Research Paper

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A Smart Home Automation System Using Android Phone

Engineering

KEYWORDS : Bluetooth, Android Phone, AVR Atmega16, LDR, LM35 Temperature Sensor, Relays

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ABSTRACT

The need of Automation System is long identified in home, office and industries application. In this paper, a Bluetooth based home appliance controlling system is proposed. It makes use of an Android phone with an android application as a remote to command the system and a microcontroller as a control and interfacing system within a home. The system includes an android Bluetooth application with a fine graphical user interface, a microcontroller with Bluetooth module, relays for interfacing purpose of appliances and some sensors like LDR and Temperature sensor in order to measure the environmental conditions. Microcontroller AVR16 has been chosen as the control and interfacing system and Android eclipse software has been used for Android application.

INTRODUCTION

The concept on control and monitoring has been ongoing for the last decade. This system is used not only to control the home appliances but also to control their parameters like speed of the fan and intensity of the light manually. This system can also work automatically where appliances are controlled according to the environmental conditions. It also show the temperature and light intensity of the environment for monitoring purpose on the screen of the android phone.

It is expected that remote control and monitoring system will become important in future. The capability that being offered by this system is very important to improve the existing control system in the industry.

RELATED WORK

The system which is used to control the home appliances has been developed by researchers. It has become very popular because of its wide use. The advancement in wireless technology has introduced some important connections in the market such as GSM, WIFI, Zigbee and Bluetooth. Each connection has its own specification and applications. With the capacity of Bluetooth with globally available frequency of 2400Hz is able to provide the connectivity of up to 100 meter at a speed of 3Mbps using a smart phone[1]. Further the controlling of electrical switches is done by Zigbee technology [2]. In addition home automation systems with security features using GSM and Zigbee 357 have been introduced [3]. The electrical relays have been controlled by RF module and Visual Basic software has been used to develop the control interface between user and the system [4]. A remote system to control the electrical devices based on wireless sensor network applying the concept of mobile network and internet to field of remote control [5]. In addition a remote wireless acquisition and control system based on Zigbee and GPRS has been introduced. The system is a star network and includes environment monitoring sensors, intelligent appliances, terminal acquisition and control nodes, family gateway and data display platform [6]. A PC based device controlling which can control the electrical devices using serial communication. The control and interfacing circuit is based on microcontroller AT89C51 [7]. A control system based on android smart phone GUI where control commands can be sent to the system by using android Bluetooth application [8]. A SMS based wireless system which can control the appliances and monitor the house events for the sake of security has been introduced in [9].

From the overall papers reviews, all the system can only switch ON/OFF the devices but never mentioned such system which can control the parameters of the electrical devices such as Speed of electrical fan and Intensity of Light. Further in this system a feature of controlling the devices according to the environmental conditions.

There will be two modes of controlling the system. 1st is manually where the user can control the relays (electrical devices) manually by touching the buttons in Android Bluetooth Application. In this mode, the user can control the parameters of different electrical devices manually by a single touch on the screen of mobile application. In the 2nd mode user need not to vary the parameters. The speed of fan and the intensity of light will be controlled automatically by sensing the environmental conditions such as temperature and Intensity of light in the environment.

In addition the system is also capable of showing the temperature value of the environment and Intensity of the sun light on the screen of the mobile. It means as environmental conditions changes, the screen will be updated with the new data values of environment.

SYSTEM OVERVIEW

The figure shows the block diagram of the system. The system can be installed directly on the wall of the room just like conventional switches at home. . The Android Phone has a Bluetooth based application. The Bluetooth module enables the user to communicate with the AVR microcontroller.

The electrical devices are connected with microcontroller with the help of relays. The AC device, the parameter of which is to be controlled, is connected with microcontroller via an AC Device Control Circuit.

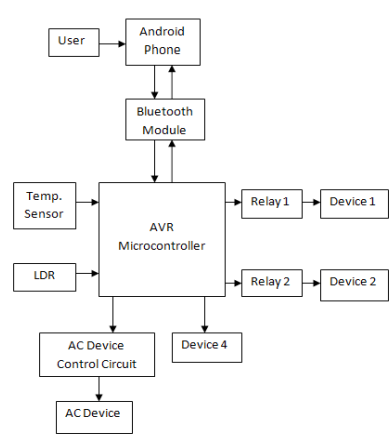

Figure 1: Block Diagram of System

Two analog sensors (Temperature Sensor and LDR) are used in the system in order to monitor the environmental conditions. The output of these sensors is further used to control the device parameters in automatic mode. In the system not only AC but also DC devices can also be controlled. As shown in the block diagram, Device 4 is a DC device the parameter of which can also be controlled by means of PWM (Pulse Width Modulation) technique.

The GUI of Android application is used to switch ON/OFF the electrical devices. The parameter of these devices can be varied with the help of scrolls in the application. Further the temperature and light intensity can be seen on the screen of the android application.

After the establishment of RF connection of smart phone with microcontroller circuit, the smart phone will act as a server to send the data or command to microcontroller circuit board.

HARDWARE DESIGN

This section gives the information about the hardware of the system. Figure 2 demonstrates the main hardware schematic of the system. Hardware of the system is comprised of HC-05 Bluetooth module, ATmega16A MCU, ULN2003AP Relay Interfacing IC, Android Phone, 12V Relays, AC controlling circuit, Temperature sensor LM35 and LDR (Light Dependent Resistor).

ATmega16A is a 40 pin IC. It consists of 8 bit CPU, 32 general purpose registers, 4 PWM channels, 8 channel-10 bit ADC. It is used in the circuit as the main control unit. All the devices and physical components are connected with mobile through the microcontroller.

A TRIAC based AC controlling circuit has been used in order to control the parameter of the AC appliance and to control the DC appliance, PWM technique has been used. Since AVR ATmega16 microcontroller have inbuilt PWM module so that it can be used to control the DC voltage. Further it also has 8 channel 10 bit ADC for interfacing of analog sensors with it directly. The relays are interfaced to microcontroller with the help of a relay driven IC ULN2003.

V. SOFTWARE DESIGN

Software design section includes an Android Phone Bluetooth application. The application is designed in Android Studio 1.0 with API level 8. The application is designed in low level API so that higher version is compatible with it. This application communicates with microcontroller with the help of Bluetooth module. In the application, whenever a button is pressed, it is detected by the microcontroller and AVR will activate the relays. Application has an option of the two modes. Further temperature and light intensity of the environment can be seen on the screen of the mobile. The interface is simple to use, user can simply touch on the icon to turn on/off the appliances after it is connected to the main circuit. The following picture shows the GUI of the application.

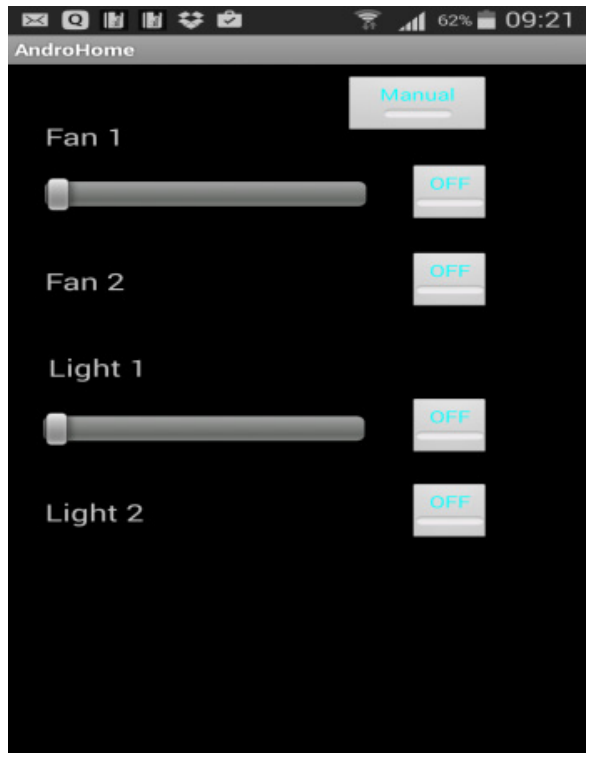

Figure 2: Application GUI

CONCLUSION

In conclusion, this low cost system is designed to improve the living standard at home. The remote control function by smart phone provides help and assistance especially to disabled and elderly. In order to provide safety protection to the user, a low voltage activating switches is replaced current electrical switches. Moreover, implementation of wireless Bluetooth connection in control board allows the system install in more simple way. Further it gives a feature to control the parameters of the electrical devices. It also gives the information about environment temperature and Sun light intensity. These values are very close to the standard values hence the error is very less. The connected application is synchronized with the AVR based system board.

For future work, the application will be having more features. The application can be implemented on the basis of Speech recognition system.

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