Smart Home System Using Android Mobile Devices

Mayur Jain[1], Pranav Dhapke[2], Suman Kumar[3],Chaitanya Patil[4]

1-4 Department of Computer Engineering, VIIT, Pune University, India

[1]mayurj07@gmail.com

[2]pranavdhapke@yahoo.com

[3]suman.kumar12345@yahoo.co.in

[4]chaitanya.viit@gmail.com

***Abstract*— A home automation system refers to a system that is used to control devices around the home. The gist of this paper is the design of a mobile-based automation system .It describes the implementation of a universal remote controller for the electrical home appliances by controlling the switches wirelessly. The system is implemented in Java and it can monitor and control the home appliances via Wi-Fi inside the home locally and remotely using an internet connection. Thus one can save the internet expenses when not needed. An Android application provides the graphical user interface (GUI) for the user. New appliances can be added anytime to the system, which provides for the scalability of the system. The appliances need not be provided by a single vendor. Password Protection is provided to block unauthorized users from accessing the appliances at home.**

***Keywords*-Smart home; android; wireless; microcontroller; home-automation; sensors; mobile devices**

I. INTRODUCTION

In modern days, we must make use of various high-tech tools and equipments to get our jobs done and make our life much easier. The homeowner must be able to control these machineries. Thus a system of remote monitoring and controlling is very much necessary. Smart home is one of these types of system equipped with home appliances which we wish to control smartly from anywhere. Some products are commercially available which allow remote home appliance controlling through internet which is undoubtedly emerging. But it lacks the true sense of real mobility and security, making the remote home appliance controlling a limited term than it is supposed to be. In search of a true remote and adequately secure solution to be really effective and practicable, mobile telephony is better than any other solutions. Mobile phones have become almost an inseparable part of civil lives today. We introduce a new mechanism so that the ordinary services of the mobile phones can be leveraged to communicate with and control the home appliances and make our homes a really smart one.

II. HARDWARE REQUIRED

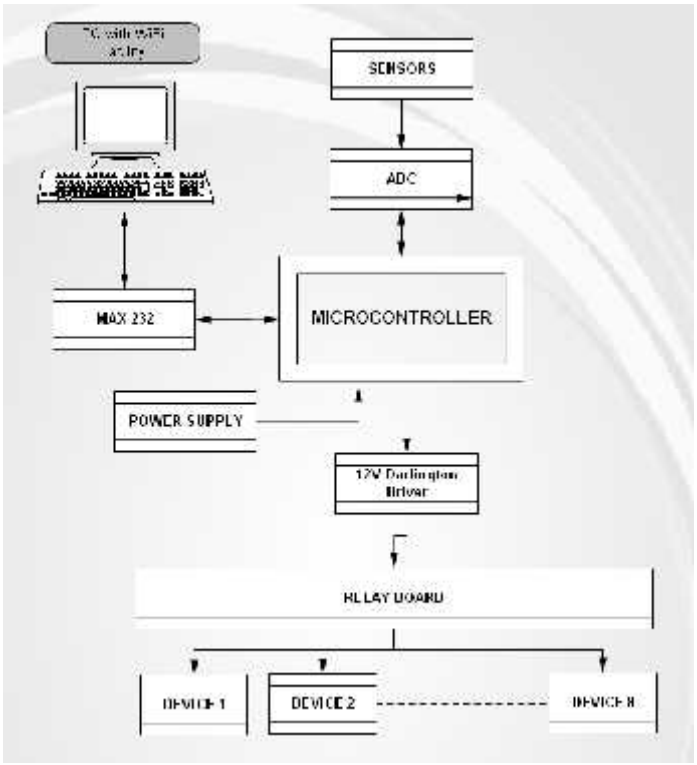

Fig. 1 Block diagram of the system

So, following are the hardware requirement for the system to be developed.

A. Microcontroller (8051)

Microcontroller used is 8051.It is one of the most popular 8 bit microcontrollers. It can address 128 Kbytes of external memory and has a basic instruction time of 1microseconds. It has 128 byte internal RAM and 4 KB internal ROM. It is available in 40 pin dual in line package.

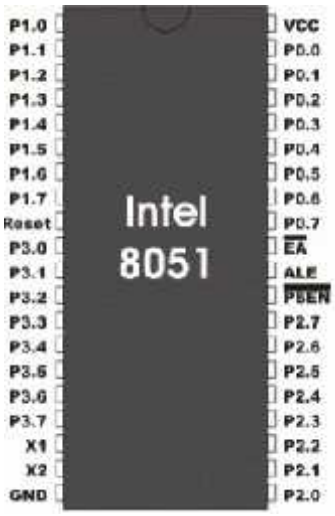

Fig. 2 Microcontroller 8051

B. ULN Darlington Driver

The ULN Darlington array is used as it a high voltage, high-current array which is ideally suited for interfacing between low-level logic microcontroller and multiple peripheral power loads of relay boards. Typical power loads totaling over 260 W (350 mA x 8, 95 V) can be controlled at an appropriate duty cycle depending on ambient temperature and number of drivers turned ON simultaneously.

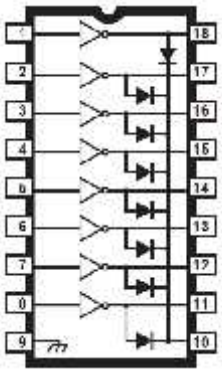

Fig. 3 ULN Darlington Driver

C. Analog-to-Digital-Converter (ADC)

To convert the analog signals received from the sensors to digital form so that the microcontroller can process them we are using ADC 0808. The ADC0808 is a monolithic CMOS device with an 8-bitanalog-to-digitalconverter, 8-channel multiplexer and microprocessor compatible control logic. The8-channel multiplexer can directly access any of 8-single-ended analog signals.

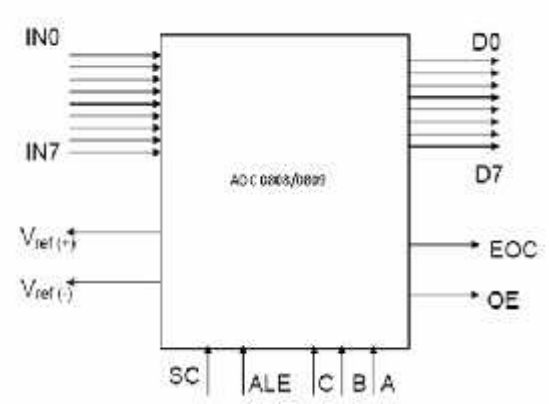

Fig. 4 ADC 0808

D. MAX 232

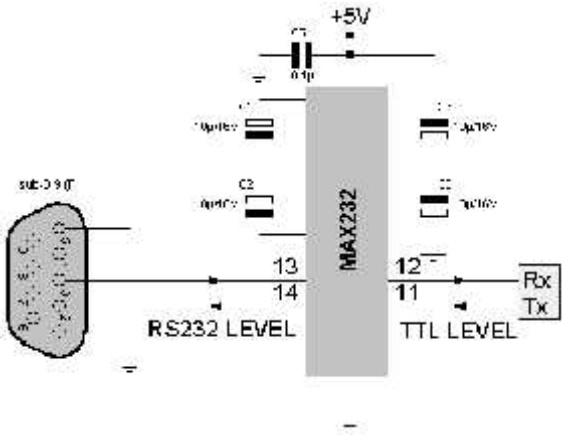

Fig. 5 MAX 232

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other, so we are using MAX232 to provide this intermediate link.

E. Sensors

Various different types of sensors are connected to the microcontroller through ADC0808. These sensors can be smoke

sensors to detect fire, temperature sensors, proximity, presence sensors, etc. Theses sensors add more functionality and security to the system.

III. CONCEPT OF HOME AUTOMATION

We have proposed a mobile-based home automation system which consists of a Smartphone (Android) with basic advanced facilities (Wi-Fi) and a home server. The home appliances are controlled by the home server, which operates according to the user command received from the android application on mobile phone. The mobile phone serves as a remote control through which a user can interact with the home automation system. The server is basically a laptop or a PC with Wi-Fi facility. As shown in system architecture diagram, to this server a microcontroller (µC) is interfaced through MAX232. The devices like fans, lightning in room, TV, security cameras, etc are monitored & controlled by connecting them to the µC through ULN and relays, also the sensors are monitored by interfacing them to µC through ADC.

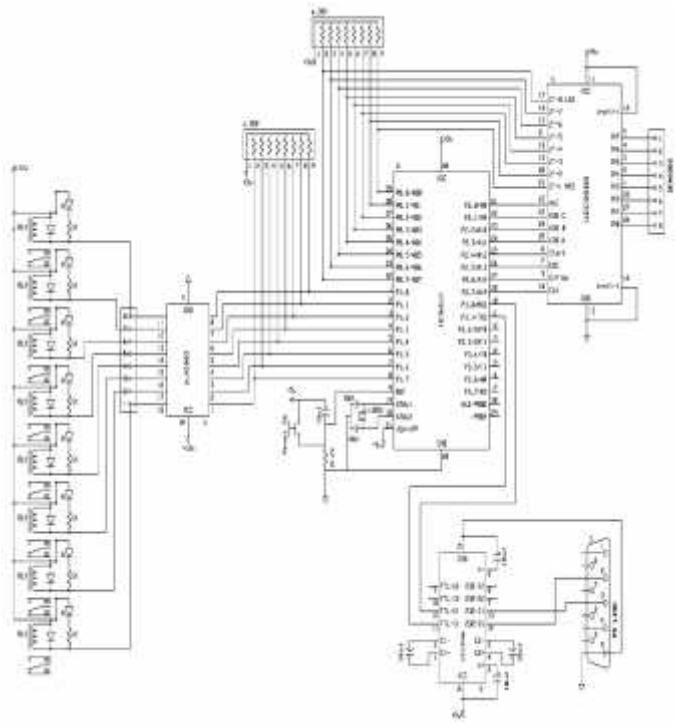

Fig. 6 Circuit Diagram

Android application is developed in JAVA (SDK) using XML layout, for this we require Android Plug-In. Then this app needs to be installed on mobile device. Now, user will be acting as a Client and send requests to the server. The client-server communication will take place through Android Networking which will convert them into serialized objects.

On the server side, Apache Tomcat will listen to these objects. This server application is developed on J2EE platform, since the communication will take place using serialized objects, so this application is developed using servlets which uses HTTP protocol. The main business logic resides in the servlets. Java servlets are server-side programs that handle clients' requests and return a customized or dynamic response for each request. Java servlets are more efficient, easier to use, more powerful, more portable, and cheaper than traditional CGI technologies. Server will send the signals to hardware module.

Now on the hardware side, the circuit diagram is shown above. Here you can see that Port 0 and Port 2 of 89C51 microcontroller is connected to ADC 0808. Port 0 will receive data from ADC while Port 2 of µC will send control for ADC. Port 3 is connected to MAX232 to interface it with server. Port 1 is connected to ULN to adjust the voltage level between relay and µC. This hardware is interfaced to server using JNI(Java Native Interface). This technology uses DLL files created in VC++ to actually interface the hardware add the function calls are implemented in Java. This is how we can manage hardware interfacing in Java.

Home automation thus allows the controlling and monitoring of various home appliances by a single system and brings greater convenience and better security.

IV. ACTIVITY DIAGRAM

The Fig. 7 below represents the activity diagram of system. It shows the process of flow of activities. Initially, user has to open the application from mobile and login. If user is a new then he must sign up for username and password else he may sign in quickly. Now the user is authenticated and on successful authentication user can access the android application. Now from the GUI of the application the user can send request for various kinds of operations as shown in the diagram. Now the server receives this request and responds by performing appropriate operations and then the user can view the status of the devices and other parameters.

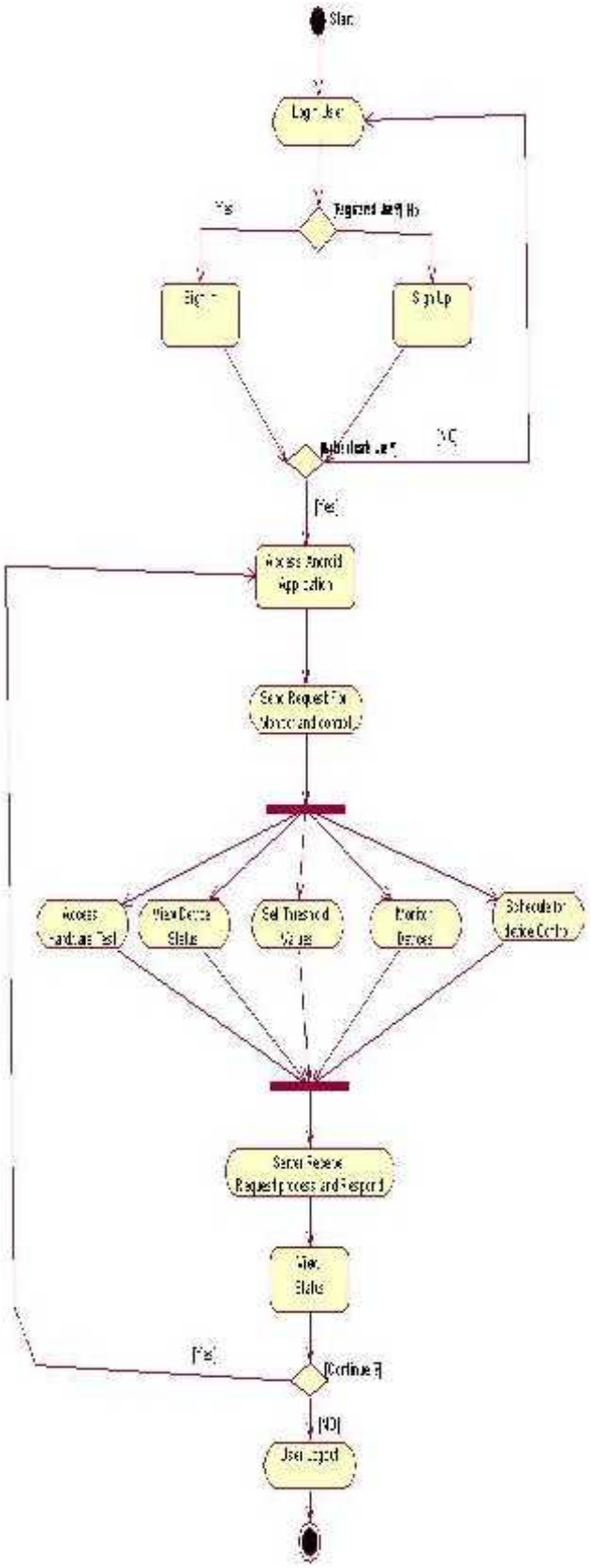

Fig. 7 Activity Diagram

V. CONCLUSION

In this paper we present a new design to control the appliances at home. A real time system is built using microcontroller 8051. The microcontroller is interfaced with sensor and appliances to control and monitor them. By implementing alarm system a good safety measurement has been taken to notify the user when the threshold value is exceeded. The incorporation of Wi-Fi helps to lower the expense of such systems and the intrusiveness of the respective system installation. The system provides a separate key to each device, and all users have their own log-in. Thus system coordinates safety and security issues in a clear and consistent manner. The system also provides for scalability by allowing addition of new devices within the network. Thus the paper provides a low-cost, flexible, user-friendly, and very secure architecture for implementing a Home Automation System.

REFERENCES

[1] A. R. Al-Ali and M. Al-Rousan, "Java based home automation system", IEEE transactions on consumer electronics, vol. 50, no. 2, pp. 498-504, 2004.

[2] Embedded systems, Rajkamal, Tata McGraw-Hill Publishing Company Limited, 2003.

[3] Luis Carlos "Wireless contol of bluetooth on/off switches in a smart home using J2ME in Mobile phones and PDA's",2007

[4] M. Van Der Werff , X. Gui and W. L. Xu," A Mobile based Home Automation System", Massey University, New Zealand.

[5] Rifat Shahriyar, Enamul Hoque, Karim Khan "Remote Controlling of Home Appliances using Mobile Telephony", International Journal of Smart Home,Vol. 2, No. 3, July, 2008

[6] The 8051 Micro Controller and Embedded Systems -Muhammad Ali Mazidi-Janice GillispiMazidi

[7] Design with PIC Micro Controller -John.B.Peatman