Home Automation using Android

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Abstract—Automation has become the key for smart homes, Implementation of such a system leads to energy conservation and also provides the user with a comfortable and convenient way to control their home appliances. Automation can also be employed to help disabled people with their daily tasks. This paper presents such a system which uses sensors to automate our home appliances. Connection to this system can be made over Bluetooth using the designed application on Android OS

Keywords – Bluetooth, Smart Home, Automation, Android.

I. INTRODUCTION

The idea of home automation has been around from the past decade, but due to cost constraints its application has been limited. The term 'Home Automation ' has been defined as *"the introduction of technology with the home to enhance the quality of life of its occupants , through the provision of different services such as remote connectivity , energy conservation and Security "*[4].

According to U.S Department of energy households in the United States consumed 21.54% of overall energy consumption during 2011 [3]. This statistical evidence motivates us to develop an Autonomous system which could reduce energy consumption without sacrificing user experience and convenience. The user should be able to operate the system with minimal computer knowledge. In this paper we design a Home automation system that is low cost yet brings Interoperability and scalability of the system. This means that the system uses sensors to determine the ambient light, temperature and other physical factors to smartly control home appliances, It can also be easily expanded with no major changes to the core, which results in lower power consumption and hence more savings. The system is wireless and uses Bluetooth technology with its globally available 2.4Ghz frequencies offering connectivity up to 100 meters at a speed of up to 3Mbps depending on the Bluetooth device class. [1] In Addition, a Bluetooth master device is able to connect up to 7 devices in a "Piconet". [2].

II. SYSTEM ARCHITECTURE

The basic architecture of the system is shown in the figure below.

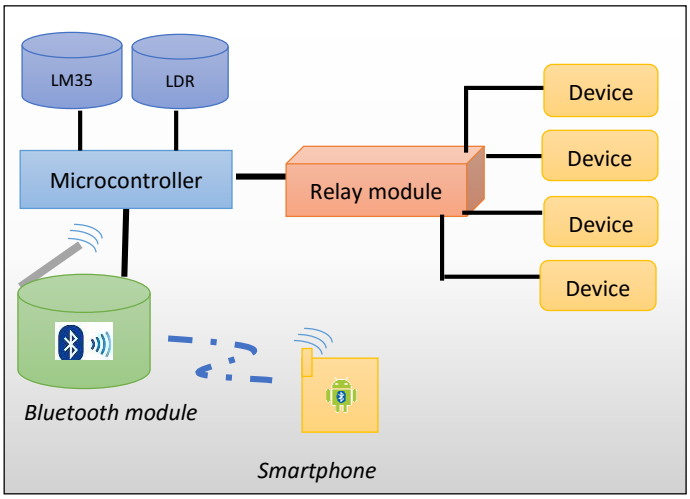

Figure 1: Basic System Architecture

This setup is directly mounted besides the conventional electrical wall switches. The Bluetooth module on the system enables it to communicate with the Android Application designed for the system. We use Arduino Uno R3 as the microcontroller. The sensors used in the design feed physical data to the microcontroller. The microcontroller then processes that data to smartly control the connected home appliances. The entire hardware setup is bought under $20 U.S Dollars.

III. HARDWARE OVERVIEW

This section focuses on the hardware used in the system. The microcontroller used is Arduino UNO R3. It has been chosen because it has sufficient I/O ports to add sensors to the system, it can serially connect to the Bluetooth module and above all it is cost effective. For the Bluetooth Module we have selected HC-05 Serial Bluetooth Module as it is low cost and widely available. We have chosen BH1750 as the Ambient Light sensor and LM35 as temperature sensor. Both of these sensors are widely available. A Relay Module is used to replace the conventional electrical switches with Low Voltage activating switches.

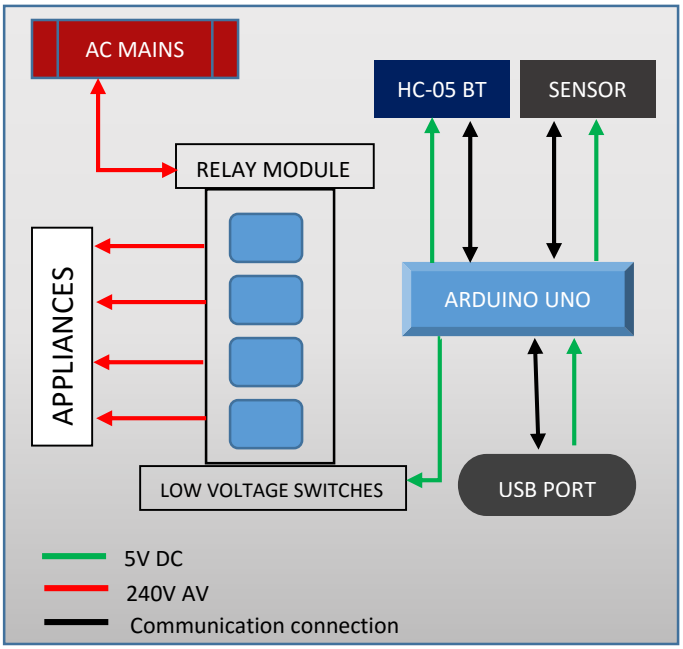

Figure 2: Hardware Block Diagram

It may be noted that the system can be installed with the existing electrical wiring. It can be installed besides the electrical switches on the wall eliminating the need for reinstallation of the home wiring. The relay module connected to the electrical wiring acts as a switch which is controlled over Bluetooth using 5V DC signals from the microcontroller.

IV. SOFTWARE OVERVIEW

This section the paper describes the software involved in working of the home automation system. It is divided into two parts.

A. *Arduino programming*

The algorithm used to program the microcontroller is illustrated below:

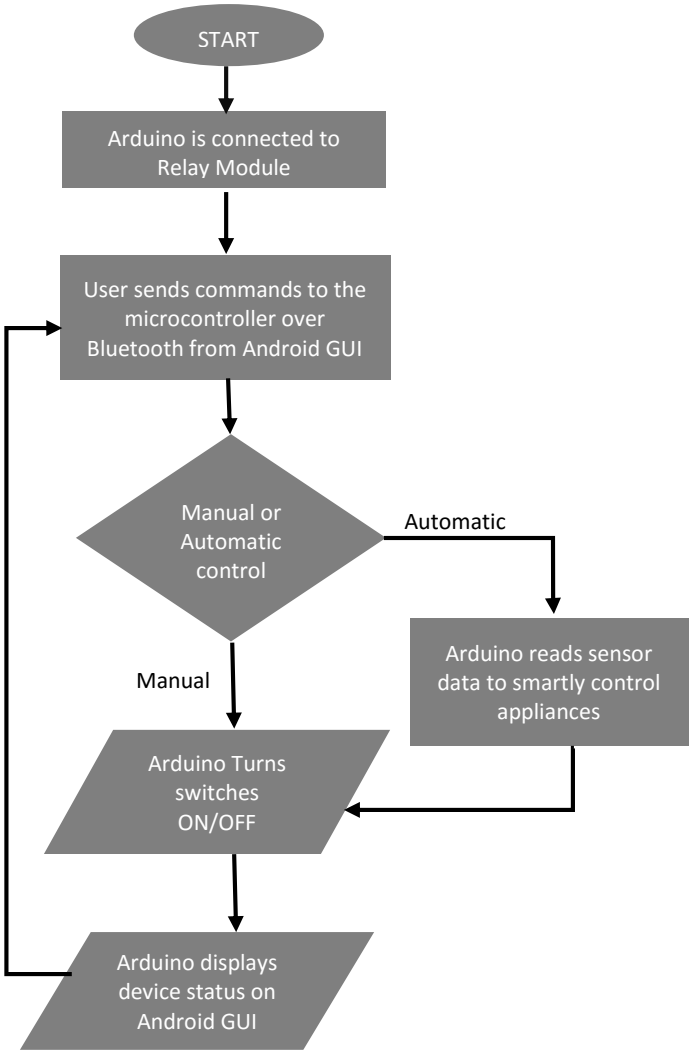

Figure 3: Flowchart for Microcontroller Program

The microcontroller receives commands from the user over Bluetooth from the Android GUI. The user has the option to manually control the home appliances or set it to automatic. When set to automatic the Arduino uses sensor data to smarty turn On/Off home appliances. The change in status of the home appliances is displayed on the Android GUI. Arduino changes the voltage of the relay switch to change its status.

B. Android GUI

The application is designed for android version 4.0 (Ice cream sandwich) with API level 16. This API level supports 99% of available Android devices. The Android interface is very simple. It has two buttons on the top to connect/disconnect to the system, a logview which displays the status of various home devices. The user can simply touch a button on the GUI to control the home appliances. Figure 4 illustrates the design of the Android GUI.

Figure 4: Android GUI

V. CONCLUSION

In conclusion, this low cost yet flexible system can be employed to improve the standard of living of common people at home. The remote control functionality of the system enables the elderly and disabled people to do their daily tasks. This low cost system is bought under $20, considering the monthly savings of $2/month on electricity, the cost of the system can be recovered over a period of 10 months, which makes it appealing to the consumer.

Furthermore, energy conservation is the need of the hour, with the growing energy demand and limited resources, this system can help reduce energy consumption to a great extent. It is also important to note that it would also help reduce the greenhouse footprint by regulating the use of home appliances.

For future work, we can implement voice recognition and control in the system. The system would use the smartphone's Mic to transmit voice commands over Bluetooth. We can also implement the same system over Wi-Fi thereby increasing the range. The system could also be connected to the internet to enable Remote Control from a different location. The scope of research and development for such systems is endless.

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