

Voice Controlled Home Automation Using Microcontroller and Android application

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Abstract: Automation is a trending topic in the 21st century making it play an important role in our daily lives. The main attraction of any automated system is reducing human efforts and time. Our paper presents an idea of microcontroller based voice controlled home automation system using android applications of smartphones. Such a system will enable users to have control over every appliance in his/her home with their voice, all that the user needs is an android Smartphone and a control circuit. The control circuit consists of 8051 microcontroller, which processes the user commands and controls the switching of devices. The connection between the microcontroller and the Smartphone is established via Bluetooth widespread wireless technology used for sharing data.

Keywords: Microcontroller, Android application, Bluetooth, Automation.

1. INTRODUCTION

Home automation is not a new concept in today's world, it is used to provide convenience for user to remotely control and monitor the appliances and it provides a better use of electricity. The efficient use of electricity makes the HOME automation to play an important role in daily life. As by the growth of PC (personal computers), internet, mobile phone and wireless technology makes it easy for a user to remotely access and controls the appliances solutions have been proposed to remotely access the HOME appliances. Some of them used internet, wireless technology to communicate and control home appliances, others used Bluetooth and GSM technology for controlling the home appliances.

Proposed method reduces the wiring and complexity of the system. A lot of research has been done and many. It provides portability to the system. It is mainly focused on the elderly people, disables and for the people who are unable to type text or face difficulties in typing. For the disable people, it is quite difficult to operate the HOME appliances physically or they are unable or feel uncomfortable to type a text so as to switch on/off the relative device. So a system has been developed to monitor the Appliances remotely by simply running the mobile application and giving voice command.

The mobile application efficiently converts the voice command to text and transfers it to the Bluetooth network. It is affordable to everyone, cheap and easy to install. As there is no wired communication between the remote user and appliances control module and the electronic devices used to control are easily available making it a cost effective solution. The technology used to develop the system is Java for mobile and Eclipse for android application and Bluetooth interface for wireless communication between home mobile and hardware control module. There are various areas where automation can be built.

2. HOME AUTOMATION

Home automation may designate an emerging practice of increased. Automation of household appliances and features in residential dwellings, particularly through electronic means that allow for things impracticable, overly expensive or simply not possible in recent decades. Home automation includes all that a building automation provides like climate controls, door and window controls, and in addition control of multimedia home theatres, pet feeding, plant watering and so on.

3. MICROCONTROLLER

A microcontroller is an inexpensive single-chip computer. Single-chip Computer means that the entire computer system lies within the confines of the Integrated circuit chip (Byte, 2002). The microcontroller on the encapsulated silver of silicon has features similar to those of our standard personal computer. Its ability to store and run unique programs makes it extremely versatile, and its ability to perform math's and logic functions allows it to mimic sophisticated logic and electronic circuits.

Microcontrollers are used in automatically controlled products and devices such as automobile engine control systems, remote controls, office machines, appliances, power tools and toys. Hence, microcontrollers due not function in Isolation, they accept input from one or more devices and provide output to other devices within a given system. In fact, they are responsible for the intelligence in most smart devices in the consumer market. The microcontroller has two general architecture types that define its mode of operation and design.

3.1 Von-Neumann Architecture

This architecture has a single, common memory space where both program instructions and data are stored. There is a single data bus which fetches both instructions and

data. And each time the CPU fetches a program instruction it may have to perform one or more read/write operations to data memory space. It must wait until these subsequent operations are complete before it can fetch and decode the next program instruction. The advantage to this architecture lies in its simplicity and economy. On some Von Neumann machines the program can read from and write to CPU registers, including the program counter. This can be dangerous as you can point the processor to memory blocks outside program memory space and careless processor manipulation can cause errors which require a hard reset.

3.2 Harvard Architecture

This architecture implements separate memory areas for program instructions and data. There are two or more internal data buses which allow simultaneous access to both instructions and data. The CPU fetches instructions on the program memory bus. If the fetched instruction requires an operation on data memory, the CPU can fetch the next program instruction while it uses the data bus for its data operation. This speeds up execution time at the cost of more hardware complexity. Most modern microcontrollers have the Harvard architecture.

4. WIRELESS COMMUNICATION

4.1 Infrared

Infrared (IR) radiation is electromagnetic radiation whose wavelength is longer than that of visible light (400 – 700 nm), but shorter than that of microwave radiation. Its wavelength spans between 750nm and 100 μ m and is employed in Short-range communication among devices that conform to the standards published by the Infrared Data Association (IrDA).

Remote controls and IrDA devices use infrared light-emitting diodes (LEDs) to emit infrared radiation which is focused by a plastic lens into a narrow beam. The beam is modulated, i.e. switched on and off, to encode the data. The receiver uses a silicon photodiode to convert the infrared radiation to an electric current. It responds only to the rapidly pulsing signal created by the transmitter, and filters out slowly changing infrared radiation from ambient light. Infrared Communications are useful for indoor use in areas of high population density. IR does not penetrate walls and so does not interfere with other devices in adjoining rooms. Infrared is the most common way for remote controls to command appliances

4.2 Bluetooth

Bluetooth is an open wireless protocol for exchanging data over short distances from fixed and mobile devices, creating personal area networks (PANs). It was originally conceived as a wireless alternative to RS232 data cables. It can connect several devices, overcoming problems of synchronization. It is a standard and a communications protocol primarily designed for low power consumption, with a short range (power-class-dependent: 1 meter, 10

meters, 100 meters) based on low-cost transceiver microchips in each device. Bluetooth makes it possible for devices to communicate with each other when they are in range. Because the devices use a radio (broadcast) communications system, they do not have to be in line of sight of each other. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 frequencies. In its basic mode, the modulation is Gaussian frequency-shift keying (GFSK). It can achieve a gross data rate of 1 Mb/s. Bluetooth provides a way to connect and exchange information between devices such as mobile phones, telephones, laptops, personal computers, printers, Global Positioning Systems (GPS) receivers, digital cameras, and video game consoles through a secure, globally unlicensed Industrial, Scientific and Medical (ISM) 2.4 GHz short-range radio frequency band. The Bluetooth specifications are developed and licensed by the Bluetooth Special Interest Group (SIG). The Bluetooth SIG consists of companies in the areas of telecommunication, computing, networking, and consumer electronics (Wikipedia, 2009).

4.3 Ethernet

Ethernet defines a number of wiring and signalling standards for the Physical connection of two or more devices together. Ethernet was originally based on the idea of computers communicating over a shared coaxial cable acting as a broadcast transmission medium. The methods used show some similarities to radio systems, although there are fundamental differences, such as the fact that it is much easier to detect collisions in a cable broadcast system than a radio broadcast. The common cable providing the communication channel was likened to the ether and it was from this reference that the name "Ethernet" was derived (Wikipedia, 2009). From this early and comparatively simple concept, Ethernet evolved into the complex networking technology that today underlies most local area networks. The coaxial cable was replaced with point-to-point links connected by Ethernet hubs and/or switches to reduce installation costs, increase reliability, and enable point-to-point management and troubleshooting. Star LAN was the first step in the evolution of Ethernet from a coaxial cable bus to a hub-managed, twisted-pair network. The advent of twisted-pair wiring dramatically lowered installation costs relative to competing technologies, including the older Ethernet technologies. Through the physical connection, Ethernet stations communicate by sending each other data packets, blocks of data that are individually sent and delivered. Despite the significant changes in Ethernet from a thick coaxial cable bus running at 10 Mbps to point-to-point links running at 1 Gbit/s and above, all generations of Ethernet (excluding early experimental versions) share the same frame formats (and hence the same interface for higher layers), and can be readily interconnected. And due to the ubiquity of Ethernet, the ever-decreasing cost of the hardware needed to support it, and the reduced panel space

needed by twisted pair Ethernet, most manufacturers now build the functionality of an Ethernet card directly into computer and laptop motherboards, eliminating the need for installation of a separate network card.

5. METHODOLOGY

In designing a home automation system, one or more suitable platforms are used in order to build a reliable and flexible system that can be easily operated and adapted for a new household appliance. Therefore, for the purpose of this project some specific deliberate choices were made on the type of platforms, hardware components and mode of operation of the home automation system.

5.1 Preliminary Considerations

Before the actual design of the project work, specific deliberate choices in selection of appropriate implementation platforms and hardware components were made. Priority was given to low cost availability, reliability, flexibility and simplicity in all these selections

5.2 Selection of Implementation Platform

As already explained in the previous chapter, there are many platforms over which a home automation system can be implemented. Of the currently available platforms – Power line, RS232, Ethernet, Bluetooth, Infrared, GSM and Microcontroller; RS232, GSM and Microcontroller were found most appropriate due to their low cost availability, reliability and simplicity when used for an individual control home automation system. Power line and Ethernet is too expensive and complex for this kind of home automation system, while GSM and Infrared are unreliable

5.3 Block Diagram

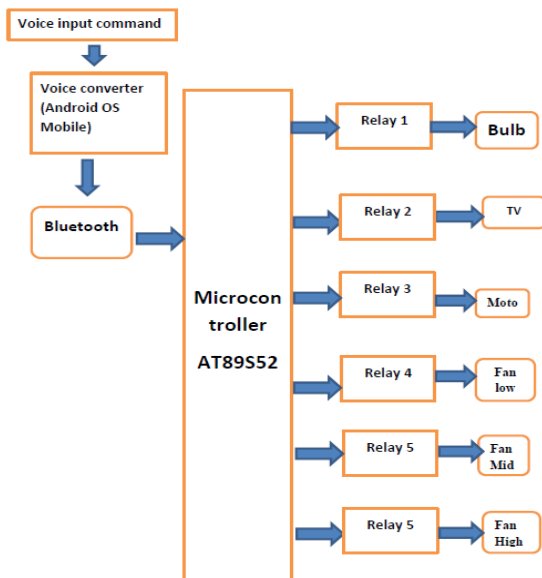


Fig.5.3.1 Block Diagram of Voice Controlled Home Appliances

5.4 Block Diagram Description

This project mainly consists of following blocks

1. Android mobile
2. Bluetooth receiver unit
3. Microcontroller
4. Relays
5. Output Relay

5.4.1 Android app

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android is a software platform and operating system for mobile devices based on the Linux operating system and developed by Google and the Open Handset Alliance. It allows developers to write managed code in a Java-like language that utilizes Google-developed Java libraries, but does not support programs developed in native code. The unveiling of the Android platform on 5 November 2007 was announced with the founding of the Open Handset Alliance, a consortium of 34 hardware, software and telecom companies devoted to advancing open standards for mobile devices. When released in 2008, most of the Android platform will be made available under the Apache free-software and open-source license.

5.4.2 Relay

Relay is a small electrical switch consisting of an electromagnet (coil), a Switch and a spring, that opens and closes under the control of another electrical Circuit. The spring holds the switch one position, until a current is passed through the coil; the coil generates a magnetic field which moves the switch. Because the relay is able to control an output circuit of higher power than the input circuit, it is often used to automatically switch large electrical power devices.

6. DESIGN AND IMPLEMENTATION

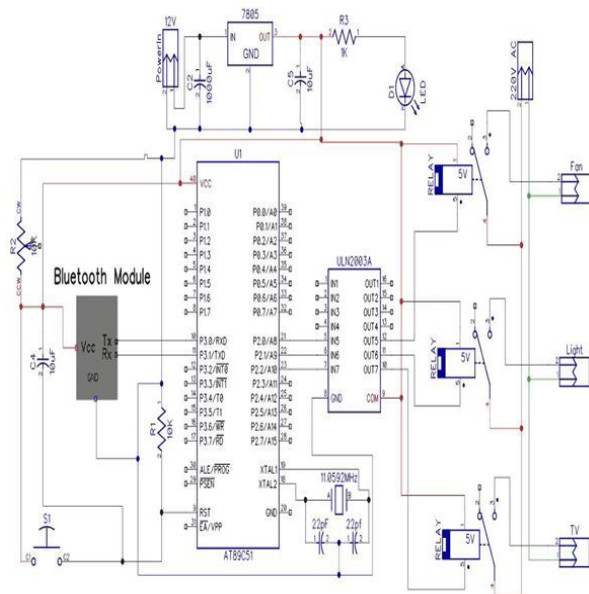


Fig.6.1 Circuit Diagram of Actual implementation

7. CONCLUSION

The aim of this project was to remotely control home devices via an Android Smartphone. We have developed a Central application, which is the gateway between the two worlds. This project gives a great contribution to conservation of electricity and also acts as boon to physically handicapped, old age people and minimizes the human efforts.

8. REFERENCES

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BIOGRAPHIES



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