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Android Application Based Real Time Home Automation

KEYWORDS: Android OS, Smartphones, Tablets.

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ABSTRACT *There are several methods that can be used to control a particular system. They may depend on many variables, whether electrical, mechanical or electronic. The most common ones are direct control and remote control, which can be manual or automatic. Automated processes provide comfort for operators, decrease risks, and increase productivity. In the development of remote control systems, the telecommunications, electronics and control concepts, makes it possible to control any mechanism, system or interface from a computer, mobile device or tablet with a friendly interface.*

Nowadays the smartphones and tablets are becoming powerful and with new and useful characteristics, and they will be a perfect match to develop control systems. The use of smartphones and tablets in development and research is not only found in control systems, but in all areas as they represent a significant business opportunity for manufacturers who consistently develop better hardware and operating systems.

In this paper we introduces an Android OS (operating system) based application for Tablet or Smartphone that communicates with the home appliances through Serial connection.

I. INTRODUCTION

In recent years the popularity of home automation has been increasing due to higher affordability and simplicity by connecting through smartphone.Home automation include controlling of lights, fans, appliances, security locks for gates and doors, etc., which are used to improve comfort, energy efficiency and security for home. Home automation is useful for elderly and disabled, who can control the things by staying at one place without the help of others and can increase the life quality of them.

A home automation system (HAS) provides the integration among all the electrical and electronic devices in a house. The techniques used in home automation systems include controlling of electronic and electrical devices, such as home entertainment systems, security systems, air conditioners, lawn watering systems, domestic robots, etc., The devices in the house may be connected to a home network to gain the access of those devices and may also allow remote access through internet. As information technology has been integrated with the home appliances and systems, they are able to communicate in an integrated manner which results in energy saving and safety benefits.

As the wireless technology is emerging day by day, several different connections are introduced such as Bluetooth, WIFI, ZIGBEE and GSM.Each of these connections has their unique specifications. Among the above mentionedwireless connections, Bluetooth is chosen with its suitable capabilities for designing this HAS project.Bluetooth with globally available frequencies of 2400Hz is able to provide connectivity up to 100 meters an speed up to 3Mbps depending on different Bluetooth device classes [1].

Based on the study of different HAS projects done by developers, [4] microcontroller is implemented in wireless HAS. For creating wireless connection, the system implemented a RF transmitter and receiver for establishing RF connection [5]. The other system implemented GSM, Internet and voice wireless HAS [5]. The GSM system [5] cost is low but the GSM mode is not considered. By consider all these systems we came to a conclusion that Bluetooth is considered the best for implementing this HAS as Android device consists of Bluetooth by default.

II. SYSTEM OVERVIEW

Figure 1 shows the block diagram of the Android application based HAS i.e., control function of the system.The system is directly connected to the electrical and electronic devices present in the home such as fan, light, etc., The Bluetooth connection is established between the system and the application which was designed and installed in the Android device.

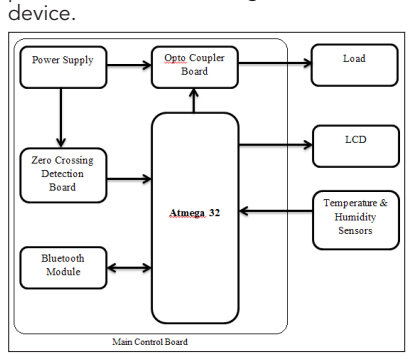

Figure1. Functional Block Diagram of System

In order to improve the standard of living, the controlling of the home appliances is done by the Android application installed in Android device.The users can easily access the Android application by sampling tapping the buttons present on the touchscreen of Android device.This method is very much useful for the persons who are physically disabled and can't move on their own to the switches to turn on the appliances.

The temperature and humidity level can be measured using the sensors that are connected to the main control board. The indication from the sensors reminds the user to turn on/off the fan or air conditioner in the house.The on/off status of home appliances, temperature and humidity readings are synchronized with the Android application present in the Android device.The monitoring of switch status and sensor reading is done in real-time; any changes in the switch status or sensor readings will be transmitted to the Android application present in Android device.

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III. HARDWARE DESIGN

In this section we discuss about the hardware construction of the main control board.Figure 2 shows the hardware blocks present in main control board.Atmel Microcontroller, Atmega32 is considered for designing of this hardware due to its capability of performing serial communication using Bluetooth connection with the Android device. As we know, the temperature and humidity sensors are considered for getting the temperature and humidity levels in the room.The Bluetooth module, BT24LT is chosen for establishing the connection between the Android device and the main control board due to its low cost.

The electrical current is directly connected to the main control board. The voltage regulator is constructed by Zero Crossing detection and Opto Coupler circuit which consists of transformer, rectifier and regulator. 3.3V to 5V DC output is needed for the specific components in the main control board.

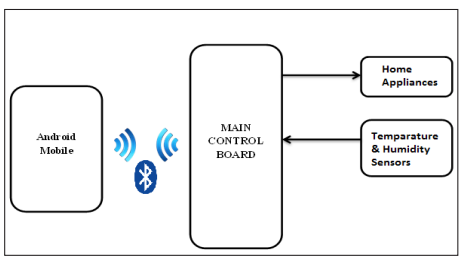


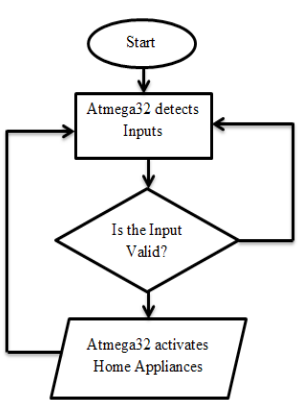
Figure2. Main Control Board Hardware Block Diagram

The system designed is directly installed beside the electrical switches on the wall.The installation of this systems does not need any wiring reinstallation and wiring on the wall, but the existing switches in directly connected to the Opto Copular circuit inside the main control board.Depending on the requirement, multiple control boards can be installed in home. With these low cost components, the main control board is constructed in small size but still performs the strong functions of the system.

IV. SOFTWARE DESIGN

Software design section is divided into two sections 1. Main function of the system designed in Atmega32 microcontroller 2. Designing of Android application.Figure 3 illustrates the control flow in Atmega32 microcontroller. The input to the main control board is detected by Atmega32 microcontroller. Any input to Atmega32 microcontroller will cause an interrupt to the main function loop of Atmega32. This will cause a change in the output peripherals connected to main control board.

The Android application is designed using MIT Beta AppInventor.This application is designed at low level API so that both the lower and higher versions of Android are compatible with it. Figure 4 illustrates the Android application i.e., installed and tested using the Android device which has Android 4.1.2.The application is simple to use, user can turn on and off the appliances that are connected to main control board by simply touching the icons present on application.



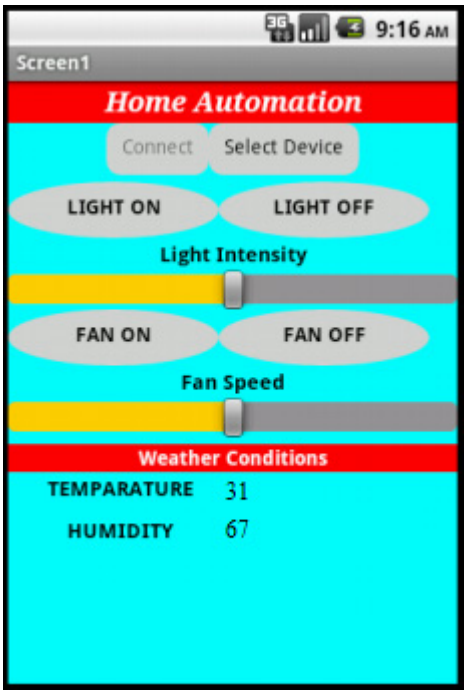


Figure3. Control Flow in Atmega32 Microcontroller

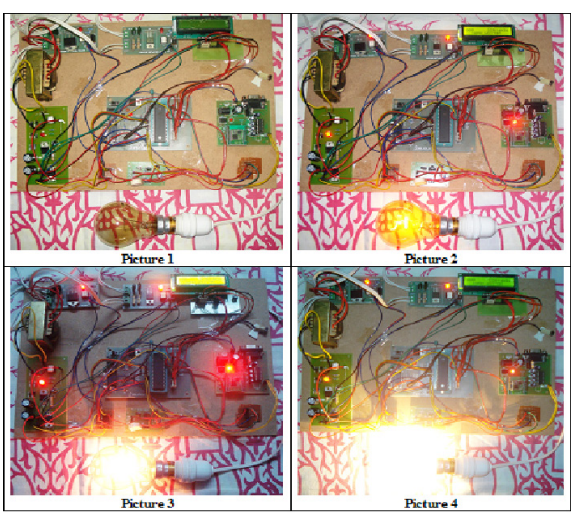


Figure4. Android GUI on Smartphone

V. RESULTS

This system is tested and verified in the real time environment. The below pictures will you understand how perfectly the system is working. As discussed above we implement it for the Fan also, there no pictures of Fan taken because the rotation and speed variations of Fan is difficult to capture in pictures.

Picture 1 is taken when the system is turned off. When the system is turned on then the bulb glows with the low intensity as show in picture 2. When we need to increase the intensity of light then we have to move the slider in Android App then the intensity of the light will change. Pictures 3 and 4 shows the bulb intensity in middle and higher levels respectively.

In the similar way, the Fan we can also control the Fan speed. The temperature and humidity values are displayed on the LCD present in the system and also in the Android App.

VI.CONCLUSION

In conclusion, this system is designed at low cost and is used

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to improve the standard of living in home.The wireless connectivity through the Android device provides help to the people especially to elderly and disabled. The implementation of the Bluetooth connection in control board allows the system to install in simple way.The control board can be directly installed besides the electrical switches.

For future work, the Android application will be implemented with speech recognition to control appliances with voice commands.All the voice commands given to the Android device will be transmitted to the main control board after signal processing. All the future work can be implemented on the same system by changing the application in the Android device.

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