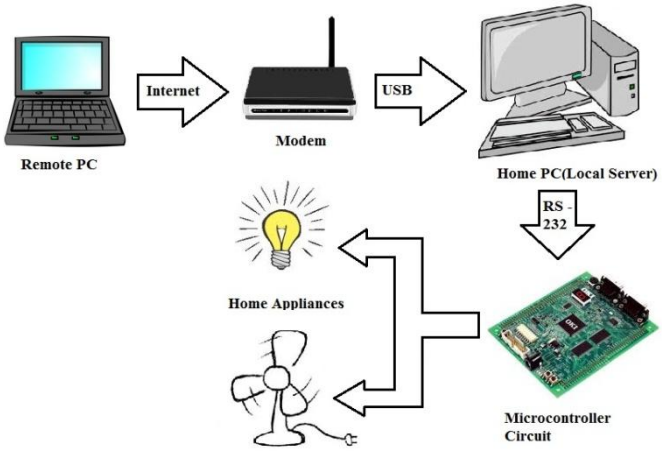

Fig.1 Project Layout

It enables users to control various aspects of their home appliances form a remote location through the use of the internet. It hence makes for a powerful & versatile system which expands the mobility of users by granting them total control over their home without the need of physical presence.

The project layout is explained below along with the components required to build a system:

1) A graphical user interface will be designed as a part of the web based application.

2) The user will access this interface and control the home appliances.

3) The data from this application will be passed on to the local server, that is, the home PC.

4) The PC will pass on the signals to the microcontroller.

5) The microcontroller will be programmed in an

appropriate way to understand this signal and thus convert it to an electrical signal and transmitted to the switch controlling the home appliance. The end result will be a simple action like: switching on a light.

III. DESIGN COMPONENTS

The system contains both hardware & software components which are classified as follows:

1. SOFTWARE COMPONENTS

i. **Visual Basic**: It is a versatile programming language which can be used to create various GUI applications. In this system, VB is used for creating a client-server application for the remote and local server respectively.

ii. **Telnet:** The purpose of the TELNET Protocol is to provide a fairly general, bi-directional, eight-bit byte oriented communications facility. Its primary goal is to allow a standard method of interfacing terminal devices and terminal-oriented processes to each other. Telnet will be used to set up a server-client program to execute commands from the remote terminal.

iii. **WinAVR** – It is a suite of executable, open source software development tools for the Atmel AVR series of RISC microprocessors hosted on the Windows platform. It includes the GNU GCC compiler for C and C++. It is used for creation & embedding of a program for the microcontroller in C language.

2. HARDWARE COMPONENTS

i. **Microcontroller:** The microcontroller used is the brain of the entire system. It will receive the commands executed on the remote server and compute the appropriate instructions to control the home appliances[2].

ii. **Local Server**: This machine serves as a focal point in the system. It acts as a bridge between the user (remote machine) & the various home appliances. It also acts an interface to the microcontroller. The microcontroller is connected to the local server via the RS-232 port[6]. The local server passes on the user commands to the microcontroller via the interface created in VB. The local server has a GUI which can also be used to control the home appliances.

iii. **Modem**: The modem receives the command signals sent to the local server from the remote PC. The modem is directly connected to the local server & acts as a connection between the local sever & the internet. The modem used in the system can either be a wired or a wireless modem.

iv. **Remote Workstation**: The remote machine is the component from which the actual user of the system will use the system to control the home appliances. The remote machine can be any machine which is connected to the internet. The remote machine can be used to access the Telnet client application over the internet. The user of the remote machine will be able to control the various home appliances remotely.

v. **Home Appliance**: The home appliances must be connected to the main power supply at all times. This is a precondition for the system. The various aspects of the system which can be controlled are :
   a. The appliances status (ON/OFF)
   b. The output power of the appliance
   c. The time for which the appliance is running.

IV. DATA FLOW DIAGRAM

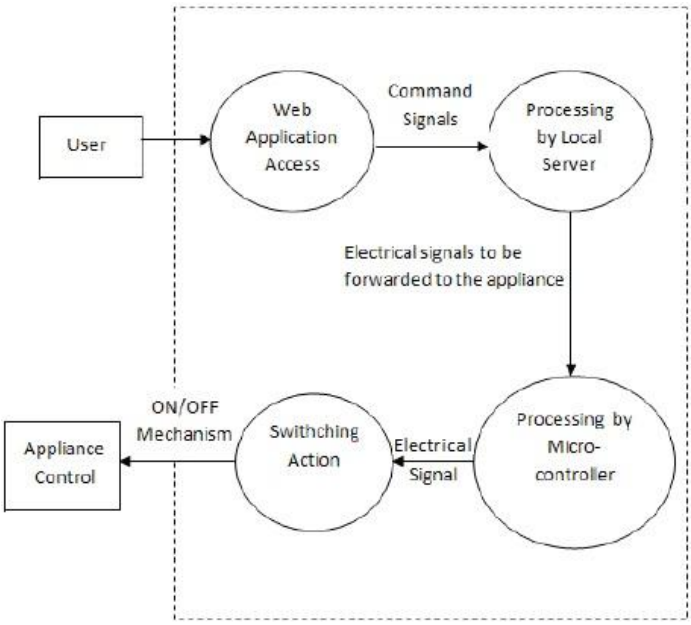

Fig.2 Data Flow Diagram

V. ADVANTAGES

- **Convenience** - It provides the user with comfort & convenience since the user can control the connected home appliances from any remote machine having internet connectivity.

- **Real-time Control –** User can monitor the real-time status of each of the connected appliances and make adjustment as & when he/she feels it necessary.

- **Report Generation** – Allows user to analyse the usage of the various appliances & the time of usage through generation of detailed reports for the same. These usage reports will give the user a complete picture of the working & efficiency of each appliance & can set usage timings & power inputs to optimise the usage to cost ratio.

- **Notifications** – Provides user with appliance related notifications regarding state of the appliance etc. as & when required.

- **Addition of an appliance** – Enables users to add an appliance with ease & simplicity. The overhead of adding an appliance is very low & is restricted to the hardware required.

- **Security** – The system can be employed as a very efficient security tool by connecting cameras, motion & light sensors etc to the system. The status of these sensors & monitors can be monitored from a remote location & can be used to gather security information about the home in general & take the required measures for the same.

VI. LIMITATIONS

- **Dependence on the internet** - The most significant limitation of the system is that it is completely dependent on the internet for the feature of remote access. In case of loss of internet connectivity, the user will still be able to control the home appliances directly from the Local Server using the GUI created for it.

- **Dependence on power supply** – For the system to function properly, all appliances must be connected to the main power supply at all times. If appliances are disconnected from the main supply, they can no longer be controlled by the user & that part of the system would be rendered non-functional.

VII. OBSTACLES FOR THE SYSTEM

- The system is not complete within itself due to its dependence on the internet. The main obstacle is building a system which can use a back-up method of control in case the internet connectivity is lost.

IX. POSSIBLE APPLICATIONS OF THE SYSTEM

- **Security & Surveillance** – Various security systems can be integrated along with this system such as, cameras, motion sensors, luminance sensors etc to enable the users to monitor various accepts of their home via a remote machine in real-time.

- **Energy Management** – One of the major applications of this system one involving the optimised management of energy consumed by the various appliances of a household. Since all appliances can be monitored & controlled in real-time, users can program the system so that a schedule is followed for the various appliances. It can be particularly useful in situations where the user has forgotten to manually turn off a particular device (lighting, fan etc.) while leaving the house. All the user needs to do is access the web application & make the required changes.

- **Lighting** – The system can be programmed to switch on certain lights as & when required, using the timers in the circuit. Example: turning on the porch light at 7PM every day.

- **Entertainment** – The system can be integrated with other devices such as sound systems, special lightings etc. For example, the user can program the system to turn lights ON & OFF in a sequence.

- **Access Control** – The system can be integrated with access control devices such as digital locking systems, facial/finger-print recognition systems etc. so as to provide the remote user with real-time information about who is entering/leaving the house and so on.

IX. CONCLUSION

The system for the "Home Automation Network" has a vast scope & almost limitless application in today's technology driven market. The system can be made efficient by modularising each and every component of the system hence ensuring

that it can be integrated with a varied range of devices. The basic vision of the system is to provide a convenient & secure system to the user, which would aid the high degree of mobility & control we. aim to achieve nowadays.

X. ACKNOWLEDGEMENT

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XI. REFERENCES

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