Speech Recognition using AI

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Abstract: Today's technology is growing very fast and we are getting attached with different technologies day by day. AI is one of the favorite as well as fascinating universal field of computer science which have great scope in future. This project deals with the design and implementation of home automation and computer control using smart intelligent devices which produces artificial intelligence background to control various operations. Voice intelligence is added to our system based on acoustics for sophistication of physically challenged or old aged people. Also, as broad perspective of system Raspberry-Pi operates, controls and manages operations in home appliances, such as turning on/off lights, fan. In case of computer, we can perform operations like play music, pause music, play next music, etc. through the voice commands. All the operations will be controlled through module which contains speech recognizer to control appliances as well as computer functions. The main aim of this automation system is to make life easier. In this project we aim to control electrical home appliances by android voice commands using Wi-Fi as a communications protocol between Raspberry pi and devices.

Keywords- **Speech Recognition, Raspberry-Pi, ATMEGA328P.**

I. INTRODUCTION

In day to day life automation can play a major role. Automation makes thing simple. The main benefit of any automated system is reducing human labour, efforts, time and errors due to human negligence. A Raspberry Pi is a credit card-sized computer which can be used for developing various applications. This project is based on Artificial Intelligence. This project represents a flexible way to control devices. In various research papers they are working on an android application where a user will provide voice commands for controlling devices such as "Turn light on" which will be connected to raspberry pi and according to it the required process will work via Wi-Fi. User can register and authenticate himself/herself in android device and after successful login he/she can give the input commands and operate the devices. It also provides security from third party users. It allows controlling number of home appliances simultaneously. Python is used as the main programming language which is default, provided by Raspberry Pi. This system requires micro SD card with an OS (Ubuntu Mate) for Raspberry Pi.

II. LITERATURE SURVEY

Yash Mittal and Sonal Sharma[1], Mohamed S. Musbahet.al adopts a client/server model and is designed to control home appliances using voice recognition technology. The model consists of three main components:
Front End User Device: Can be any mobile device such as a laptop or smart phone with a good microphone and voice recognition feature. The device used in this paper is a Windows 7 PC which contains an inbuilt Windows 7 Speech Recognition Software.
Home Server: Can be any laptop or a computer which consists of a Wi-Fi adapter and a Windows operating system (Windows XP or higher).
End User Device: Consists of two parts, Arduino Uno to process the incoming commands and the home devices. The devices considered in this paper are a D.C. fan and LED lights. The front-end device primarily contains two voice commands namely start listening and on/off. The device application establishes a connection to the home server via a wireless ad-hoc connection (TCP/IP transmission protocol). The home server in turn acknowledges the connection and receives commands from the front end interface while opening a connection to the microcontroller and then forwards the command to it. Now the Arduino implements the given command according to the target device. Sonali Sen[2] has designed a system of an "Intelligent Voice Controlled Home Automation System". The author 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 switch off will enable the user to have complete control over any appliance without any effort.
T. Anitha1, T. Uppalaiah[3] designed a system of "Android Based Home Automation using Raspberry Pi". The system as the name indicates, "Android based home automation" makes the system more flexible and provides attractive user interface compared to other home automation systems. In this system author integrate mobile devices into home automation systems. A novel architecture for a home automation system is proposed using the relatively new communication technologies. The system consists of mainly three components is a Wi-Fi module, raspberry pi board and relay circuits. Wi-Fi is used as the communication channel between android phone and the raspberry pi board. They hide the complexity of notions involved in the home automation system by including them into a simple, but comprehensive set of related concepts. This simplification is needed to fit as much of the functionality on the limited space offered by a mobile device's display.

III. **OVERVIEW**
1. **HARDWARE**
A. **RASPBERRY PI 3**

- Broadcom BCM2837 64bit ARMv7 Quad Core Processor powered Single Board Computer running at 1.2GHz
- 1GB RAM
- BCM43143 WiFi on board
- Bluetooth Low Energy (BLE) on board
- 40pin extended GPIO
- 4 x USB 2 ports
- 4 pole Stereo output and Composite video port
- Full size HDMI
- CSI camera port for connecting the Raspberry Pi camera
- DSI display port for connecting the Raspberry Pi touch screen display
- Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source (now supports up to 2.4 Amps)

Fig1. RASPBERRY PI 3B

B. **USB MIC**

USB mic contains all the elements of traditional microphone: capsule, diaphragm etc. The mic has advanced USB which provides superior clarity with simple plug and play connection. This mic differs from other microphones is its inclusion of two additional circuits: an on-board preamp & analog-to-digital (A/D) converter. Pre amp makes it unnecessary for U2B mic to be connected to external mic and A/D converter changes output from analog to digital so it can be plugged directly into computer and read by recoding software.

Fig2. USB MIC

C. LCD Display

We are using 16x2 LCD display. It consists of 16 columns & 2 rows. So it can display 32 characters at a time. LCD display is provided for showing the current status of the system. This display is connected to raspberry pi which shows current status of system.

Fig3. LCD DISPLAY

D. ATMEGA 328P

We are using ATMEGA 328P microcontroller which is a low power CMOS 8-bit microcontroller based on AVR enhanced RISC architecture.

Fig4. ATMEGA 328P

E. HT12E

It works as RF transmitter. We are using this encoder for remote control applications. This encoder capable of encoding information which contains N address bits & 12-N data bits. Programmed addresses are transmitted together with header bits via RF/infrared triggered signal.

Fig5. HT12E

F. HT12D

It works as RF receiver. This decoder paired with Holteks 212 series of encoder. Means for exact operation, pair of encoder with same number of addresses & data format should be chosen. Data or addresses encoder that are transmitted that compare the input data continuously with local addresses. If no error found, input data is decoded and then transferred to output pins.

Fig6. HT12D

G. RELAY MODULE

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact form such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

Fig7. RELAY MODULE

2. SOFTWARE

a) RASPBIAN OS

Raspbian OS is one of the official operating systems available for free to download and use. The system is based on Debian Linux and is optimized to work efficiently with the raspberry pi computer. An OS is a set of basic programs and utilities that runs on a specified hardware, in this case, the pi. Debian is very lightweight and makes a great choice for the pi. The Raspbian includes tools for browsing, python programming and GUI desktop.

Fig1. RASPBIAN OS

b) PYTHON

In this project we are using the python language which is very much easy to learn and it is very powerful programming language, besides that it is very comfortable to use with raspberry pi. The data structures, syntax are very easy to use and also they are very effective for scripting purposes as well as the development of many applications. Basically the python can be proved as one of the future proof language.

c) ARDUINO PLATFORM

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

d) EMBEDDED C

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory, and basic I/O operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing. Embedded C use most of the syntax and semantics of standard C, e.g. main() function, variable definition, datatype declaration, conditional statements (if, switch. case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, unions, etc. A Technical Report was published in 2004 and a second revision in 2006.

IV. PROPOSED SYSTEM

The aim of our proposed system is to design and implement a cheap, open source and flexible automation system that it is capable of controlling house appliances and computer through human voice. We are using the concept of master & slave control using Raspberry-Pi & ATMEGA328P as master & slave respectively.

The USB MIC is used to take voice input or voice commands from the user. The MIC is simply of plug-in, plug-out type. It consists of A to D convertor (Analog to Digital convertor). So the input command which is in analog form converted into digital form.

Now, this digital signal is transferred to the main part of our system that is Raspberry-Pi, which is already programmed in python. After receiving the signal R-Pi starts recognition of the command which is said by the user. After recognition it will check whether the command is right or wrong, if the command is correct it R-Pi sends the 4-bit digital data to the encoder.
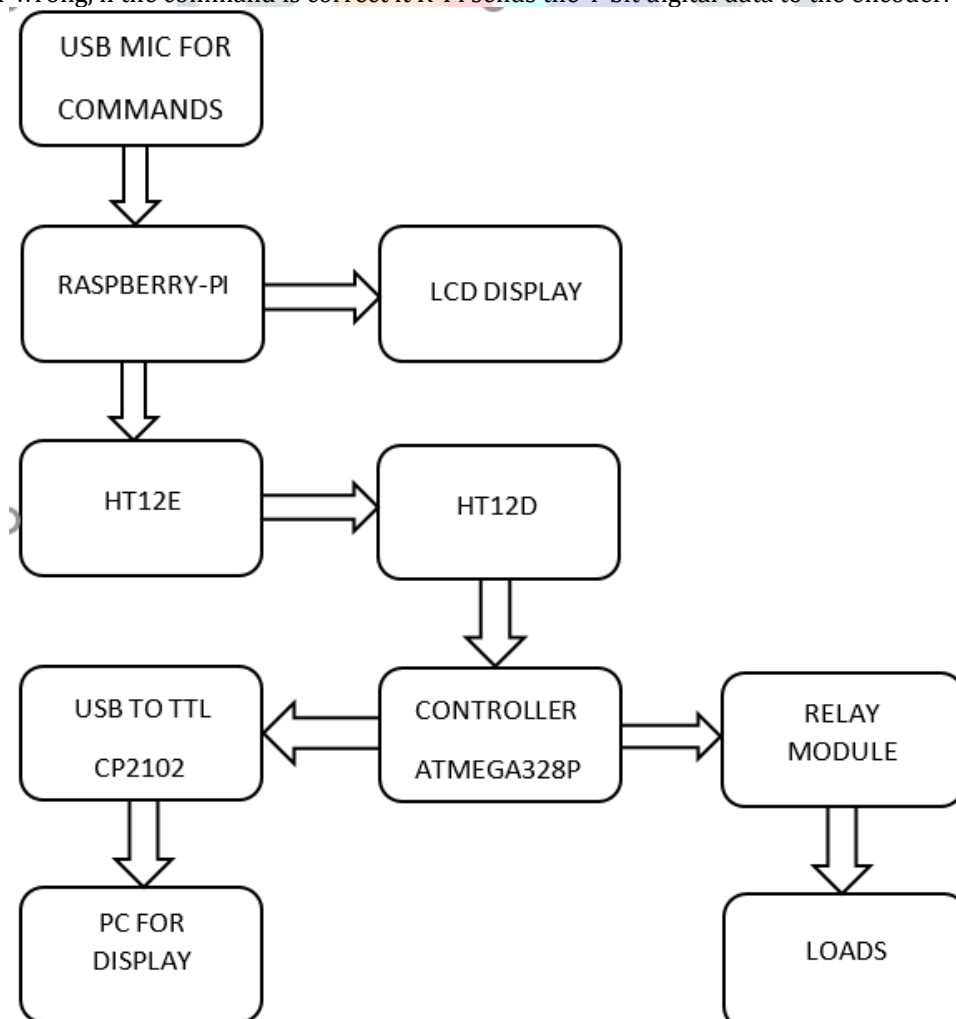
LCD display is used to show the whole process which is occurring in the system. Basically LCD display shows the status of the system. Now, the HT12E encoder receives 4-bit data which is sent by the R-Pi. Encoder collects data and makes the packet of that data. The packet consists of 12-bits, which comprises of 8-bits of address and 4-bits of data. Then the packet is transmitted.

Now, the HT12D decoder receives the packet which contains 12-bits, decoder will decode the packet means it removes the 8-bits of address and it send 4-bits data to the microcontroller.

Then microcontroller receives 4-bit data, depending upon data microcontroller checks whether the command is for Home appliances or for the Computer function. If the command is for home appliance the respective relay operates and the appliance is turned on or off. Same goes for computer functions, if the command is for computer the respective function takes place and computer completes the process.
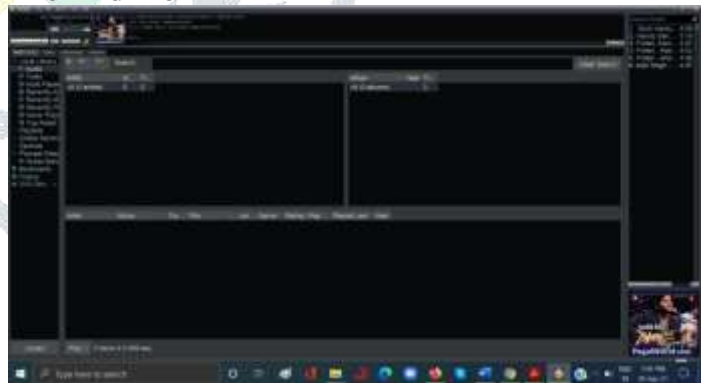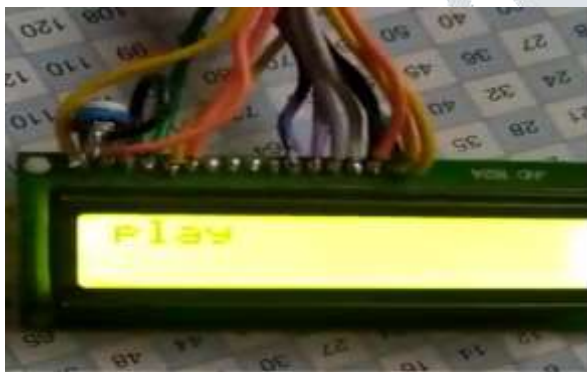
V. RESULTS

The proposed system has been implemented, tested and below are the results that we got,
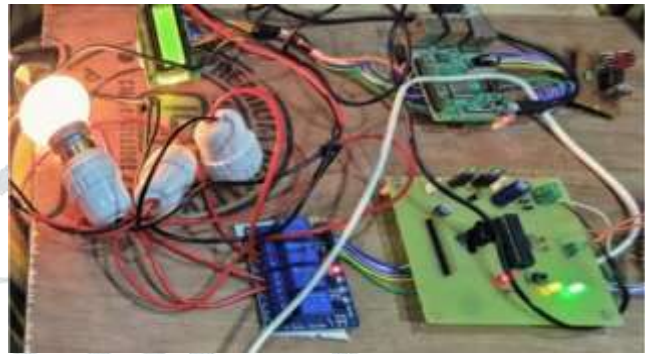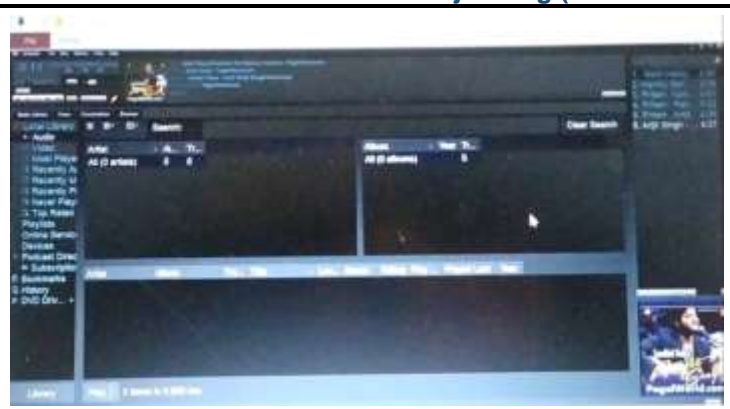

HOME AUTOMATION-LIGHT ON

HOME AUTOMATION-LIGHT OFF

COMPUTER CONTROL- PLAY

COMPUTER CONTROL- BACK

COMPUTER CONTROL- STOP

VI. CONCLUSION

This paper presented design, fabrication and testing of Speech recognition using AI. In this paper we discussed and demonstrated how we can use Artificial Intelligence (AI) for voice recognition and home automation and computer applications. With the use of bulbs and computer we have demonstrated the working of our proposed system.

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