Implementation of Android Voice Recognition for Smart Home Application using Bluetooth

S. Anita, S. Jothi

Abstract: ***Bluetooth technology is a low power wireless communication intended to replace the cables connecting many different devices. The low cost Bluetooth technology is open standard technology for implementing short range wireless communication. In this paper two android devices are connected through Bluetooth technology, which controls the electrical devices (Fan, Light) by Voice recognition. The developed system recognizes the voice commands, convert them into proper text and send the text through Bluetooth wireless medium. The received text is associated with ARM 11, performs the required switching operation and the output is acknowledged in the transmitter section. Hence, this paper has been presented for elderly and disabled people to control home appliances by voice recognition which offers high attention among public.***

Index Terms: Android, Bluetooth, Voice recognition, ARM 11

I. INTRODUCTION

In recent years, release of Android smart phone platform is an open sourcing mobile operating system based on Linux which is completely open and integrated platform for mobile devices. In this paper, If we speak Fan on, which is automatically converted in to proper text, is transmitted to ARM11(MINI 6410) board through Bluetooth device (IEEE 802.15.4). The controller controls the corresponding switching operation. The reply message (Voice) is again given to the Android transmitter. The existing paper carries out a "Bluetooth Remote Home automation system using android application". In this system the user can easily touch on the screen of the phone (Android GUI)/PC to control the home application by touch the icon. This method provides the facility to control the electrical devices without a walk to the switches on the wall through Bluetooth wireless technology. This portable system is able to assist the disabled people who have problem with locomotion difficulty. Here the PIC microcontroller to control the electrical devices [1]. Another popular Home automation system is Voice recognition based wireless home automation system in which voice command is compared with the previously stored value using Zigbee wireless technology [2]. In the paper [3] home automation can be done by Voice recognition by using Radio frequency(RF) technology in which the voice stored in the Database.

On the contrary, this E-control system incorporates Android, Bluetooth with the home application. So we can control the Electrical devices (Fan, light) with low cost by Voice to text conversion methodology and the controlled information will be received by transmitter by text to voice conversion.

Manuscript Received on March 2015.

S. Anita, Faculty, Department of Electronics and Communication Engineering, St. Anne's College of Engineering & Technology, Panruti, Cuddalore, Tamilnadu, India.

S. Jothi, Faculty, Department of Computer Science, Jayaraj Annapackiam College, Theni, Tamilnadu, India.

Our system based Android OS is created (Booting, Kernel and application file) according to our application which is explained in section II. Our proposed system is very useful in elderly disabled people.

II. ANDROID

Android is a Linux-core open-source operating system, mainly used in portable devices. Android operating system was originally developed by Andy Rubin, major support in mobile phone firstly. Purchased and injected by Google in 2005 which formed the Open Handset Alliance to develop and improve, Android gradually extended to the Tablet PC and other fields. Android operating system consists of four levels from the top to down, namely, the application layer, application frame work layer, component library layer and virtual machine & Linux kernel layer. As an open operating system, developers can use Java, C/C++ as the programming language to develop applications in Android. It also support a variety of other scripting language (such as: python, lua, tcl, php, etc.) by use of SL4A and others, such as: Qt (qt for android), Mono (mono for android) and some other well-known programming frameworks have begun to support the Android programming, even though MonoDroid. Developers can also use C# as programming language to develop applications. In addition, Google released Simple language which is similar to Basic languages especially for beginners in 2009. In Web programming language, JavaScript, ajax, HTML5, jquery, sencha, dojo, mobl, Phone Gap, etc. have been developed for Android. [10]. Android has built-in tools which make iteasy for applications to do that, while at the same time letting the system maintain control of what types of devices application is available to. With a bit of forethought and some minor changes in application's manifest file, it can ensure that users whose devices can't run application will never see it in the Android Market, and will not get in trouble by downloading it. This can explains how it can control which devices have access to its applications, and how to prepare its applications to make sure they reach the right audience. Android provides an open development platform and offers developers the capability to build greatly rich and innovative applications. Developers are free to be superiority of device hardware, access location information, run background service, set alarm, add inform to the status bar, and so on. Developers have full access to the same framework. The core applications use APIs. The application architecture is designed to simplify the reuse of components; any application can publish its abilities and any other application may then make use of those abilities. These same mechanism permits components to be replaced by the user.

From top to bottom Android platform is composed of the Linux kernel, system libraries, Android run time, application frame work and so on five parts. It is shown in Figure .1

A. Linux Kernel

Android relies on Linux 2.6 version. It provides core system services: security, memory management, process management, network group, driven model. The core part is equivalent to a abstract level between the hardware layer and other software in the systems.

B. Library and Android Runtime

Android includes a set of C/C++ libraries. Various components of Android system are use now. These functions are exposed to developers through the Android application framework. Android's core libraries provide most of the function to the Java class libraries. Every Android application runs in its own process, and enjoys the proprietary instance distributed by Dalvik virtual machine, and support multiple virtual machines efficiently run on the same device

C. Application Framework

Upper core application program of Android system is reply on frame arrangement API development, application Architecture can simplify component reuse mechanism. Any application can publish its own features. These functions can be used to any other application (of course, it is restricted from the framework constraints safety standards); and the same to reuse mechanism, the framework supports component replacement.

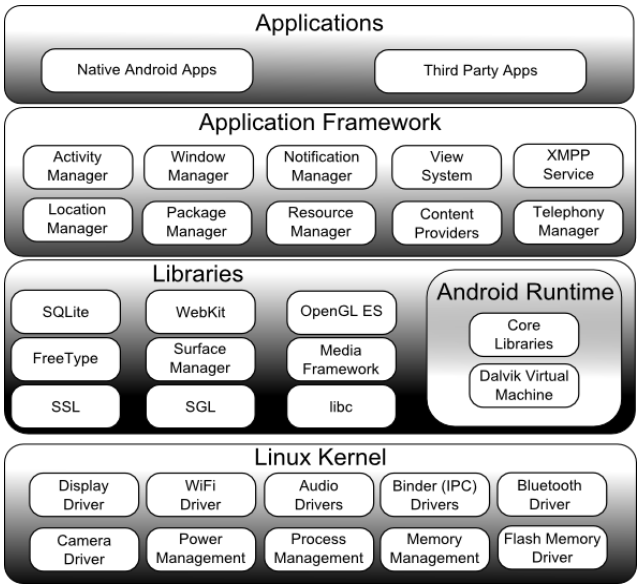

Fig. 1Android System Architecture

D. Applications

Android applications are written in Java programming language. The Android SDK tools compile the code along with any data and resource files—into an Android package, an archive file with an .apk suffix. All the code in a single .apk file is considered to be one application and is the file that Android-powered devices use to install the application. The Android platform default includes a set of core applications. It includes home, browser, communication services, contacts and other applications. These applications are written by the Java programming language. It can provide developers a reference. As the Android platform applications equality, developers can write their own applications to replace the default applications provided by Android.

III. PROPOSED SYSTEM DESIGN

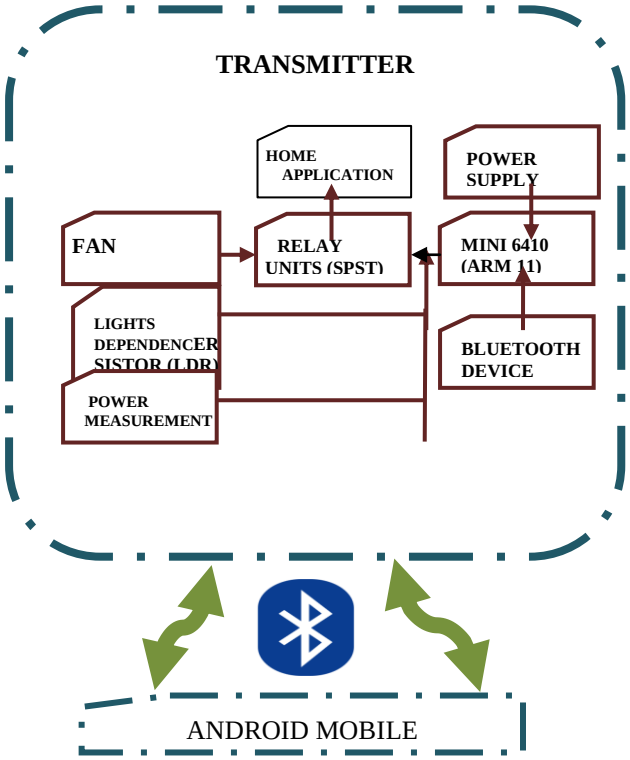

Fig. 2 Proposed system design

This section describes the conceptual design of a flexible and low cost android Bluetooth chatting system (figure 2).The controlling and monitoring message are transmitted and received by Bluetooth technology (IEEE 802.15.4) standard. This project consists of android phone in transmitter section and Arm microcontroller (Samsung mini6410), Bluetooth module; relay unit, temperature sensor and power measurement unit in receiver section. Arm controller is one of the advanced microcontrollers which is used to collect the Bluetooth data and touch with LCD display. Communication between two persons (Android, ARM 11) can be achieved by implementing the chatting apps. If We speak Fan/Light on /off automatically these voice data‘s are converted into text message (Speech to text code) and transfers via android mobile (Bluetooth) to Bluetooth device which is present in the receiving section. The controller mini6410 collects all the data’s via Bluetooth, then the received data will be compared with corresponding electrical devices to be on/off automatically through relay unit. The controlled information will be replied (Voice) to the transmitter through sensors and power measurement unit.

IV. HARDWARE SYSTEM DESIGN

ARM 11 systems (mini 6410)

Fig. 3.Mini 6410 board

The Mini6410 Single Board, as depicted in figure 3, is a high-performance controller board. It is designed based on the S3C6410 microcontroller, 256MByte DDRSDRAM, 1GByte N and Flash, RTC, Audio and net on board. It has integratedRS232, USB, Ethernet, Audio In/Out, Keyboard, LCD, CVBS,TV out, camera in,SD card and more other functions on board. So many hardware resources provided by the expansion board, it becomes a solid reference board for customer design. The board supports Linux 2.6.28, Android2.1 and Windows CE 6.0 operating system and is provided with complete basic drivers which enable a quick channel to evaluate the Samsung S3C6410 processor and customize application software. It would be an ideal development platform for multimedia and communication applications.

The Mini6410 board has 8 user buttons and their definitions are listed here.

Table.1 user buttons of mini 6410

User Button	Function	User Button	
K6	Up	K8	OK
K5	Down	K7	Cancel
K4	Left		
K3	Right		
K2	Menu (pressing "menu" and keeping it down for a while you will see the screen rotate)		
K1	Home		

Bluetooth system

V2.0 Bluetooth module is used which 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 2.4 GHz radio transceiver and baseband. The hardware structure of Bluetooth module is shown in fig.4.

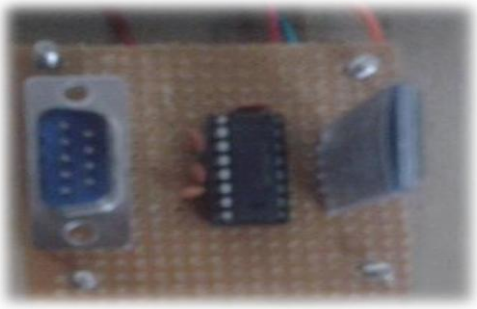

Fig. 4.Bluetooth system

Relay system

The relay system used is SPST (single pole single throw switch) is shown in fig.6.These have two terminals which can be connected or disconnected. Including two for the coil, such a relay has four terminals in total. It is ambiguous whether the pole is normally open or normally closed. The terminology "SPNO" and "SPNC" is sometimes used to resolve the ambiguity.

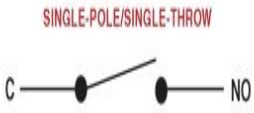

Fig. 6. SPST Switch

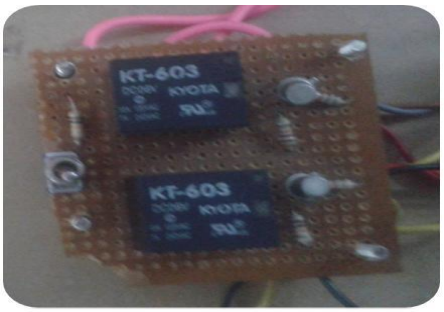

Fig. 6.Relay system

Light Dependent Resistor (LDR)

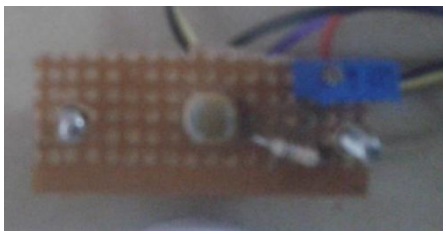

Fig. 7. LDR Unit

The figure 7 shows the hardware unit of LDR which is the product of Sunrom. LDRs are a very useful tool in a light/dark circuits. A LDR can have a variety of resistance and functions. For example it can be used to turn on a light when the LDR is in darkness or to turn off a light when the LDR is in light.

It can also work the other way around so when the LDR is in light it turns on the circuit and when it's in darkness the resistance increase and disrupts the circuit. The light source illumination for 60W bulb at 1m is 50.

V. SOFTWARE SYSTEM DESIGN

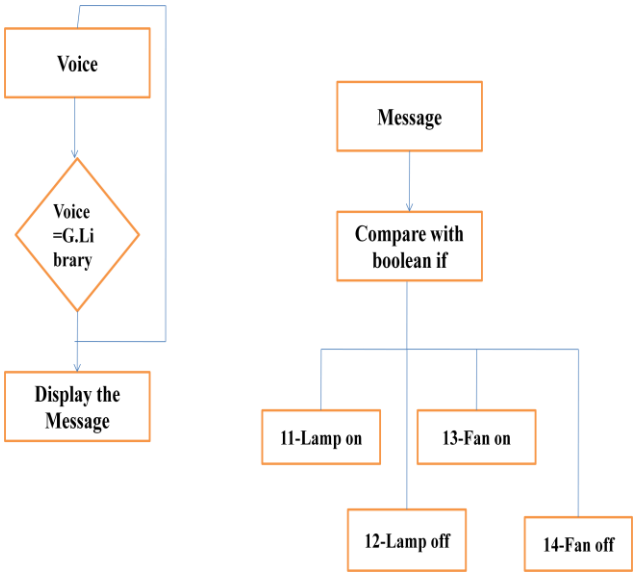

Fig. 8 Software system design

ANDROID sdk

Android is a software stack for mobile devices that includes an operating system, middleware and key application. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. It has the features of SQLite for structured data storage, Application framework enabling reuse and replacement of components, optimized graphics powered by custom 2D graphics library;3D graphics based on the OpenGL ES 1.0 specification and supports GPS, Compasses, Accelerated 3D graphics,EDGE,3G,WiFi,SMS messaging, MMS, Bluetooth, Video/still digital cameras and touch screen. The SDK includes set of development tools like Debugger, Libraries, An emulator, Documentation, Sample code and Tutorials.

Eclipse Software

It is an Integrated Development Environment provides many features to ease Java programming (and others, e.g. C/C++) Eclipse IDE + ADT (Android Development Tools) have the advantage of Reduces Development and Testing Time, Makes User Interface easier and make Application Description Easier. The programming languages are Java (officially supported), C/C++ (possible but not supported).The supported tools are adb (android debug bridge) which is act as an interface between emulator and connected device and ddms (dalvik debug monitor service)-acts as a port forwarding services between IDE's and emulator.

Implementation and Results

This section outlines the actual implementation of the proposed system. The entire system was broken down into smaller blocks in order to simplify the process.

Transmitter Section

My system has Android mobile in transmitter section in which Voice to text conversion code is written in terms of Eclipse software. If we speak light on, the corresponding voice is recognize and converted into digital data. This discrete data is compared with previous Google dictionary which is stored in the Server. The output of transmitter is text data which will be the source code to on the light. These data's are transmitted via Bluetooth.

Voice to Text conversion:

Using the below mention devoice to text conversion code, voice is compared with Google library and produced corresponding text.

Importandroid. Speech.RecognizerIntent;

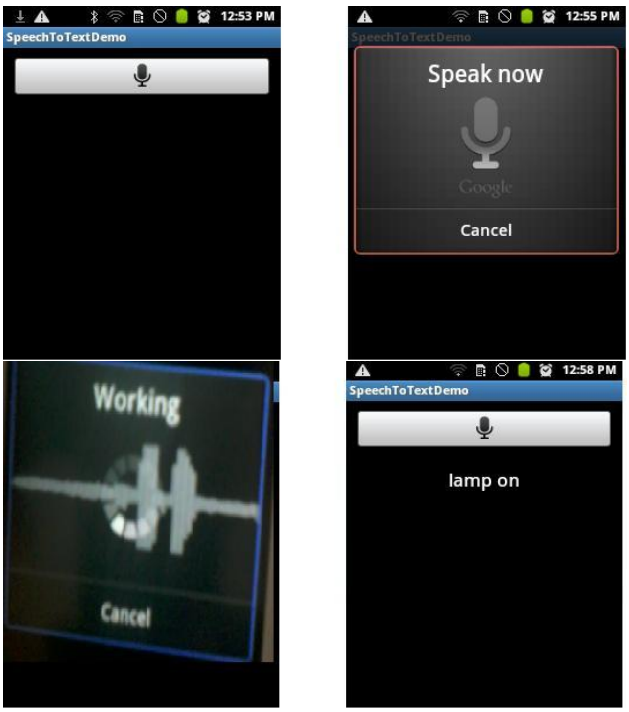

Fig. 9.Output for voice to text conversion

Receiver Section

The transmitted text is received by Bluetooth dongle in the receiver section, which is connected with Android OS in which MINI6410 board was constructed. This Mini6410 is act as controlling device to control the light/fan to ON/OFF. The transmitted text is received by Bluetooth dongle in the receiver section, which is connected with Android OS in which MINI6410 board was constructed. This Mini6410 is act as controlling device to control the light/fan to ON/OFF.

Text to voice conversion:

The controlled information will be propagated through Bluetooth dongle to the transmitter. Here the analog signal is generated for each character which will produce the Voice. The voice conversion code is as,

importandroid.speech.tts.TextToSpeech

importandroid.speech.tts. TextToSpeech.OnInitListener;

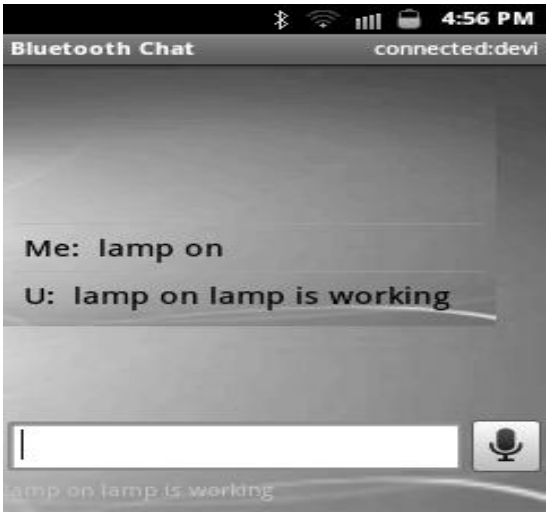

Fig. 10.Output for text to voice conversion

Android booting file creation:

In order to initialize and combine all peripheral files into one image file, Android booting file used. The applied booting file in our system is given as

U_boot_sd_raw256.bin

All these OS supported booting files are written in Linux.

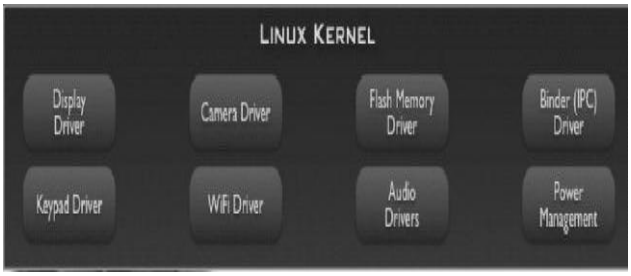

Fig. 10. ANDROID Kernel

Android kernel system:

The figure shows the structure of Android kernel. All the multimedia driver files are written in the kernel system. The kernel file is given as

azimage.bin

Android file system

Fig. 11. ANDROID File System

The Android application frame work is given in figure .Desired application program can be written in terms of Java.Our proposed application is known as

Bluetoothchatting.apk

Once the light is on, the temperature of the light is sensed by SunromLDR and the fan is sensed by power measurement circuit which consists of relay act as SPST. The measured value is again given to Mini6140.Through Bluetooth device text is propagated to Android mobile for conversion of voice.

VI. CONCLUSION

In this paper, we introduce the development of **E-Control Based on Android Bluetooth Chatting for Smart Home Application.** This system is used to control the electrical devices by low cost Bluetooth wireless technology without human intervention, which can be applicable only for a single room. For further development; we can apply this system to the whole home system. Still it needs to further improve the usability and functionality of the system.

REFERENCES

1. R.A.Ramlee,M.H.Leong,R.S.S.Singh,M.M.Ismail,M.A.Othman,H.A. Sulaiman,M.H.Misran,M.A.Meor Said," Bluetooth Remote Home Automation System Using Android Application", "The International Journal of Engineering And Science (IJES)",Volume 2,issue 01,2013,pp.149-153.
2. HumaidAishu"eili, GourabSen Gupta, Subhasukhopadhyay,"Voice Recognition Based Wirless Home Automation System", 4th International conference on Mechatronics", 2011.
3. KailashPatiDutta, PankajRai and VinceetShekher,"Microcontroller Based Voice Activated Wireless Automation System", VSRD International Journal of Electrical, Electronics & Communication Engineering", Volume 2,2012,pp.642-649.
4. Weihua pan, FucaiLuo, Lei Xu,"Research and design of chatting room system based on android Bluetooth", IEEE 2012, pp 3390-3392.
5. N. Sriskanthan, F. Tan, A. Karande,"Bluetooth based home automation system", Elsevier, Microprocessors and Microsystems 26 (2002), pp. 281-289.
6. Somak R. Das, Silvia Chita,NinaPeterson,Behrooz A. Shirazi and medhaBhadkamkar," Home automation and security for mobile devices","1st IEEE percom workshop on pervasive communication and service clouds",pp 141-146.
7. Li Liu, Yanfang Jing, Zengxiao Chi1, JianBang Chen1, Chao Ma1"Design and implementation of Android Phone Based Group Communication and Navigation System", pp 3174-3177.
8. Han Bing "Analysis and Research of system Security Based on Android", fifth international conference on intelligent computation technology and automation, 2012, pp. 581-584.
9. www.ubi.com.
10. www.wikipedia.com
11. http://www.bluetooth.com/Pages/what-is-bluetoothtechnology.aspx