

## Assistive Domotics for Physically Disabled

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**Abstract**—Assistive technology is aimed at providing automated aid to people with disabilities. It promotes greater independency by enabling disabled people to perform tasks they are unable to accomplish themselves. The present system developed would facilitate to ease by changing interacting automatically. It works based on mere voice commands and uses a low-power ZigBee wireless communication modules along with arduino. It recognizes the voice commands and send the data wirelessly using a zigbee module and thus corresponding switching operation is performed. The system is intended to control all essential electrical appliances for instance lights, fan, etc using voice commands.

**Keywords**—Home automation; speech recognition; zigbee; voice commands; arduino

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### I. INTRODUCTION

Home automation system aims at decreasing human effort. Most of the automation system focuses on luxury. Remote controllers were used in many of earlier systems, one such work was the use of URC that uses various receivers to connect all appliances [1], whereas our present system uses speech commands to control the appliances wirelessly. This system targets especially on elderly and disabled persons. It allows wirelessly controlling lights, fans, air conditioners, television sets, security cameras, electronic doors, computer systems etc. and turning on or off any appliance. The overall system is controlled from a voice recognition chip-EasyVR. This chip sends the voice commands in binary sequence to arduino. The base station unit takes decision and sends the commands to remote station by ZigBee transceiver. The remote system receives the commands through ZigBee transceiver and performs the request function.

### II. SYSTEM OVERVIEW

#### A. BASE STATION

The microphone in the base station accepts audio as an input. The audio signal from the microphone will be fed into the EasyVR speech recognition chip. The EasyVR chip will process the audio and only if the speech commands are recognized it will pass the commands through arduino and ZigBee to various positions at home where the matched command operation will be performed.

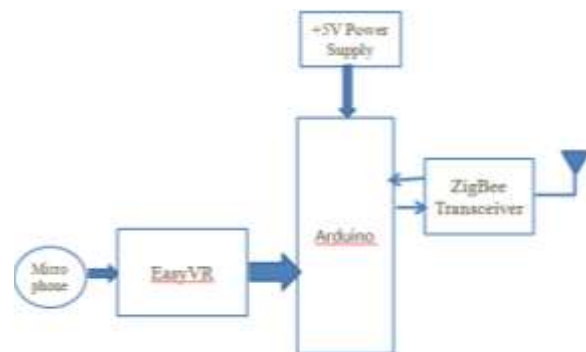


Fig. 1 Block diagram of base station of system

#### B. REMOTE STATION

The remote station Arduino receives the digital signal commands from the base station using the Zigbee wireless protocol and performs the request function. On the basis of command signals received it will update corresponding relay switches.



Fig 2 Block diagram of remote station of system

### III. SYSTEM WORKING

Sequence of activities in the present work is shown in flowchart below.

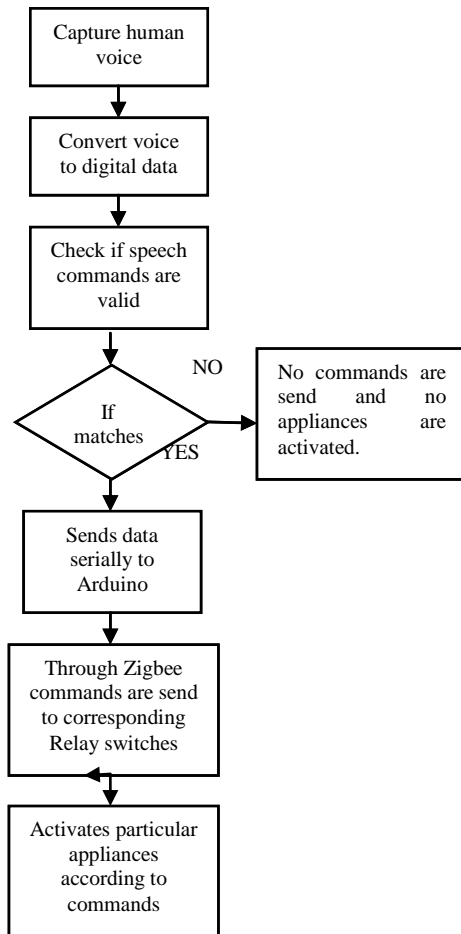


Fig 3 Process flow of hardware design

Human voice is captured using microphone. These commands are converted to digital data and sent to the voice recognition chip. If the commands are recognized then commands are sent to arduino. Commands are then sent to corresponding devices through zigbee and accordingly the particular appliances are activated. If the commands are not recognized then no appliances are activated.

### IV. HARDWARE DESCRIPTION

The hardware components in the system include speech recognition unit EasyVR, arduino and wireless technology zigbee.

#### A. EasyVR

EasyVR module is a speech recognition circuit that is completely assembled, programmable and easy to use. As per the requirement of the system words can be trained.



Fig 4 EasyVr

#### B. Arduino UNO

Arduino is an open source platform which consists of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that can be used to write and upload code on to computer.



Fig 5 Arduino Uno

#### C. ZIGBEE

ZigBee is a IEEE 802.15.4 Standard for data communications. It has data rate of 250kbps compared to other wireless systems like Bluetooth and wifi ,Zigbee aims at automation while Bluetooth and wifi aim at connectivity of mobile devices in close proximity. Zigbee uses low data rate and consume less power. It supports devices with longer range.

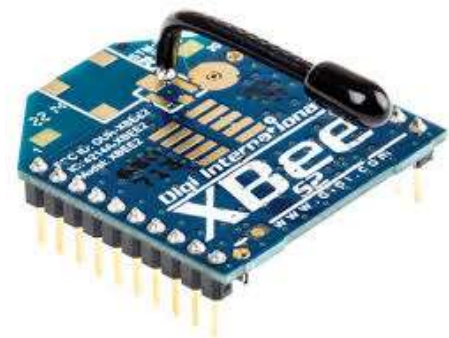


Fig 6 Zigbee module

### V. SOFTWARE DESCRIPTION

We mainly use X-CTU, EasyVR Commander and Arduino IDE.

X-CTU is XBee configuration software. It is used for configuration of XBee to communicate with the source and destination XBee.

EasyVR commander is used to configure EasyVR module connected to PC through arduino. Module includes set of built in speaker independent commands for ready to run basic controls. Also it supports up to 32 user defined speaker dependent triggers or commands, as well as voice passwords.

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with keypads for common functions and a series of menus. It connects to the Arduino and hardware to upload programs and communicate with them.

## VI. SOFTWARE DESIGN

The first step in the system was configuring two zigbees.

### 1. Configuring two zigbees:

It is important to set ZigBee Module Source address and Destination address, to transfer data from one ZigBee (Source) to another ZigBee module (Destination) so that it does not interfere with other module in the same network. Also to set ID address to both Zigbee X-CTU software is used. X-CTU software communicates with ZigBee, to change configuration or Transmit/Receive data.

To begin with PAN ID of both the zigbees are made identical as shown in fig 5.1 The destination address of the co-ordinator is changed to the MAC address of the router and vice versa using the write option. Thus one of the zigbee modules is made as the co-ordinator and another one as router for communication.

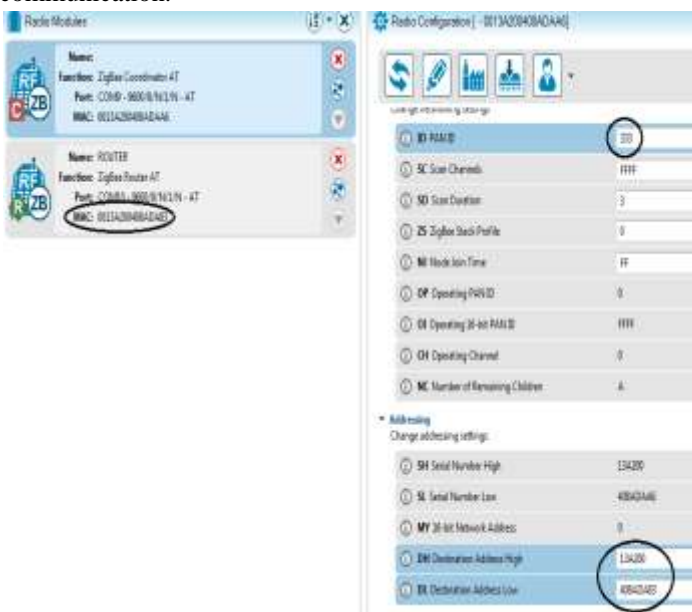


Fig: 7 Setting PAN ID and IP address



Fig 8: Communication between two zigbee

### 2. Training the speech commands

Speech commands are trained on EasyVR module using EasyVR Commander. It has option of entering any custom voice command and then training the module to recognize typed command. The voice command can be tested for recognition by saying it in microphone and then software indicates the command spoken on screen.

In this project four different voice commands are trained for controlling two appliances, i.e. "BULB\_ON, LIGHT\_OFF, FAN and OFF".

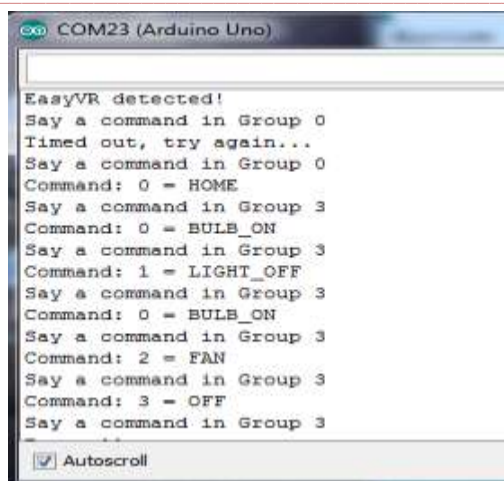
Trained commands are shown in fig below.



Fig 9: Training speech commands

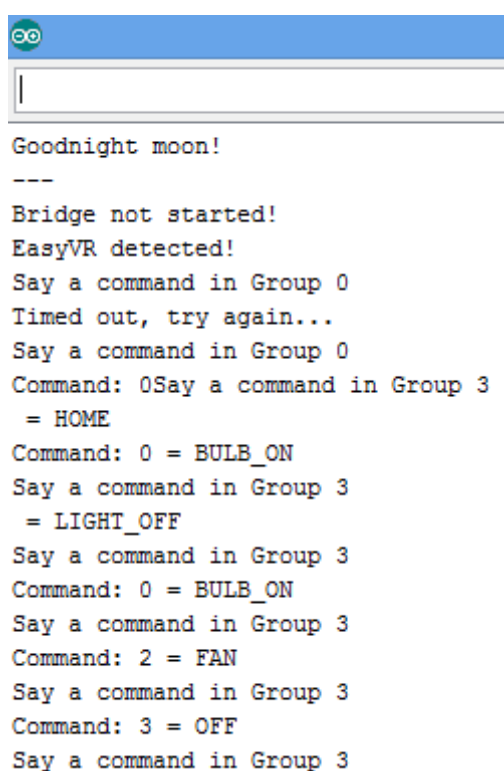
## VII. EXPERIMENTAL RESULTS

Using EasyVR module four commands were trained. The co-ordinator zigbee is connected to one arduino and the router zigbee to the other arduino. Data is sent serially from co-ordinator zigbee to receiver zigbee and corresponding relay switches are activated. Data sent can be viewed in serial monitor.



```
COM23 (Arduino Uno)
EasyVR detected!
Say a command in Group 0
Timed out, try again...
Say a command in Group 0
Command: 0 = HOME
Say a command in Group 3
Command: 0 = BULB_ON
Say a command in Group 3
Command: 1 = LIGHT_OFF
Say a command in Group 3
Command: 0 = BULB_ON
Say a command in Group 3
Command: 2 = FAN
Say a command in Group 3
Command: 3 = OFF
Say a command in Group 3
Autoscroll
```

Fig 10: Output in serial monitor at transmitter



```
Goodnight moon!
---
Bridge not started!
EasyVR detected!
Say a command in Group 0
Timed out, try again...
Say a command in Group 0
Command: 0Say a command in Group 3
= HOME
Command: 0 = BULB_ON
Say a command in Group 3
= LIGHT_OFF
Say a command in Group 3
Command: 0 = BULB_ON
Say a command in Group 3
Command: 2 = FAN
Say a command in Group 3
Command: 3 = OFF
Say a command in Group 3
```

Fig 11: output in serial monitor at receiver

## VIII. CONCLUSION

This system provides help and assistance especially to elderly and disabled. It allows user to control all appliances using speech commands. The system recognizes the voice commands and uses zigbee module to send data serially to the receiver zigbee and corresponding appliances are activated. The system can be further expanded using smart phones and internet to control the appliances from anywhere.

## IX. ACKNOWLEDGEMENT

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