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VOICE ACTIVATED HOME AUTOMATION USING MACHINE LEARNING AND IOT

Jayalakshmi.S[1], Pranav Ramakrishnan[2], Vyshnav.K [3] , Maxwell Martin [4],Arjunan.V.M [5]

Department of Electrical and Electronics, SCMS School of Engineering and Technology, Kerala

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Abstract- ***The developments in the modern technology has allowed us to do all kinds of work more efficiently or even automate the different processes. We spent most of our time in our respective houses and a lot of time is wasted on turning on switches. We all have a smartphone on our hands or even a smart watch, and all these devices have a built-in microphone. This feature is already used by systems like Google assistant and Alexa to control a specific device, but they don't have the ability to control the complete house. Technologies like machine learning and internet of things (IoT) has given us the ability to build systems for home automation using our voice. This allows the user to control the different systems in their houses easily***

Key Words*: *Internet of Things (IoT), Machine Learning, Home Automation.

1.INTRODUCTION

Home automation is a feature that is only possible due to the current advancements in technology. It allows the user to control the devices in their homes without the need to move to the location where the control system for the device is located. This allows streamlining the workflow of the user because time is not wasted in moving from place to place. Here we are using voice as the means to send the control signal. Voice is a feature that can be done simultaneously with the other work that we are performing which helps us to further streamline our workflow. IoT can then be used to connect the devices to the control system. Here since voices is being used it can easily be manipulated by an external person which gives them to control others homes. The main aim of this project is to create a voice recognition system that converts the users voice into useful commands and then using machine learning the restricting particular voices access to particular devices.

2. LITERATURE REVIEW

Machine learning has been the pinnacle of the current technological development and it is being used in all kinds of domains. Use of machine learning is talked in the paper that we took as a reference. Leandro Filipe [1] talks about using machine learning to train the system to recognize the users voice efficiently and send the correct data as output to the control system. Vaibhav Bhapkae [3] in his paper talks about how we can use machine learning to train a particular voice and how to use this to detect a particular user. Further research was done on how to interface the Wi-Fi module to the voice verification and detection system.

3. METHODOLOGY

In this project we use python to develop the voice detection system. The audio module available in python is used to access data from the microphone. From this the Speech Recognition module can be used to convert the voice data to text so that the required event class can be created. Depending on the access level we give to different devices, we can map each devise to the specific user who has access to it. We then use the machine learning to understand who the user is and grant access depending on the user's access level.

Design of this system consist of three different layers which are the voice recognition, machine learning and IoT layers

A) The voice recognition layer involves obtaining the voice and creating the event classes.

B) In the machine learning layer, when a command the requires higher level of access the program send the voice obtained from the user and checks if the voices is in line with previously recorded voice models created by the machine learning program

C) In the IoT layer, after all the voice processing is done the event class created from the voice is used to send data to the Wi-Fi module. This is done with the help of an open source cloud platform called Think Speak. This cloud has built-in api system using which we can update control variables directly from the voice recognition program, from where the ESP8266 can collect data and update the pin output.

Voice detection: The voice spoken by the user has to be taken in as an input and has to be properly processed. This is done in this section with the help of a built-in python library called pyAudio. Using this library, we can easily get the voice as an input via the machines microphone.

Event class:This section involves using the data obtained from the user's voice to create the specific commands that can be used the system to send data out to the necessary end location where we want to see the results.

Machine learning: depending on the type of command encountered, some of them might have to be restricted to a small number of people. We can use machine learning to train the system to recognize the user and other people who want to have access, so if someone else comes and wants to activate that particular command it will not work.

IoT framework: This is where the cloud and hardware part of the home automation system comes into play. The data required depending on the user is update on the cloud server using the python program and the WIFI module take in the data from this server and then updates its codebase which then performs the activity we need it to do.

4. BLOCK DIAGRAM

Fig 1 shows the basic block diagram of the whole system which starts from the voice detection section. The recorded voice is used to recognized and the event classes are created, which then branches off to create the closed and open classes with are denied access depending on the level of access available to the user. When a closed loop or event is encounted the machine learning system is used to verify the user. If all the data is proper the corresponding data is sent to the IoT framework which helps us to control the end user devices.

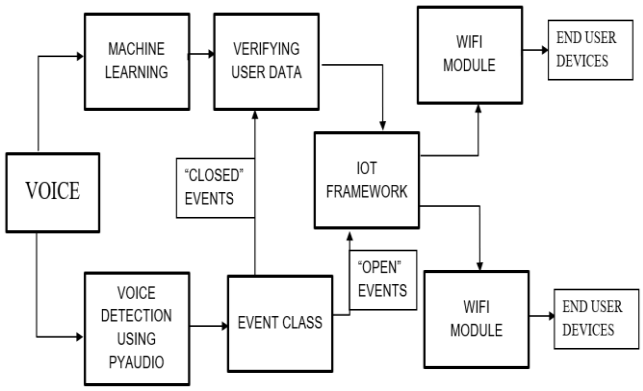

Fig 1 Block diagram for the system

FLOWCHART

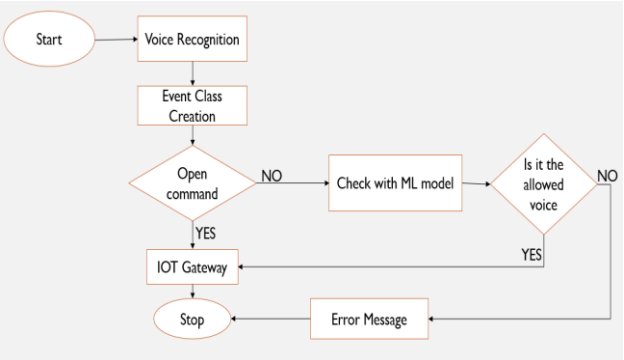

Fig 2 Flow chart of the system

5. SOFTWARE

Microcontroller is the brain of this project and the way how the microcontroller should work is based on the software execution. Data from the sensor is processed and send to Thing Speak online cloud server [7] through ESP8266 Wi-Fi module. Arduino Uno is programmed using Arduino ide with different sensor library. By proper user id and API Key data is transferred and monitored.

VERIFICATION OF SPEAKERS

When using speaker verification, the enrolled voice and the new voice are compared 1:1. This task calls for greater precision than speaker identification, which conducts an N-1 comparison of each of the N enrolled voices and a new voice. Two kinds of speaker verification exist: Text-specific utterances are used for enrolment and verification in text dependent speaker verification (TD-SV).This approach makes use of text-independent utterances as opposed to text independent speaker verification (TI-SV).The utterance similarity matrix is calculated at each step forward in the technique, and the integrated loss is employed as the goal function.

AUTOSENSING

The cross-platform audio I/O package Port Audio has Python bindings available thanks to PyAudio. Python may be used to play and record audio on a variety of platforms with PyAudio.PyAudio must first be instantiated using Pyaudio in order to be used. The port audio system is set up using PyAudio Open a stream using pyaudio on the specified device with the certain audio parameters to record or play audio. This creates a stream for audio playback or recording. By using pyaudio we can write audio data to the stream. Stream., or

use pyaudio to read audio data from the stream.

INTEGRATED DEVELOPMENT ENVIRONMENT

The main purpose of the open source Arduino IDE programming environment is writing and compiling code.A common guy can easily understand the learning process thanks to this official programming software that makes code compilation easy. All operating systems, including MAC, Windows, and Linux, easily support this software. The Arduino family of modules includes theArduino Uno, Arduino Mega Arduino Leonardo, and many. It mainly consists of a text editor for writing code, a message area, a toolbar with buttons for certain common tasks , and a text console. Sketches are the programmes that are created with this software. Most of this softwares coding makes use of functions of c/c++

ARDUINO

The sketch for an Arduino is depicted in the figure below. There are numerous icons on the tool bar. The upload symbol is the second from the left, followed by the verify icon, the third by the download icon.The fourth step in starting a new project and the fifth step is to save project. The icon for opening the serial monitor is located on the far right. The blank space in the Coding is in the middle.

6. SIMULATION

Entire simulation of the voice automation system is done using Easy EDA. Based on the sensor, in simulation analog and digital input is given which will resemble real time inputs. Hardware is implemented based on the results of simulation. Fig 3 represents the simulation of actual system.

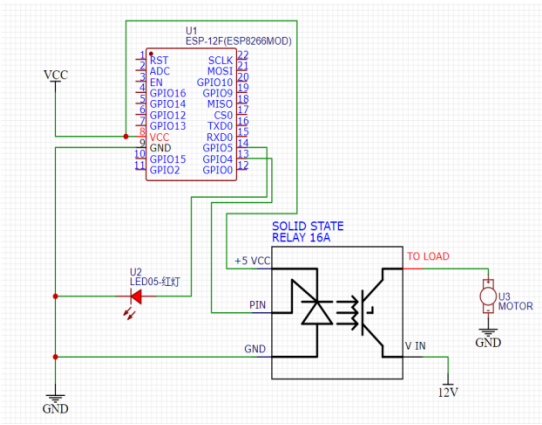

Fig 3 simulation of the circuit

7. HARDWARE

Components for the proposed system are NodeMCU ESP8266, solid state relay, power regulator:

a) **NodeMCU ESP8266:** This is low-cost Wi-Fi microprocessor with software integrated TCP/IP networking software and microcontroller capabilities.The manufacturer named Ai-Thinker created ESP-01 module. This tiny module enables microcontrollers with the use of Hayes-style instructions. This also enables to join a Wi-Fi network TCP/IP connections .However, at initially, there was hardly any information available in English on the chip and the orders it would receive.

b) **Solid state relay:** When an external voltage (AC or DC) is applied across its control terminals an electrical switching device called a solid state relay (SSR)can be turns on or off. This is more durable than electromechanical relay but solid-state electronics can't have any moving parts. SSRs are made up of a sensor that senses to the proper input (a control signal), an electronic switch that changes power to the load circuitry, and a coupling mechanism that enables the control signal to activate the switch without using any mechanical components. They might be made to switch AC or DC loads. Semiconductor devices like transistors and thyristors are used by packaged SSRs to switch currents up to around 100 amperes.

c) **Power regulator:** A voltage regulator is used to maintain a constant voltage. Negative feedback or a feed-forward architecture is used in a voltage regulator. Voltage regulators manage the automotive alternators plant's output in central power plant generators. Voltage regulators can be installed at a substation or together with distribution lines in an electric power distribution system to get all customers receive constant voltage regardless of the amount of electricity they consume.

8.RESULT ANALYSIS

In the proposed model the voice detection system gets the voice from the system and sends it to the necessary module and from there it checks the validity of the user depending on the command the user wants to use. The data is then sent to the server and from there it is sent the server where it updates the control variable in the IoT framework. The ESP8266 WIFI module the detects the change in the control variable and then does the necessary control system changes.

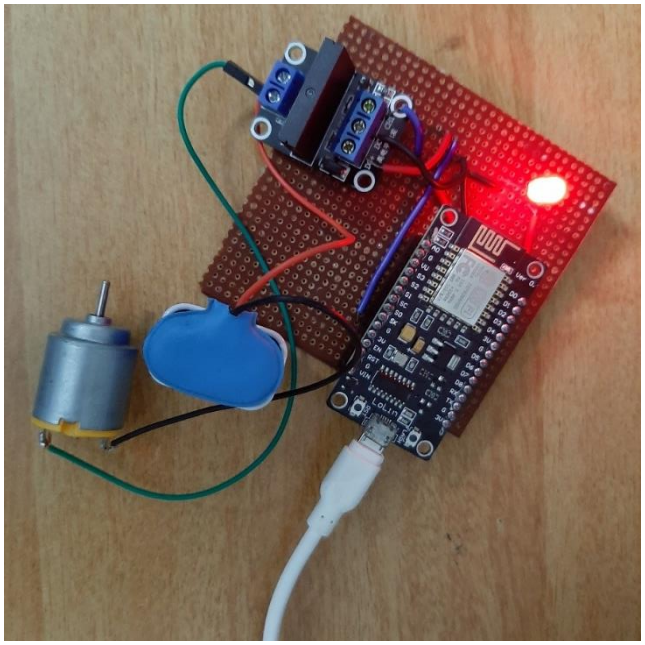

Fig 4 Testing of the lighting command

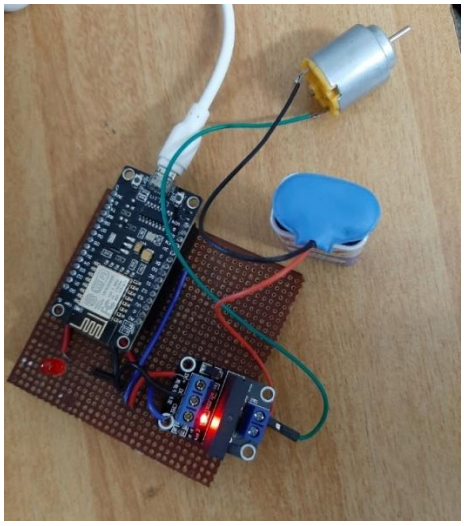

Fig 5 Testing of the motoring command

The action for the control pf the motor can be seen the relay light turning on. In ThingSpeak website we can update the control variable of the IoT framework

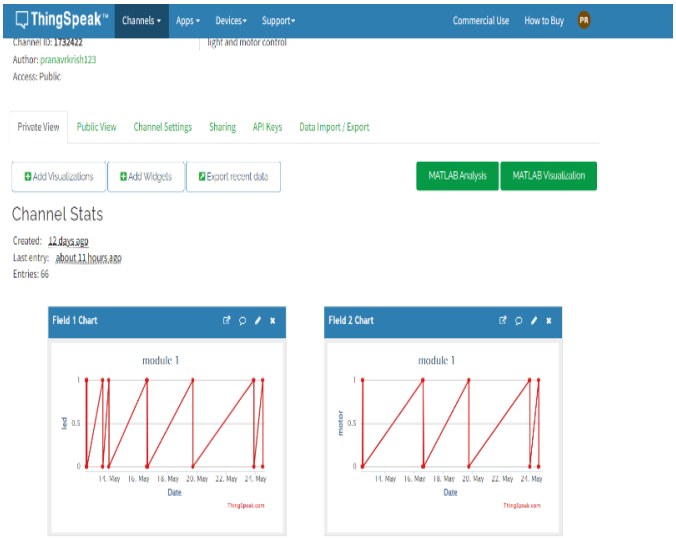

Fig 6 Thinkspeak variables

9.NOVELTY OF THE WORK

We as humans have always been in the search of making our lives easier and easier. So, automation of the simplest task like turning of light and or other similar devices where we spend a good of our life doing can be cut down by a large amount. This will make our work life more efficient and it helps us to save a lot of time which we can use to do more important things.

10. FUTURE DEVELOPMENT

Technology is evolving day by day this results in the advancement of technology in health care sector. Researchers are continuously working to develop new and better voice detection sensors and equipment. Future development in this device is done by better developing the machine learning system where can accurately and efficiently detect the said user and properly detect the commands said by the user. After the implementation of the mentioned features this device become a complete package for complete home automation

11. CONCLUSION

This paper suggests an architecture for a smart home controller that focuses on the use of online learning and can manage many connected devices in accordance with user preferences and routines. Utilizing equipment, the study of this controller was put to use in a real-world situation. It goes without saying that the methods employed here may be readily applied to any other smart home device. The concept uses various modules to automatically

connect all the lights and fans in a home, and it can be operated directly from a phone or a system.
Nevertheless, the outcomes of the various evaluation tests serve as a confirmation of the effectiveness and functionality of the created system. In addition, an examination of the time and space complexity of the employed online learning algorithms was performed. From these and in response to the research question posed in Section I,it is possible to confirm that evolvable intelligence can be incorporated into a smart home controller using online learning techniques, resulting in a solution that can automatically adapt to the user's habits and behavioral patterns. Furthermore, it is anticipated that any future work in this field will be guided by the flaws and restrictions of the design of the ML models examined here.

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