Smart Home System Using Android Application

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Abstract: - **When you use computers, entertainment systems or telephones, the various pieces and parts of the systems make up a community of electronic devices. These devices communicate with each other using a variety of wires, cables, radio signals and infrared light beams, and an even greater variety of connectors, plugs and protocols. Art of connecting things is becoming more and more complex every day. In this article, we will look at a method of connecting devices, called** Bluetooth **that can streamline the process. A Bluetooth connection is wireless and automatic, and it has a number of interesting features that can simplify our daily lives. There are already more than 40 million** *Bluetooth* **enabled home and professional healthcare devices on the market from leading manufacturers like 3M, A&D, Nonie and Omron. With the release of the first** *Bluetooth* **profile specification in June 2011, soon there will be millions more. Mobile devices have been integrated into our everyday life. Consequently, home automation and security are becoming increasingly prominent features on mobile devices. In th-is project, we have developed a loads controlling system that interfaces with an Android mobile device. The mobile device and security system communicate via Bluetooth because a short-range-only communications system was desired. The mobile application can be loaded onto any compatible device, and once loaded, interface with the security system. Commands to ON/OFF the loads to which the security system is installed can be sent quickly from the mobile device via a simple, easy to use GUI. The security system then acts on these commands, taking the appropriate action and sending a confirmation back to the mobile device. Temperature and humidity levels in the home also monitored by respective sensors.**

Keywords: **Android, Smart home, Security system & Bluetooth.**

1. INTRODUCTION

Nowadays, smart phones are becoming more powerful with reinforced processors, larger storage capabilities, richer entertainment functions and more communication methods. A "smart home security system" typically is a domestic environment that has been partially automated. Home automation includes centralized control for emergency light, door lock system, appliance management, and others. Home security systems aims to enhance the comfort, energy consumption efficiency and security. Generally, houses are equipped with independent control panels to control all of the systems and appliances present in the house. Moreover, those control panels are often not related each other. The main purpose of a smart home is to centralize the control of all the devices into a single control unit which can be programmed to do specific tasks suitable for the owner and the others. The goal of a smart home is not only convenience but also to reduce the consumption of resources.

Consequently, Home security system becomes one of the prominent futures on mobile devices. The user can control door lock, light and other devices using remote control Access control system used to allow only authorized members while the user away from their house. With dramatic increase in smart phone users, smart phones have gradually turned into an all-purpose portable device and provided people for their daily use.

Bluetooth, which is mainly used for data exchange, add new features to smart phones. Mobile phones have been important Electronic devices in our life. A home security system consists of an electronic device installed in a home. Most of today's Home security system uses Android technology to get accuracy in security providing. Bluetooth technology, created by telecom vendor Ericsson in 1994, shows its advantage by integrating with smart phones. It has changed how people use digital devices at home or office, and has transferred traditional wired digital devices into wireless devices. A host Bluetooth device is capable of communicating with up to seven Bluetooth modules at the same time through one link. The concept of Smart Living has offered better opportunity in convenience, comfort and security the home. In recent years, an open-source platform Android has been widely used in smart phones.

Android has a complete software package consisting of an operating system, middleware layer, and core applications. Different from other existing platforms like iOS (iPhone OS), it comes with Software Development Kit (SDK), which provides essential tools and Application Programming Interfaces (APIs) for developers to build new applications for Android platform in Java. Android platform has support for Bluetooth network stack, which allows Bluetooth-enabled devices to communicate wirelessly with each other in a short distance. The application of microcontroller in such an instrument will reduce cost. Primarily, the microcontroller is capable of storing and a programming. The microcontroller contains a CPU (central processing unit), RAM (random-access memory), ROM (read only memory), IO (input/output), serial and parallel ports, timers, and sometimes other built-in peripherals such as A/D (analog-to-digital) and D/A (digital-to-analog) converters.

There is a large variety of microcontroller on the market today. We will focus on a few versatile microcontroller chips called programmable interface controller ARM7 chips from PHILIPS. PHILIPS uses ARM7 to describe its series of ARM micro controllers. At controlling system side we have

Bluetooth module, micro controller and load controlling circuits. Whenever this blue tooth module receives command from its paired blue tooth transmitter then it transfers this command to micro controller. Micro controller will control the respective loads depends upon the command it received.

2. PROBLEM OUTLINE IN EXISISTING SYSTEM

In the earlier days the loads are controlled by using switches by going to the near of switch boards. As technology increases there were wireless technologies developed like IR, RF, and ZIGBEE etc. But these all technologies need a separate remote like transmitter object to operate the loads. Current advertising techniques are extremely costly. They require more money and time when proposed routinely since they require a dedicated employee to arrive to the targeted place of advertisement; thus, adding the cost of the transportation and all the equipment needed for changing or updating the advertisements. Recent announcements are all based on computers that are connected via wires, whereas the need is to have new ways of communications that go with the new trends and technologies.

3. PROPOSED SYSTEM

The objective of this project is to design and develop a smart home System using Bluetooth technology along with android mobile. The most advanced technology is Bluetooth. And the technology based on Android OS. By using this technology, we just need and android mobile and there is no separate remote. By using the mobile itself you can send commands to the Bluetooth module. The aim of this project is to controlling the home appliances like loads using Android mobile. By using android application we can control the loads from nearby places of our home/office/colleges or anywhere. The system intended to control electrical appliances by giving text as input by old age or elder people in house/office/colleges with relatively low cost design, user-friendly interface and ease of installation. Here we can also monitor temperature and humidity levels of the home.

4. SCOPE OF STUDY

The scope of study which is needed for the completion of this project involves the following criteria:
1. Architecture of LPC2148- ARM 7 knowledge.
2. Programming in C language.
3. The study of the serial communication.
4. Interfacing LCD with microcontroller.
5. Interfacing BLUETOOTH with microcontroller.
6. The circuitry and devices that is needed to construct the devices and establish the necessary communication between the devices.

5. LITERATURE REVIEW

In this, we will discuss about the information found by study and research that is critical and have an important value in the contribution of the whole project. It also gives some basic knowledge or theoretical base and is used as a foundation to successfully achieve the main objectives. Most of the literatures are from the related articles, journals, books and previous works of the same fields. These literatures are then compiled and use as a guidance to the work of this project. For the security system to work, the user device has to be able to communicate with the servers providing the security information. Connecting device to the system with wires is impractical and takes a lot of time. It also means there should be several public plugs around the building, where people can connect the wires from their mobile devices. That is why wireless technology is chosen to be used as the communication medium between the user's portable device and the guidance system, to allow a connectivity that requires very little effort from the user.

There are several different wireless technology standards on the market that could be used for creating a functional guidance system. While Bluetooth wireless technology was chosen for creating such a system, few other technologies are introduced and their capabilities are analyzed.

These technologies are: IrDA (Infrared Data Association) from infrared communications. Home networking and wireless LAN (Local Area Network) technologies from RF (Radio Frequency) data communication systems. DECT (Digital Enhanced Cordless Telecommunications) and mobile phone technologies from voice based communicating system. This paper presents the overall design of Home Automation System (HAS) with low cost and wireless remote control. This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home. The main control system implements wireless Bluetooth technology to provide remote access from smart phone. The design remains the existing electrical switches and provides more safety control on the switches with low voltage activating method. The switches status is synchronized in all the control system whereby every user interface indicates the real time existing switches status. The system intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation. The main aim of this project is to control the electrical appliances in home like lights, fans, motors, etc using Bluetooth module. These Bluetooth modules are more reliable, secure and low power modules and these modules do not require line of sight also.

Micro controller plays vital role in this system, Based on the controlling method it reads the input condition and control the loads accordingly. This system also consists of temperature and humidity sensor.

Room temperature and humidity level in the house is measured by the sensors that connected to the main control board. The indication from the sensor is able to remind the user to switch on/off the heater, fan or air cond. in the house. The home appliance on/off status and temperature or humidity reading are synchronized to the smart phone.

6. HARDWARE IMPLEMENTATION OF THE PROJECT

This briefly explains about the Hardware Implementation of the project. It discusses the design and working of the design with the help of block diagram and circuit diagram and explanation of circuit diagram in detail. It explains the features, timer programming, serial communication, interrupts of LPC2148 microcontroller. It also explains the various modules used in this project.

Project Design
The implementation of the project design can be divided in two parts.
- Hardware implementation
- Firmware implementation

Hardware implementation deals in drawing the schematic on the plane paper according to the application, testing the schematic design over the breadboard using the various IC's to find if the design meets the objective, carrying out the PCB layout of the schematic tested on breadboard, finally preparing the board and testing the designed hardware.The firmware part deals in programming the microcontroller so that it can control the operation of the IC's used in the implementation. In the present work, we have used the Orcad design software for PCB circuit design, the Keil µv4 software development tool to write and compile the source code, which has been written in the C language. The Proload programmer has been used to write this compile code into the microcontroller. The firmware implementation is explained in the next chapter. The project design and principle are explained in this chapter using the block diagram and circuit diagram. The block diagram discusses about the required components of the design and working condition is explained using circuit diagram and system wiring diagram.

Block Diagram of the Project and its Description
The block diagram of the design is as shown in Fig 1. It consists of Power Supply Unit, ARM 7 (LPC 2148), Bluetooth module, Fire sensor, Temperature sensor, lights and LCD. The brief description of each unit is explained as follows.

WORKING PROCEDURE
The main aim of this project is to provide the security to the home and control the electrical appliances in the home from the remote place using Bluetooth technology. For this project, we are using smart phone, in which we have to download and install the Bluetooth spp application from the play store and pair the Bluetooth in mobile with the Bluetooth module in the hardware kit.

First of all to open the door, we are using to sensors fire and temperature sensors. If one of these sensors goes beyond some threshold level then the information received by the android mobile in app. If the user wants to know the status of the sensors then you have send a predefined letter (S in this case) then the status was received. In the same manner, we can control the load also by sending the predefined letter to the controller. The code was written in the embedded c language using keil compiler and the relevant hex file was dumped into the LPC 2148 using flash magic software.
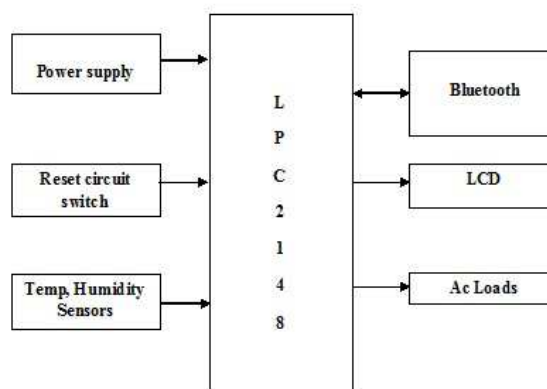
Block Diagram:

Fig 1: Block diagram

Android Mobile:

Firmware Implementation
Firmware implementation deals in programming the microcontroller so that it can control the operation of the IC's used in the implementation. In the present work, we have used the Orcad design software for PCB circuit design, the Keil µv4 software development tool to write and compile the source code, which has been written in the C language. The Flash magic programmer.

Software Tools Required

- Orcad
- Keil µVision4
- Flash Magic

Orcad is used for drawing the schematic diagram, it is mentioned above. Keilµv4, Flash magic are the two software tools used to program microcontroller. The working of each software tool is explained below in detail.

Programming code description

A compiler for a high level language helps to reduce production time. To program the LPC2148 microcontroller the Keil µv4 is used. The programming is done in the embedded C language or Assembly language. Keil µv4 is a suite of executable, open source software development tools for the microcontrollers hosted on the Windows platform.

Keil Compiler

Keil compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code. The compilation of the C program converts it into machine language file (**.**hex). This is the only language the microcontroller will understand, because it contains the original program code converted into a hexadecimal format. During this step there are some warnings about eventual errors in the program. If there are no errors and warnings then run the program, the system performs all the required tasks and behaves as expected the software developed. If not, the whole procedure will have to be repeated again. Below figures show the compilation of the program.
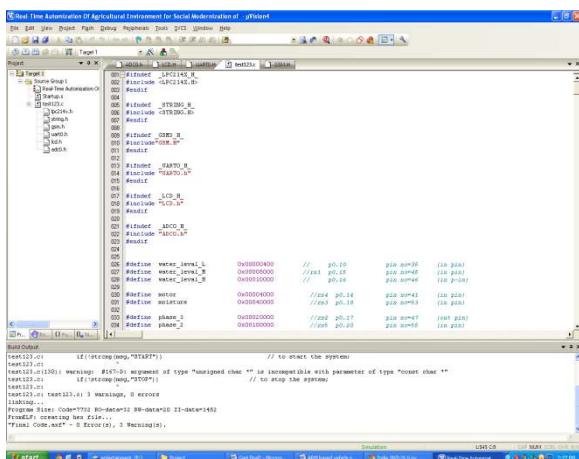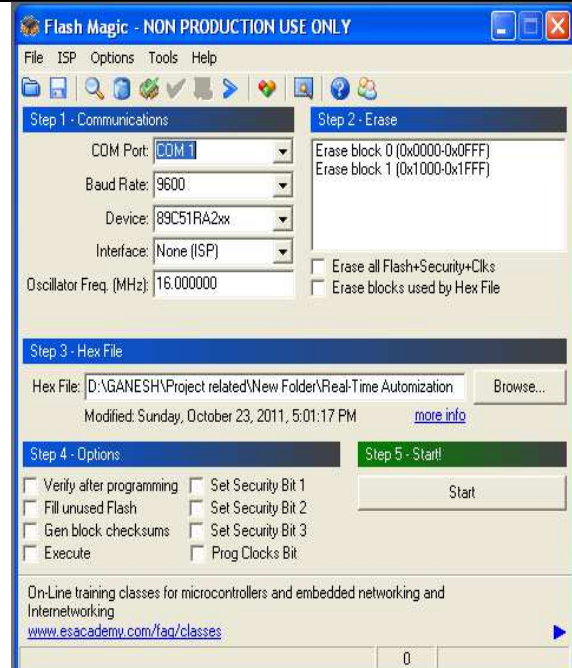

Figure: Compilation of source Code.

Flash magic

Flash Magic is a PC tool for programming flash based microcontrollers from NXP using a serial or Ethernet protocol while in the target hardware. The figures below show how the baud rate is selected for the microcontroller, how are the registers erased before the device is programmed.

Dumping of the code into Microcontroller

7. RESULTS

The implementation and realization of **"SMART HOME SYSTEM USING ANDROID APPLICATION"** is done successfully. The communication is properly done without any interference between different modules in the design. Design is done to meet all the specifications and requirements. Software tools like keil uvision simulator, Flashmagic to dump the source code into the microcontroller, orcad lite for the schematic diagram have been used to develop the software code before realizing the hardware. Circuit is implemented in Orcad and implemented on the microcontroller board. The performance has been verified both in software simulator and hardware design. The total circuit is completely verified functionally and is following the application software. It can be concluded that the design implemented in the present work provide portability, flexibility and the data transmission is also done with low power consumption.

8. CONCLUSION

The objective of the project is to realize the Smart Living, more specifically the home security system using Bluetooth technology. The system has been successfully designed and prototyped to monitor and control the home from dangers using an Android Bluetooth-enabled phone and Bluetooth modules.

In this project, Android based smart home security system that can be controlled remotely is proposed and implemented. Any android supported device can be used to install the smart home app, and control and monitor the smart home environment. A low cost smart home system has been developed which does not require a PC as all processing is handled by the microcontroller.

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