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Android and Bluetooth Based Voice Controlled Wireless Smart Home System

R Manisha[1], Namitha S N[2], Nethravathy S[3], Nethra Priyadarshini S[4], Mrs Meenakshi[5]

Dept of Computer Science & Engineering, NMIT, Bangalore, India[1,2,3,4]

PhD Scholar, Assistant Professor, Dept. of Computer Science & Engineering, NMIT, Bangalore, India[5]

Abstract: Home automation system, is designed to assist and provide support in order to fulfil the needs of elderly and disabled people at home. It has been designed for mobile phones having android platform,to automate Bluetooth interfaced microcontroller which controls home appliances like lights, fans. It presents the automated approach of controlling the devices in a household that could ease the task of using the traditional method of the switch. The most famous and efficient technology for short range wireless communication-Bluetooth,is used here to automate the system has been around for more than a decade. In this project, a voice controlled wireless smart home system has been presented for elderly and disabled people. The proposed system consists of two components namely (1)voice recognition system, (2) wireless system. Android application has been used for voice recognition system. On the other hand, Bluetooth wireless modules have been used to implement the wireless system.

Keywords: Wireless System, Android application, Wireless Smart Home System, Bluetooth, Voice Controlled.

1. INTRODUCTION

In Home Automation Project, a voice controlled smart system is been presented for elderly and disabled people to make their purposes and needs easy. This proposed system has two main components namely (a) voice recognition system, and (b) wireless system. Android application has been used for voice recognition system. On the other hand, Bluetooth wireless modules have been used to implement the wireless system.
The main goal of this system is to control electronic home appliances through voice commands. It can recognize the input voice commands from a user, convert them into a required data format, and send the data through the wireless transmitter. Based on the data received at the wireless receiver associated with the gadgets, desired switching operations are performed. The proposed system is a low cost and low power home automation system since Bluetooth is used. In addition, this smart system needs to be trained of voice
Commands just once. Thereafter, the system can then recognize the voice commands independent of vocabulary size, noise, and speaker characteristics (i.e.-accent).
Home automation system has been around for more than a decade. The main concept is to form a network connecting the electrical and electronic appliances in a house. This is a growing technology, which has changed the way people live. [1] According to the data published by the market research and market intelligence from ABI about 4million home automation system were sold globally in 2013. It is also estimated by the same organization that 90million homes worldwide will employ home automation systems by the end of 2017. [2]There have been several commercial and research versions of smart home system introduced and built. But, none of the versions has broken through the main stream yet other than security systems. Smart home systems have captured many desperate technologies so far and products have been in the market for more than one decade. [3]Many companies have entered in this field including Google. Google has announced an ambitious project named android@ home for smart home platforms. Some of the reasons for the failure have been studied and listed below:

- Cost: The existing systems are expensive and are owned by rich families with large house and estates.
- Difficult to install: Expert professionals are needed to install and configure the system.
- Difficult to use: The control interfaces have poor quality and are not user-friendly.
- Vendor dependency: Need to use separate systems for different company's appliances.
- Less functionality: Most of the systems can either monitor or control the functions.
- Not customized: Most of the systems are not customized with the needs of the users.

Wireless communication based home automation system has gained a high momentum for the last couple of years. Wireless communication reduces the complexity related to the installation and maintenance compared to its wired counterpart. A typical wireless home automation system comprises of battery operated and low power wireless sensors and actuators. Bluetooth, WI-Fi and Zigbee are the popular choices for the backbone of such systems. [4]Wireless network based smart home systems have become very popular as they provide comfort, security and safety. The

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availability of cheap wireless sensors and actuators and modules has reduced the gap between the luxury and mass-market segmentation of home automation technologies.

A typical wireless home automation system should deal with the following constraints:

- High interference
- Multi-chip end to end connectivity
- Dynamic topology
- Various traffic patterns
- Internet connectivity
- Secured communication

A typical wireless home automation system consists of two main parts:

- The user interfaces- It is used for monitoring and controlling the system.
- Communication protocol- It is used for getting data to and from the home appliances.

A voice controlled home automation system has drawn considerable attentions in the recent years. Considering all the above mentioned advantages we have selected Bluetooth. [5]Initially, home automation system were designed for the people seeking luxury and sophisticated home. But there was always a need to develop home automation system for the people with special needs like elderly and disabled. According to the report published by the WHO, around 785 million people of 15 years and older live with disability of these, the world health survey reports that 110million people have significant difficulties in function. [6]In order to assist the old people and the people with disability, home automation technologies are adopting voice-controlled or voice recognition technologies. The main idea is to control and monitor home appliances by using speech recognition.
One of the experimental works on the android and Bluetooth based home automation system was presented here. Voice control system for Bluetooth based home automation has been introduced. In this system, Bluetooth device receives voice commands as input to the Renesas microcontroller, which converts the data into a required format to be used in the microcontroller.
[7] Finally the system generates some control factors to switch on/off the home appliances. A client-server based voice control system for home automation has been presented. Voice command is captured by the client. The server system converts the voice commands into a form that is used to control the home appliances.
Android mobile based voice command control and monitoring system have been implemented here, in which artificial intelligence has been used for voice recognition. Our work is different from other related works in the following ways: We use Bluetooth and android application here. The user interface is easier to design and implement. The system can be remotely controlled by a mobile or a computer and it can easily be extended to include more appliances. The system is easy to install and configurable. Unlike other related systems, no expertise skills are required to install and configure this system. Android's voice recognition library has been included in our work. [8]The system can recognize the voice commands independent of vocabulary size, noise, speaker characteristics or accent.

2. MATERIALS AND METHODS

2.1 System Design

(Figure 1) Illustrates the overall control function of the Home Automation System (HAS). This system is installed directly into the wall. Bluetooth device helps to connect the device (Smart Phone) with the Graphical User Interface (GUI) wirelessly. An Android app is created to send the commands to Renesas Microcontroller through Bluetooth device. Input of the commands is voice based. Google text speech is used to give the voice input. Upon receiving the command the microcontroller drives the motor driver to change the state of led or fan. An emergency switch is provided,if its state is changed, voice output will be played on the android device saying "It's an Emergency... Please Help!!"LCD displays the commands being executed by the microcontroller.

2.2 Hardware Design

This section discusses about the hardware construction of HAS. Figure 2 shows the circuit connection of Home automation system. The main control unit here is Renesas Micro-controller, R5F100LE which is used because it has serial interface features to establish Bluetooth connectivity. Renesas microcontroller auto generates code for the chosen ports also, which is useful in coding.Renesas Microcontroller operates at 32MHz.It is a 16 bit microcontroller.RAM capacity is 4kb.Input voltage is 12V but for this microcontroller 5V is enough so we use voltage regulator to cut down the voltage. It is a 64 pin microcontroller but we use only 58 pins, other 6 pins are reserved.
For Bluetooth module HC-05 serial Bluetooth Module is used to establish connectivity between main control board and GUI. The Motor Driver (L293D) is an integrated circuit used to drive fan and led light. It is used to vary the speed of

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fan and control the brightness of led light. It requires 12V and 5V power supply. It is a dual channel which controls two motors i.e. fan and led light with a single IC.(Integrated Circuit). It uses 10 logic i.e. if it is 1(high), fan andled light is enabled, if it is 0 (low), fans and led light is disabled. LCD (liquid Crystal Display) is used to display the commands executed by the controller.

Light Emitting Diode(LED) is a semiconductor light source. This is used as prototype for the lights present at homes. Using this one can control the brightness of the led light through the commands. CPU FAN is basically used for cooling down the CPU system. In the regard we can make use of this as a prototype for the fans present at homes. When current is passed through the coil it creates magnetic field and the coil rotates which in turn rotates the fan. Emergency switch has three connections, for voltage, ground and to port. The initial value of the switch will be zero. If the switch state is changed to 1, a command is sent to the android app through Bluetooth which will give a voice output on the android app saying "It's an emergency…please help!!!"

2.3. Software Design

Software design section includes the main functions of the system designed in the microcontroller and the GUI (Android). (Figure 3) The android app provides a login page which can be accessed by a particular user. After the login is successful Android Main Page appears (Figure 4). If Bluetooth is not enabled, a pop up message will appear to enable the Bluetooth. After this, Bluetooth module in the circuit is paired with the device Bluetooth and is connected. When input voice command is given it is sent to the micro controller, which executes the command.

Renesas microcontroller is programmed through Cubesuite+ software. Ports are chosen accordingly and using the registers or buffers available, the program is coded. The program is compiled. After compilation a .hex extension file is generated, which is dumped onto the microcontroller. Upon receiving the command through Bluetooth the functions written into the microcontroller are executed.

To dump the code onto the microcontroller we use NAND Flash through a software Flash programmer. NAND flash is a type of non-volatile storage that does not require power to retain the data.It can be electrically erased and re-programmed. The advantage of NAND flash is faster to program and erase time.

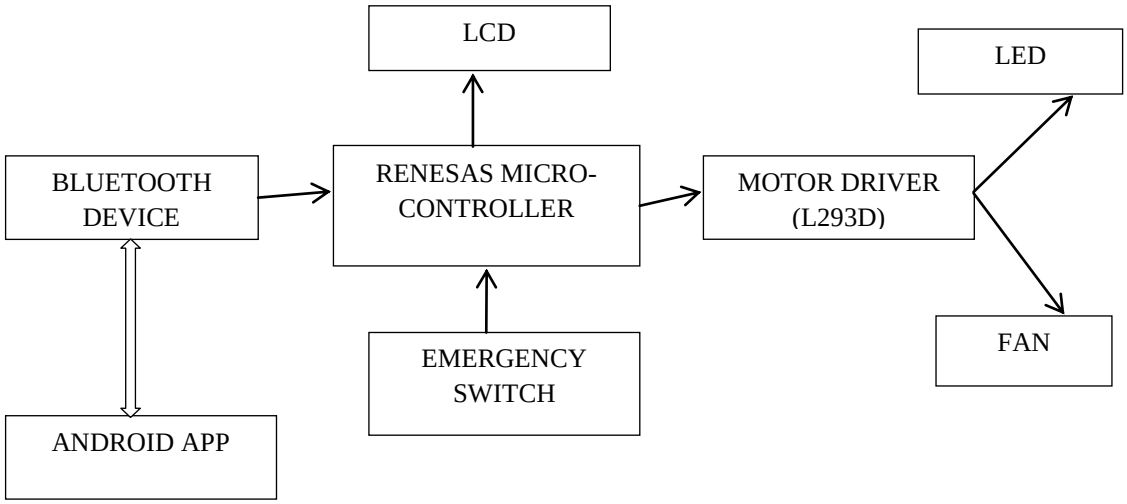

Figure 1:Block diagram of home automation system

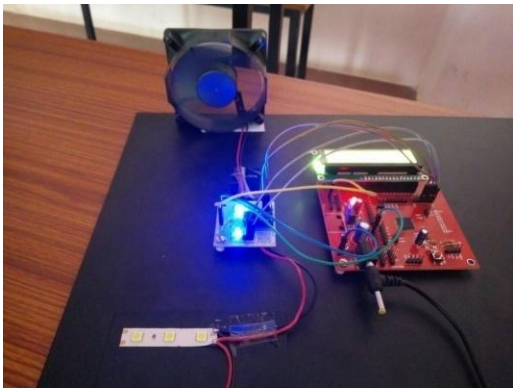

Figure 2: Circuitry for Home automation system

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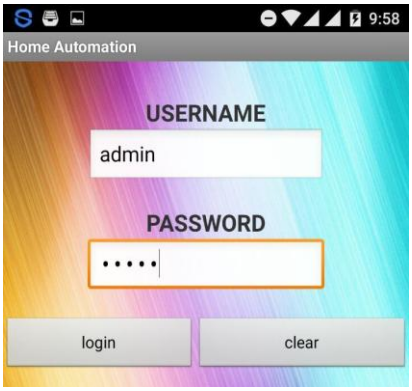

Figure 3: Android Login Page

Figure 4: Android Main Page

4. CONCLUSION

Due to tremendous growth in technology and advancement in wireless communication, smart way of living has turned out to be a major part in the present era of human life. Design and implementation of home automation system using android for mobile phone has been discussed. The remote controlled function by smart phone provides help and assistance especially to disabled and elderly people. This proposed system has two main components namely voice recognition system, and wireless system. Android application has been used for voice recognition system. On the other hand, Bluetooth wireless modules have been used to implement the wireless system. Home automation application program is tested on various android mobile phones. The Home Automation System furnishes a good paradigm for any automation system based on android mobile phone and Bluetooth.

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