# Voice Operated System to Control Devices Remotely

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***Abstract*— The voice operated device control system is an integrated system to facilitate elderly and disabled people and industry people with an easy-to-use device automation system that can be fully operated based on speech commands. The system is modular i.e. constructed in a way that is easy to install, configure, run, and maintain. This paper introduces voice operated system which is developed using microcontroller with the ZigBee wireless communication technology and speech recognition technique. The automation centers on recognition of voice commands using HM2007 and uses low-power RF ZigBee wireless communication modules which are relatively cheap. This system is used to control all lights and electrical appliances in a home or office using voice commands with help of HM2007 chip that is widely used for such appliances. The proposed system gives the overall framework of hardware and software design, and describes ways to implement the system.**

***Keywords*— Microcontroller; automation; ZigBee; voice command; HM2007; voice recognition***

## I. INTRODUCTION

The development of the new technologies in the field of electronics has brought tremendous changes in the day to day life of every human being. They have entered the fields like industry, medicine, telecommunication and also home automation [5]. Most of the system makes use of a web server and mobile communication for controlling the appliances [4]. A typical wireless device automation system allows one to control appliances from a centralized control unit which is wireless. These appliances usually have to be specially designed to be compatible with each other and with the control unit for most commercially available automation systems [4]. The project demonstrates a system that allows one to wirelessly control lights, fans, air conditioners, television sets, security cameras, electronic doors, computer systems, audio/visual equipments, industrial machines, industrial equipments etc. and turn on or off any appliance that is plugged into a wall outlet[7][10].

Table 1. Comparision table of existing automation techniques

| Technology | Processor | Tools | Applications | Advantages |
|---|---|---|---|---|
| Smart card | PIC16f 84A | Electromechanical relay interface ,card reader | Secured door system | Low cost and low complexity |
| RFID | PC | Passive RFID | Digital door lock system | Secure access |
| RFID | PC | 24 bit tag and 8 bit user ID tag | Secure access of home | Information in tag is protected |
| RFID | Atmel 89S52 | Low cost antenna system, RFID reader | Authentication system | Reduced cost enhanced reliability |
| ZigBee | ARM, x51 | Beekit, code warriorIDE | Light switching, temperature control | Easy network creation and modification |
| RFID, ZigBee | PC | ZigBee | Smart digital door lock system | Easy installation |
| Wi-Fi, ZigBee | Wi-Fi processor ZigBee processor | Wi-Fi and ZigBee network | Light switch, radiator valve | Increase connectivity of devices, remote access |
| GSM, Bluetooth | 8051 family | GSM module, Bluetooth module,RS 232 interface | Controlling light, fan and other interface | Bluetooth eliminates usage charges |
| Voice commands | AT89S 51 | HM 2007 | Electrical devices | Cheap, easy to install and easy to run |

## II. HARDWARE DESIGN

In this section we present the hardware descriptions in the two units:

### *A. Microphone with voice recognition unit:*

The human voice is captured through microphone. It is matched with the voice previously recorded in HM2007. If it matches the corresponding signals are sending

through Zigbee. Here HM 2007 is the voice recognition unit [2][6].

On this system voice is recorded and saved and then recognized whenever a command is given through microphone [1].

The speech recognition system is a completely assembled and easy to use programmable speech recognition circuit. Programmable, in the sense that you train the words (or vocal utterances) you want the circuit to recognize. This board allows you to experiment with many facets of speech recognition technology [11]. It has 8 bit data out which can be interfaced with any microcontroller for further development. Some of interfacing applications which can be made are controlling home/industrial appliances, robotics movements, Speech Assisted technologies and many more [5].

Features:

- Self-contained stand alone speech recognition circuit.
- User programmable.
- Up to 20 word vocabulary of duration 1.92 seconds each.
- Multi-lingual.
- Non-volatile memory back up that will keep the speech recognition data in memory even after power off.
- Easily interfaced to control external circuits & appliances.

### B. *Appliance control unit:*

Once the speech commands are recognized, control charterers are sent to the specified appliance address through ZigBee communication protocol [7]. Each appliance that has to be controlled has a relay controlling circuit. The control characters corresponding to the recognized commands are then sent serially from the central controller module to the appliance control modules that are connected to the appliances [10].

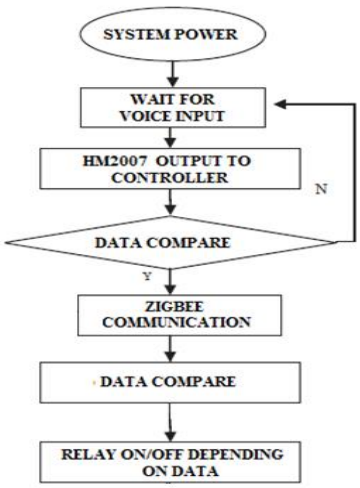


Figure 1. Flow chart of entire system

## III. Main functional blocks

### A. *Speech recognition unit:*

The heart of speech recognition system is HM2007 voice recognition IC. The IC can recognize 20 words, each word a length of 1.92 seconds [11]. The test related to speech recognition unit was conducted in one of the reference paper[10]. The tests involved 5 subjects; the trials were conducted with people with different Indian languages. The test subjects were a mix of male and female and 7 different voice commands were sent by each person. Thus the test involved sending a total of 5 commands. 80.05% of these commands were recognized correctly. The tests results of voice command recognition are mentioned below[10]:

| Category | Indian English | Hindi | Telugu | Tamil | Malayalam | Kannada | Marati |
|---|---|---|---|---|---|---|---|
| Person 1 | 68 | 85.7 | 88.6 | 70.3 | 67.7 | 75.8 | 96.7 |
| Person 2 | 86 | 80 | 85 | 77 | 70 | 81.8 | 88 |
| Person 3 | 67 | 88 | 80 | 80 | 74 | 85 | 85 |
| Person 4 | 90 | 77 | 90 | 77 | 78.6 | 82 | 90 |
| Person 5 | 85 | 60 | 77 | 90 | 76 | 68 | 82 |
| Average | 79.2 | 78.1 | 84.1 | 78.86 | 73.3 | 78.5 | 88.3 |

Figure 2. Percentage of commands correctly recognized

### B. *ZigBee module:*

It is a low-cost, low-power, wireless networking standard (IEEE 802.15.4). The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and different networking topologies provides high reliability and larger range[1][9].

### C. *Microcontroller:*

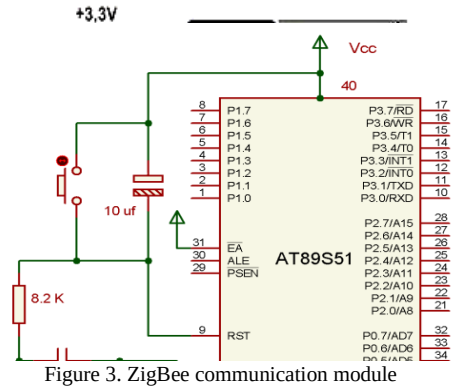


Figure 3. ZigBee communication module

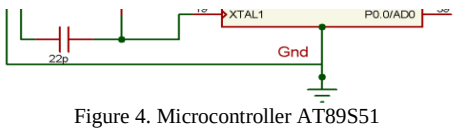


Figure 4. Microcontroller AT89S51

Any 8-bit microcontroller can be configured with the system. Here we have used 8051 microcontroller (AT89S51)-full static CMOS controller, 8k Flash memory, 256 bytes RAM, 4 I/O ports of 8 bit wide, 3 timers/counters, 8 interrupt sources[3].

D. *Liquid crystal display:*

16x2 LCD that is 16 characters per row. The LCD

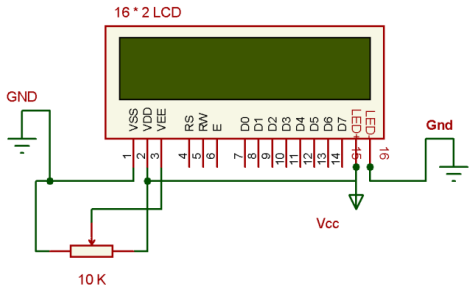


Figure 5. 16X2 LCD

display is used in both base and remote sections. These LCD displays are used to show status of the voice commands.

E. *Power supply unit:*

The power supply of different voltages is required for different unit blocks in this system. 9V/12V is required for the relay driver circuit and 5V is necessary for all other circuits.

F. *Relay driver board:*

The relay driver board contains 8 relays. This board is used to change the state of a relay.

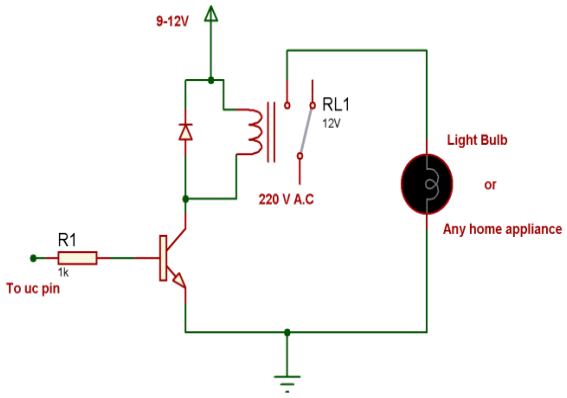


Figure 6. Relay driver circuit

## IV. SYSTEM ARCHITECTURE

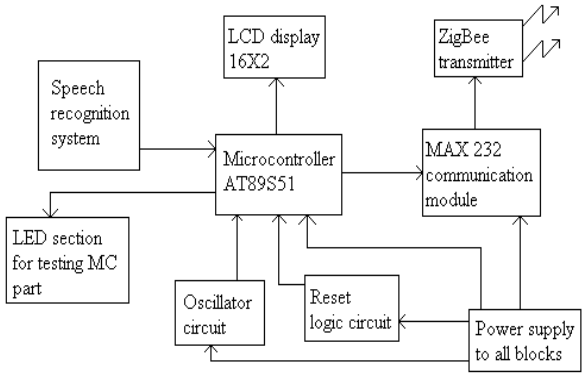


Figure 7. Transmitter section

## V. SOFTWARE DESIGN

The main program for this system is written in the embedded C programming language[3]. The schematic diagram for this system which consists of all the components was designed by using the Proteus ISIS 7 professional editions. The main program was developed in the Keil Integrated Development Environment by using the embedded C programming language. The printed circuit boards are developed by using EAGLE 6.2 Professional software.

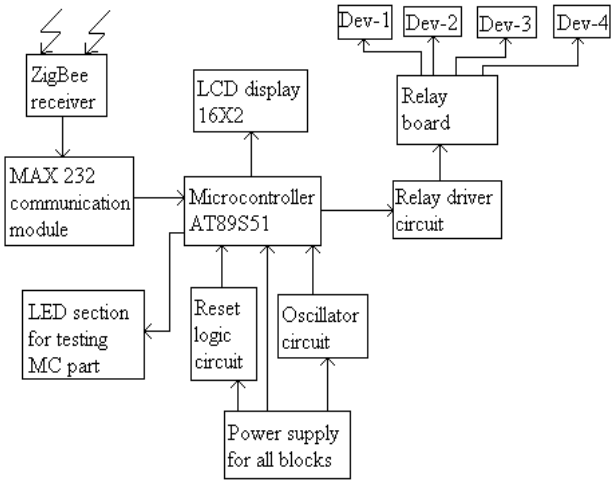


Figure 8. Receiver section

## VI. CONCLUSION

This project has described the design and implementation of voice operated system to control devices remotely. It has a function of controlling the devices which are located at remote place. It is difficult to control the devices with a voice command, but this can be easily achieved in this system.

## REFERENCES

[1] Zigbee Alliance website, http://www.zigbee.org.
[2] http://www.datasheetarchive.com/HM2007L-datasheet.html.
[3] Muhammad Mazidi and Janice Mazidi , "The 8051 microcontroller and embedded systems", Pearson education, Second edition, printed in India by Gopson papers ltd.
[4] Manasee Patil, S.R.N. Reddy, "International journal of soft computing and engineering", ISSN:2231-2307, Volume-3, Issue-3, July-2013.
[5] "The use of speech recognition technology in automotive applications" by Andrew William Gellatly, Committee chairman: Thomas A. Dingus industrial and systems engineering.
[6] L. R. Rabiner, B. H. Juang, "Fundamentals of speech recognition", Prentice hall, Englewood Cliffs, New Jersey, 1993.
[7] "The emergence of ZigBee in building automations and industrial controls", IEEE computing & control engineering, April/May 2005.
[8] Kailash Pati Dutta, "Microcontroller based voice activated wireless automation system", VSRD-IJEECE, 2012, 642-649.
[9] Rathod, Parikh, and Shah, "Wireless automation using ZigBee protocols", Proceedings of the 9th international conference on wireless and optical communication, lndore, 2012 September 20-22, pp.1-5.
[10] Y. Usha Devi, "Wireless home automation system using ZigBee", International journal of scientific & engineering research, Volume 3, Issue 8, August-2012, ISSN 2229-5518.
[11] www.imagesco.com/articles/hm2007/SpeechRecognitionTutorial01.html.