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VOICE RECOGNITION BASED DEVICE CONTROL SYSTEM USING SMARTPHONE APP

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Abstract:- This paper illustrates a non-traditional approach to system control focused on speech recognition using mobile apps and MATLAB. In all ways, life is becoming simple and simple with advancement in technology. New research is currently going on in every field to boost device efficiency and to make work simpler than previous ones. Automatic systems are favored over manual systems in today's world. One of them is speech recognition based interface control. It consists of a Wi-Fi control board, a relay circuit and a Smartphone app. This allows devices to be operated by users by just sitting in one position. A significant advantage of this method is the control of machines, i.e. making them on and off as per user requirements. This user can save as well as discourage excessive use of energy by using it. Device access is restricted to a single user, so that protection is not compromised.

Keywords-*Node MCU, speech recognition, device control, automation*

I INTRODUCTION

In every field of science until now, speech recognition technology has played an important role and it also has future aspects of speaker vigor, context and surrounding noise elimination promises to achieve system effectiveness. In speech recognition, the machine detects and responds to voice commands accordingly. There is hand-free access and control of different equipment due to the use of voice as data. There is another factor that is now playing an important role in the development of technology, along with speech recognition. The internet has played a major and central role in this system. We know the Internet has made it easy to connect to any corner of the globe. Together with other consumer electronic equipment such as fan, light & heater, it is voice operated door lock. This operates door lock and other devices remotely with voice from anywhere. To operate, an android app is created. Voice is transmitted through the cloud server. The Android app has a password. The cellular phone acts as a controller. Device status is first indicated in the Android app, whether it is in ON condition or OFF condition. The status of all devices is also shown on the PC (cloud server)

This project is created by taking into account the end user. Without getting another work hamper, devices can be operated from anywhere. Technology for speech recognition is something that has been dreamt of and worked on for decades. User-to-user applications can vary. There are many applications, especially for domestic use. One of them is speech recognition based interface control. The aim of this paper is to create an application based on speech recognition that enables users to use words or commands to turn on or off appliances or devices such as fans, lamps and heaters. These commands are listed in the program and one is fixed. If users or customers want to change these commands, they can alter them by simply changing program of the system.

II. RELATED WORK

2.1 Voice To Text Conversion Method

The key factor considered in this prototype is Home Automation. The microcomputer uses a timer and a voice to control various electronic devices at home. The timer option uses a timer to monitor the operation, while the voice option uses oral voice signals to control the system. In this, voice commands are first converted to text using the VTC method (voice to text converter) and the output is provided to the receiver to control the ON and OFF switching of home devices.

2.2 SMS Over GSM Network Method

GSM-based appliance control is used when users are far from home. Using SMS sent over the GSM network is done remotely. In this system implementation, AT commands are

used. As far as security is concerned, feedback is also provided for use.

2.3 Infrared Remote Control Method

The Infrared Remote Controller is used to operate the devices in this process. In this system, home-based servers are created. There are also provisions to check the current status of devices via the cellular network.

2.4 Bluetooth Based method

Bluetooth Remote Control can be used on these devices. The keyboard is connected to the microcontroller system and connected to the Bluetooth module as well. This allows wireless access to the tools to be controlled. The microcontroller sends the corresponding action command signal via Bluetooth to the receiver when the key on the keypad is pressed; on the other hand, the receiver performs appropriate action on receipt of it.

2.5 Speech recognition application method

The application is designed to monitor and control the devices in this way. Voice input is taken by the system and converted into symbolic data. It sends this data over a Wi-Fi network. Speech recognition application is designed using the VB.net language.

2.6 Speech versus touch

In this DTMF(Dual Tone Multiple Frequency) technique is used. It has been proven that DTMF signals works better for linear task whereas Speech signals has been found more effective for nonlinear tasks.

2.7 CELP based speaker verification Method

In this, text free speaker identification is used for speech coding. CELP parameters for speech coding method have main concern of working of system under noisy condition.

III. PROPOSED SYSTEM

Proposed system works as follow

- It operates on voice commands.
- User's identity is verified through stored voice samples using MATLAB
- Devices can be operated from anywhere in the world.
- Use of MATLAB for speech recognition and to display spoken voice signals
- Easy and hand free use of voice commands for switching ON and OFF of devices

3.1 System Design and Implementation

This system consists of a wifi-interface microcontroller board, relay driver, relay, power supply and appliances such as door lock, heater, etc. Raspberry pi is also very helpful in automation, as mentioned in [2]. The Node MCU is used here as a microcontroller that controls all the devices connected to the system's brain. It gives the rest of the devices corresponding orders. The mobile application is used in this project to give voice commands and NODE MCU will give commands to the relay driver accordingly.

The Node MCU is a small microcontroller board that supports Wi-Fi. It has a GPIO of 11. Only 4 GPIOs are used out of 11 here. These pins are given to the relay driver through which ON/OFF is obtained for relays. ULN2803 is used here as a relay-driver.

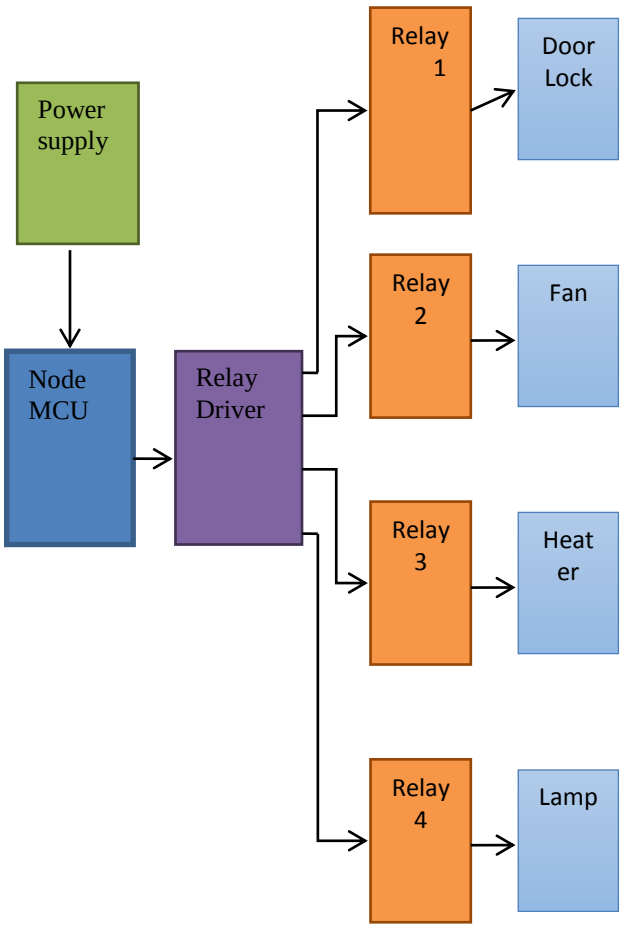

Figure 1: Proposed System

3.2 Hardware Implementation

Hardware of project consists of Node MCU, Relay driver, Relay, LM317 [1].

3.2.1 Node MCU

Node MCU is an open source platform. Firmware is included. The hardware consists of the ULN2803 Relay Node MCU. We explain various components in detail in this section. Node MCU is a LUA-based open source firmware developed for the Wi-Fi chip ESP8266. It is a programmable Wi-Fi module that is used for connecting to the Internet of Things (IoT) Internet and similar technologies with both analog and digital input pins. 17 GPIO pins support it. Out of these 6 pins, the flash memory chip is connected. The MCU node supports serial communication protocols such as the Universal Asynchronous Receiver Transmitter (UART), Serial Peripheral Interface (SPI), and Inter Integrated Circuit (I2E).

3.2.2 Relay Driver ULN 2803

The electromagnetic switch is the Relay Driver IC. The ULN2803A IC is composed of an array of eight NPN Darlington transistors. The Darlington configuration is one in which two transistors (NPN or PNP) are linked in such a way that the first transistor's Ie (emitter current) acts as the second transistor's Ib(base current). In applications where current amplification or switching is needed, this sort of super alpha arrangement is used. Darlington pairs can connect in parallel to obtain higher current capability. Each Darlington pair in the ULN driver 2803 IC has a current collector rating of 500Ma. The maximum voltage of each Darlington pair is 50v Vce(collector to emitter).

3.2.3 Relay

Basically, a relay is a switch that opens and closes circuits. It is composed of an electromagnet and a contact package. The SPDT (single pole double throw) relay is being used in this project. The relay is 12V. It has 1 common terminal and NO (normally open) & NC (normally close) pins. Similarly, when relay is energized, NO and Common terminal have continuity when NC and common terminal have continuity when it is not energized. It has reverse polarity protection as well. Applications where there is electronic control of devices such as light, fan, motor, AC relays are more commonly used, i.e. turning ON and OFF. In control operations, there are many more applications.

3.3 Software Implementation

3.3.1 Arduino Software

The Arduino IDE (integrated environment for development) is a software development tool written in the language of Java Programming. It is a cross-platform framework that supports various Windows, macOS, Linux, etc. operating systems. If special code structuring rules are used, C and C++ programming languages are also supported. Arduino IDE has a project writing software library in which several different inputs and common output procedures are usable. It is compatible with all Arduino software boards. The user can write and upload the programs in real time.

3.3.2 App inventor

Specially designed for Android, it is an open source web application. App Inventor is supported by Google and it is maintained by the Massachusetts Institute of Technology. It can be used for programming by new developers to render various Android-based operating system software applications. It also supports a graphical interface. The application can be generated by the visual objects drag-and-drop method and Android devices can run such applications successfully. Google, in Educational Study and Studies, is exceptional. The required use of Android to build the module [2].

3.3.3 Matlab

Matrix Laboratory is a programming language that allows programmers to function from various paradigms in a variety of styles. It is also often referred to as the language of multi-paradigms. This language was developed by Math Works. For engineering and science matrix based calculations as well as visualizations, this language is commonly used. It has been used in a number of applications, such as image processing, communication systems, design of control systems, testing and measurement, etc. MATLAB is being used in this project for sound recording. This would help strengthen the system and increase its confidentiality. We can operate devices using the voice of anyone by normal speech synthesis, but we need only one user voice for this system so that only people voice commands and it will ON/OFF device by unique user's voice commands. [5].

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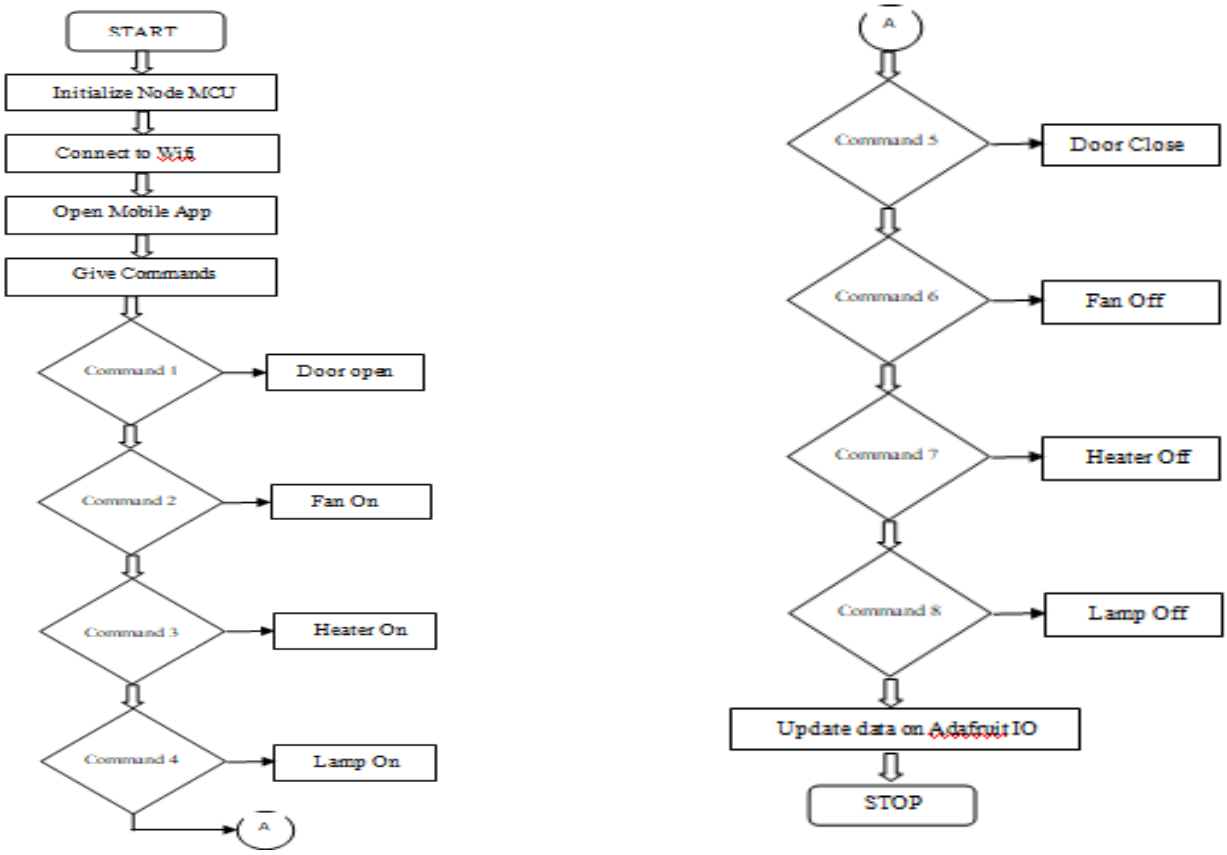

Figure 2: Flowchart of system

3.3.4 Adafruit IO

Adafruit is a server on a cloud. It will view your data online and in real-time. This makes your project linked to the internet: motor control, sensor data reading, and more. It links web services to projects such as Twitter, RSS feeds, weather services, etc.

It connects other internet-enabled devices to your project. Adafruit can manage and simulate several data streams. A special integrated feature of Adafruit IO is Dashboards. This dashboard allows the data to be plotted, graphed, gauged, logged, and displayed. Dashboards can be viewed from everywhere on earth [3].

Above figure shows flow chart for the system. Initially turn ON system and system gets initialized in some time. Connect wifi to node MCU and Mobile. Note both should be connected to same Wifi. Open mobile application. Give voice commands. Here four devices are connected to system to make them ON and OFF eight commands are used. Along with this update all device status on Adafruit IO.

IV. RESULT ANALYSIS

The figure above shows the system's flow map. The ON machine initially turns on and the system gets initialized in a while. Link wifi to the smartphone and MCU nodes. Notice that both should be linked to the same Wifi connection. Open mobile apps. Offer commands by voice. Four devices are linked to the system here to use eight commands to make them ON and OFF. All device status for Adafruit IO, along with this update. Component and app and platform information are given in the section below. This project consists of a node MCU that has GPIOs and Wifi connectivity. The comparison table showing the various boards and their characteristics is available for several boards on the market.

Table 1: Comparison between ESP Boards

Parameters	**ESP 01**	**ESP12E Node MCU**
GPIO	4	11
ADC Pins	1	1
Memory	1 Mb	4Mb
Breadboard Friendly	No	Yes
USBto Serial convertor	No	Yes
Serial Chip	CH340	CP2102
Price	$6	$6

Below table shows different components present in the system and its voltage levels and response time. This one decides total response of system.

Table 2: Circuit components and its voltages

Sensor type	**Allowed Voltage**	**Actuation**	**Response time**
Node MCU	3.3v	Automatic	1 sec
Relay	12v	Automatic	1 sec
ULN2803	12v	Manual	250msec

The figure 3 shows mobile application developed for this project in this many buttons are given to control devices as well as speech recognizer which will accept speech/ commands.

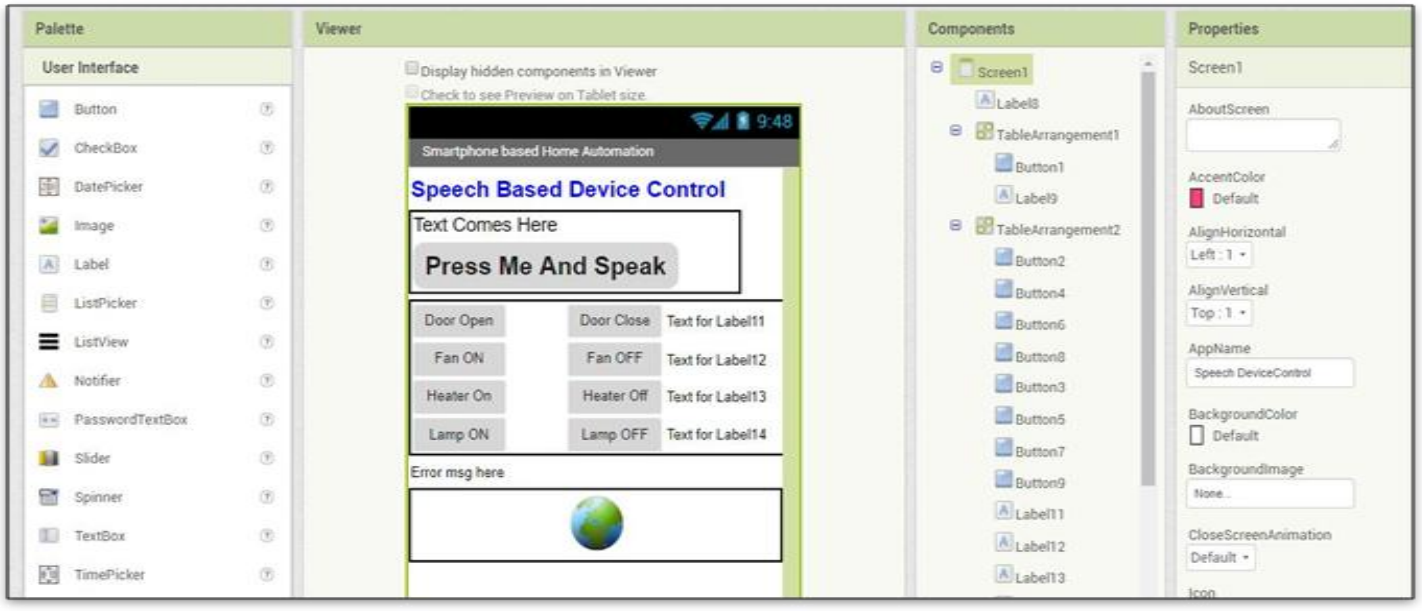

Figure 3 : Mobile Application

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Figure 4 :Adafruitio

Above figure 4 shows adafruitio which consist of device and shows its status that is whether it is on or off.

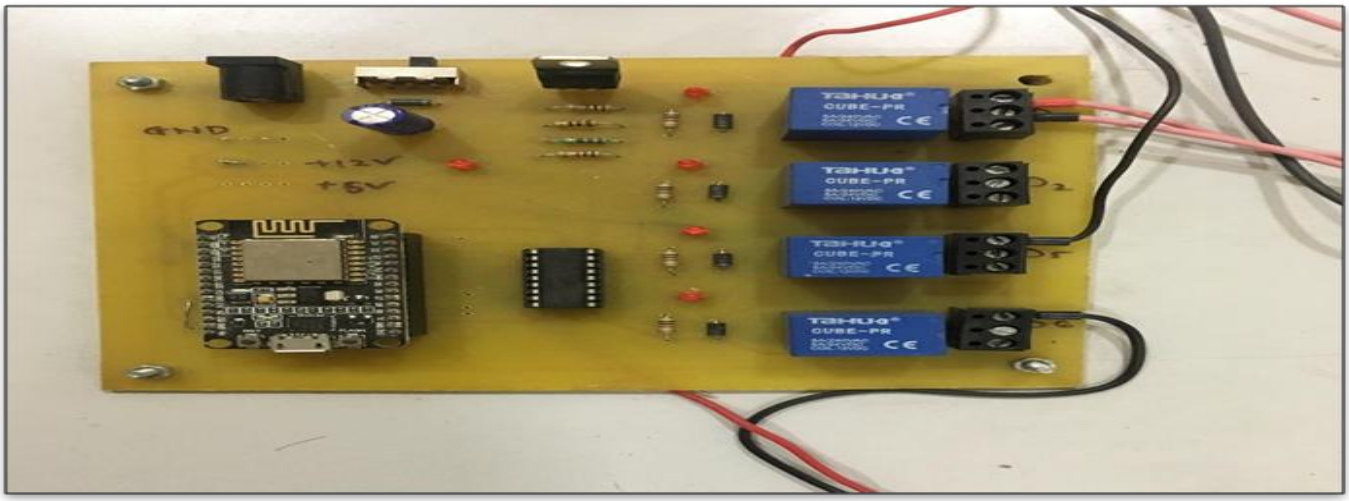

Figure 5 : Actual Circuit

V. CONCLUSION AND FUTURE SCOPE

There are several modifications that can be made in the existing framework and new innovations can be implemented in the same one. In this, for control purposes, we should incorporate the Internet of things. This will help us enhance system efficiency and the user can monitor remote location status as well as control device status. In addition, we will contribute artificial intelligence to this network. This system is currently being developed for domestic purposes and we can develop it for different fields. The system has a large future because it can also be run everywhere because it operates on voice.

IoT use is an additional bonus to more major advances in it. In the existing framework, there are several changes that can be made and new technologies can be introduced into the same one. We can add internet of stuff for controlling intent in this. This will allow us to enhance system efficiency and the user can monitor remote location status

as well as control device status. We can introduce artificial intelligence to this network along with that. This system is currently being built for domestic purposes and we may develop it for different areas. The device has a broad future, as it can also be controlled anywhere by voice. IoT use is an additional bonus for further major advances in it.

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