DESIGN AND IMPLEMENTATION OF SMART AUTOMATION SYSTEM

N Prameela and N Tulasichitra
Department of Computer Science and Engineering,
MLR Institute of Technology, Hyderabad, India.

R Karthik
Department of Electronics and Communication Engineering,
MLR Institute of Technology, Hyderabad, India.

ABSTRACT

The project Voice based home automation using Bluetooth project helps to control the electrical devices based on Bluetooth input signal. Here The Bluetooth device receives this input signal from android mobile. This system is especially useful in case of handicapped, disabled people or aged people who find it difficult to walk and operate the electrical switches to turn on or off the loads. This smart home automation system solves this type of issue as now the user just has to give voice commands in the android phone to turn on or off the devices. Here two devices are used to demonstrate light & fan. All these electrical devices can be individually turned ON or OFF or all devices at the same time. This system solves the issue by interfacing a unit with home appliances that switches these devices based on the input signals received from android mobile. The Android app also provides an effective Google speech for providing this functionality.

Key words: ArduinoUno, HC-05 Bluetooth Module, Home Automation, Android phone.

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1. INTRODUCTION

Wireless technologies are becoming more popular around the world and the consumers appreciate this wireless lifestyle which gives them relieve of the well-known “cable chaos” that tends to grow under their desk. Concepts on smart home application and development include various implementation techniques and are never limited. Smart home systems are created based on analysis on client needs and budget to cater for the system. With technologies
available today, efficient integration of this system could be achieved. Now, advancement in wireless technology introduced new ideas such as Bluetooth and cloud, GSM, Internet linking; Wi-Fi, which has been slowly replacing the conventional wired technology which requires wire bonded interconnection between electrical devices.

The purpose of this project is to present an approach to design an interaction home controlling system for user, which functioning properly and is easy to use. Home control system involves the home automation and monitoring where users can control lighting, and switch electronic appliances using only their voice. Home automation can design in many types of scope and aspects such as a one-stop centre 2 control panel, objects for identification sensors or voice recognition. For this project, voice will become the main concept. Home control system interface must have the characteristic of a friendly user and does not provide complex tasking. The areas inside the house will be defined where automation is most desirable. Voice commands will classify to indicate the type of vocabulary word by using engineering software.

2. SYSTEM DESIGN

2.1 System Components

![Block Diagram of the System](image)

The Voice-operated Android mobile and Arduino Home automation system uses an Android based Bluetooth enabled phone for its application and the Arduino Uno as the microcontroller. The key components of this system are:

- Android based phone
- Bluetooth module
- Arduino Uno
- Relay boards

2.2. Android Based Phone

Android is a mobile operating system (OS) based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, the OS uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse
pinching to manipulate on-screen objects, and a virtual keyboard. We have used the Android platform because of its huge market globally and it’s easy to use user interface.

Applications on the Android phones extend the functionality of devices and are written primarily in the Java programming language using the Android software development kit (SDK). The voice recognizer which is an in-built feature of Android phones is used to build an application which the user can operate to automate the appliances in his house. The user interface of the application is shown below:

![Interface for the Voice Control Application](image)

**Figure 2** Interface for the Voice Control Application

The microphone button is tapped and the voice command is given to switch the corresponding device on/off. The voice recognizer listens and converts what is said to the nearest matching words or text. The Bluetooth adapter present in the phone is configured to send this text to the Bluetooth module on the Arduino Uno board that would in turn control the electrical appliances through the relay boards.

### 2.3 Bluetooth Module

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs). The Bluetooth module being used allows us to transmit and receive signals. It receives the text from the Android phone and transmits it to the serial port of the Arduino Uno.

![HC-05 connectivity with Atmega328p](image)

**Figure 3** HC-05 connectivity with Atmega328p
The Bluetooth module being used here is the HC-05 module. It is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has a slave default Baud rate of 9600. It auto connects to the last device on power as default. Pairing pin code is “1234” as default.

2.4 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328p. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller. We either need to connect it to a computer using a USB cable or power it with an AC-to-DC adapter. The Arduino circuit acts as an interface between the software part and the hardware part of the project.

The Bluetooth module transmits the text to the Arduino Uno serial port. The text is matched against the various combinations of predefined texts to switch the appliances on/off. The appliance name and a command for on/off are stored as predefined command. For example, to switch on a television the user needs to say “television on” and to switch it off he needs to say “television off”. The appliances are connected via the relay boards to pin numbers 2, 3 and 4 of the Arduino Uno. When the matching text is detected the corresponding pin number is given a high or low output signal to switch the appliance on and off respectively.

2.5 Relay Boards

A relay is an electromagnetic switch. In other words it is activated when a current is applied to it. Normally a relay is used in a circuit as a type of switch (as shown below). There are different types of relays and they operate at different voltages. When a circuit is built the voltage that will trigger it has to be considered. In this project the relay circuit is used to turn the appliances on/off. The high/low signal is supplied from the Arduino Uno microcontroller. When a low voltage is given to the relay of an appliance it is turned off and when a high voltage is given it is turned on. The relay circuit to drive four appliances in the Voice-operated Android and Arduino Home automation system is shown below. The number of appliances can be modified according to the user’s requirements.
3. IMPLEMENTATION

Using the above mentioned components we implement our system on a breadboard. The microcontroller device with the Bluetooth module and relay circuit needs to be attached with the switch board. Then we need to launch the android based application-“BTVOICE APPLICATION” on our Smartphone. Through the application we can instruct the microcontroller to switch on/off an appliance. After getting the instruction through the Bluetooth module the microcontroller gives the signal to the relay board.

The application first searches for the Bluetooth device. If it is available then it launches the voice recognizer. It reads the voice and converts the audio signal into a string. It produces a value for each appliance which will be given to the microcontroller device. The microcontroller uses the port in serial mode. After reading the data it decodes the input value and sends a signal to the parallel port through which the relay circuit will be activated.

In this work we use Bluetooth module. We can also attach a GSM module to do the work, using which the application can be used anywhere where a mobile network is available. Some images to illustrate the working of the system have been given below.

![Application connecting to the Bluetooth device](image1)

Figure 5 Application connecting to the Bluetooth device

![Turning ON Bedroom Light 1](image2)

Figure 6 Turning ON Bedroom Light 1
4. FLOWCHART

![Flowchart of the entire system](image)

**Figure 7** Flowchart of the entire system

5. CONCLUSION

The proposed project undertakes a viable solution the need of automation at the very basic level, that is, in our homes. The project will enable us to bring every appliance at every corner of our home under our control from a single point without having to get up and manually switch on or off the appliance. The use of a Bluetooth module assists the use of this system from various locations in our house.

The system is further simplified by allowing appliances to be controlled by our voice. The user need not have to have to immense knowledge over the language of English. Just by saying the appliance name and the corresponding number assigned to that particular appliance, and telling it to switch on or off will enable the user to have complete control over any appliance without any effort.

Android applications are very simple and user friendly allowing the user to understand its functionalities in very little time. Hence, the use of android application in this system allows a user to easily learn the process and get accustomed to the functions. Moreover, the entire system is very flexible and scalable. Any number of appliances can be added as and when
required. Hence, the systems finds use not only in houses but also in many offices where appliances such as fans or lights on multiple floors can be controlled by a person on any of the floors, saving manual labour and human effort to switch on or off the electronic appliances, thereby saving time.

This system, though primarily aimed to reduce human effort, will be of much importance to old aged people and physically handicapped people. It will enable them to control their home devices with ease, without going through much pressure or stress of moving about.

Due to the inexpensive materials used in the construction and further cost optimization if the device is taken to the market, it finds application in a wide area. Scalability of the project would be considerably easier as the device can be used in every building using electrical appliances and devices.

In addition, there have been many advertisements broadcasted by the Government of India promoting awareness to switch off household appliances when not in use and thus save electricity. Hence, such a project would assist the initiatives taken by the government, as most people forget to switch off home appliances and are too lazy to return and switch it off.

REFERENCES


