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Artificial intelligence voice assistant and home automation

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Abstract

In the realm of artificial intelligence (AI), the fusion of A.I. voice assistants with home automation has revolutionized the way humans interact with and control their living spaces. A.I. voice assistants, powered by sophisticated natural language processing algorithms, seamlessly interpret user commands and queries, enabling a fluid and intuitive communication channel between individuals and their smart homes. Through advanced machine learning models, these assistants continually evolve, adapting to user preferences and refining their capabilities over time. The symbiotic integration of A.I. voice assistants and home automation systems transcends conventional paradigms, ushering in an era where users can effortlessly manage diverse aspects of their home environment with a mere vocal prompt. This transformative synergy not only enhances the efficiency of daily tasks but also augments accessibility, making smart home technology more inclusive for users with varying levels of technical expertise. As A.I. voice assistants continue to evolve, their role in home automation stands as a testament to the profound impact of artificial intelligence on shaping the future of modern living.

Keywords: Internet of Things; Python; Speech to Text; Voice Assistant; Texts to Speak.

1. Introduction

In the era of technological advancement, the integration of Artificial Intelligence (A.I.) has transcended traditional boundaries, revolutionizing the way we live and interact with our surroundings. One such groundbreaking application is the fusion of A.I. Voice Assistants and Home Automation, a synergy that promises to redefine the concept of smart living. This project delves into the intricacies of developing an innovative and efficient A.I. Voice Assistant & Home Automation system that not only elevates user experience but also caters to the growing need for seamless and intelligent home management.

In modern times especially nowadays digital age, assistants that speak have become an extremely big growing or rising subject; in thus, they have grown into an essential component of every person's daily lives. It is very beneficial for individuals simply by listening to their instructions, and providing instructions isn't that difficult—the user only must speak a single language for the voice assistant to function. The language most often used for controlling is spoken English. As a result, even young children can use it to give commands. Given that it's abstracted, those who are physically impaired may also find it to be of great use.

In simple terms, this indicates that the device has been integrated using the online world of things since, for instance, a person who is not to take steps may just utter the phrases using their own voice to instruct your staff to turn off the light bulbs. This can additionally place orders you things, remember what you need to ask for and where to ask from, remember your favorite restaurant for meals, and much more. It additionally has the ability to remind you of anything you need to remind of your assistant to remind you of.

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The convergence of A.I. Voice Assistants, driven by sophisticated natural language processing algorithms, with the capabilities of Home Automation technology, presents an unparalleled opportunity to create an intelligent and responsive living environment. From controlling lighting and temperature to managing security systems and entertainment devices, the potential applications of this integrated system are vast and transformative.

The journey towards intelligent homes began with the emergence of basic automation systems, allowing for remote control of lighting, temperature, and security. However, the integration of AI voice assistants elevates this concept to new heights, enabling intuitive interaction with our living environments through natural language commands. This synergy between AI and home automation not only simplifies daily tasks but also fosters a more personalized and adaptive living experience. Imagine arriving home after a long day and simply uttering a command to adjust the lighting, play your favorite music, and set the thermostat to your preferred temperature – all orchestrated seamlessly by AI.

As we embark on this project, our aim is not only to showcase the technical prowess behind the development but also to address the ethical considerations and user-centric design principles that come with creating an A.I. Voice Assistant & Home Automation system. Furthermore, by sharing our methodologies and insights, we intend to contribute to the broader discourse on responsible A.I. development and sustainable smart home solutions.

A voice assistant is very important and will also save us a lot of time and everything will be easier to do in voice assistance. In other words, multi-tasking.

Python and Arduino technology and explore the amazing world of artificial intelligence (AI).

Beyond the realm of convenience, the marriage of AI voice assistance and home automation holds profound implications for energy efficiency, accessibility, and security. By harnessing the analytical capabilities of AI, smart homes can optimize energy consumption patterns, reducing waste and environmental impact. Moreover, for individuals with disabilities or limited mobility, voice-activated controls offer newfound independence and accessibility within their living spaces. Additionally, with AI-driven security systems, homeowners can enjoy peace of mind knowing that their property is monitored and protected around the clock. As we embark on this exploration of AI voice assistance and home automation, we delve into a realm where technology not only enhances our lives but also reshapes the very fabric of our homes and communities.

The Super Duper project aims to create a smart and intuitive system that responds amazingly to voice commands to control and manage a variety of every interesting home appliance.

2. Literature review

Voice Activated Personal Assistants Acceptable of Usage in a Public Domain was presented by **Aarthi Easwara Moorthy** (2014) et al.; this technology allows users to manage household equipment with just their voice, but it may not work as intended when strangers are around. Additionally, the design of controlled by voice virtual assistants serves as a foundational translator and fulfills user requests via the computer's personal assistance [1].

According to **Veton Këpuska** (2018) and colleagues, Future Digital Personal Assistance will employ artificial intelligence to provide more human-machine interaction through gesture detection, picture or video recognition, and speech recognition. The user will see the outcome after the assistant selects the ideal output device. System calls are absent [2].

According to **George Terzopoulos** (2019) et al., artificial intelligence (AI) is the processing of natural language, which will be highly beneficial for people in their daily lives. He also suggested voice-controlled assistants and smart speaker systems for use in everyday life and education. People who are blind will find it very helpful as its IoT characteristics enable them to do daily duties. [3]. the modern world since it can control household appliances with merely voice commands, increasing the

A brief study on a speech control systems built around an artificially intelligent (AI) helper has been offered by **Tae-Kook Kim** (2020) et al. It indicates that the AI assistant uses the conditional auto-run system, IFTTT (IF This, Then That), along with the open programming interfaces (API). Although it lacks system calls, it can still be controlled via the Raspberry PI computer board [5].

A voice assistant powered by artificial intelligence was suggested by **Subhash S.** et al. in 2020. The speech to text feature has been built by the author using a recorded audio file, after which the functions are processed. This project makes use

of the Google's Texts To Speak (S) processor and a strong library. Despite this, functionality like the Internet of Things and calling the system are absent [6].

According to **Benedict D. C.** et al. (2020), customer choices made using computer-controlled virtual assistants are likely to elicit stronger emotional reactions from the system when it imitates human behavior. There are Internet of Things functions on the assistant. It may also place orders for items that consumers request, yet this paper has several drawbacks. The primary drawback of voice assistants is that they do not have system calls, which means they must rely on the speaker's capacity to convey the many options for decisions in speech conversations [7].

Following various api responses and system requests, **Nivedita Singh** (2021) et al. presented an audio assistant utilizing the Python's voice text module. This led to the development of a voice assistants utilizing The programming language Python that enables users to execute any kind of operation by voice without interacting with a mouse or keyboard. Additionally, hybrid systems may run this. As a result, this article is deficient in a few areas, such as the poorly implemented system functions [8].

In a work on computer assistance AI, **Abeed Sayyed** (2021) et al. combined The programming language Python with the Internet of Things capabilities and artificial intelligence (also known as AI features in conjunction with a Sql Database (Database). Although this endeavor lacks functionality for systems and calls to the API, it does provide a database connect & querying mechanism [9].

A project on Handheld Voice Processing with a Graphical User Interface, or GUI, Automat was unveiled by **P. Krishnaraj** et al. in 2021. The system utilizes The programming language Python and the search engine's online voice recognition technology to transform spoken input to text. As an outcome, this project features both a portable foundation and a graphical user interface. This Texts to Speech (TTS) system has comparably poor precision and no Internet of Things functionality [10].

The creation of a computer speech recognition systems using the programming language Python was suggested by **M. Sermakani** et al. in 2021. With Python serving as the backend, this project combines AI technologies such as voice activation, automated speech recognition, Teach-To-Speech, and voice biometrics. In addition to having a strong mind technologies and dialogue managing procedure, this project has a dependable internet connection, which is essential because users occasionally lock themselves out of their own homes [4].

A Novel Python-based Speech Help Systems for Lowering the Device Requirement of Current Generation Real Server was the project that **Rajdip Paul** (2021) et al. proposed. The assistance program that this writer has suggested uses The programming language Python as the backend and supports calls to the system, calls to the API, and a number of other functionalities. Although this project responds to api calls rather effectively, comprehension and dependability still require work [12].

A Python-based project called The Voice- Assisted Assistant for PC was presented by **V.Geetha** et al. in 2021. With The programming language Python serving as the backend, the author suggested a virtual assistant project that would allow us to perform tasks like restarting or shutting off our computer with a simple voice command or reading the most recent news. Not every API will be able to translate the original JSON (JavaScript Object Notation) information into text, however this project includes a backed up library. Additionally, the processing of request calls is delayed [13].

The Feasibility Study of Ai Intelligence-Based Voice-Based Assistants that can appropriately respond to user requests was proposed by **Dilawar Shah Zwakman** et al. in 2021. It does not have API calls, but it does have a feature that allows it to schedule a voice conversation with someone the user mentions [14].

The polling tool, Ok the search engine Google: Utilizing Virtual Assistance Tools for Gathering Data in Psychology and behavioral Studies, was invented by **Philipp Sprengholz** et al. in 2021. It is an improvement on the Google Assistant's functionality and was used to verify the reliability and accuracy of the information collected by the test. Each type of inquiry has specified synonyms and possible replies, thus it may be used to analyze a person's behavior. Given that it's an interpersonal and psychological study helper [15].

A study titled "Within the rooms Voice-Based AI Virtual Assistant Enhancing On-site Resort Service and Customers' Experience" was proposed by **Dimitrios Buhalis** et al. in 2021. wherein hotel amenities make use of voice assistants. This will come in extremely handy in the present COVID-19 age. In this COVID era, human contact is seen as dangerous, and losing human contact when using a voice assistance is not seen as advantageous. It requires sophisticated connectivity and instruction for employees to operate the air conditioning and light settings in the space [16].

3. Proposed work

Voice assistants have become indispensable problem-solving tools in today's world. With just a spoken command, users can instantly find solutions to a wide range of queries without the need for any additional tools or resources. They also play a crucial role in home maintenance tasks, such as setting timers or controlling various appliances. In this context, having an AI-powered voice assistant like "Hello NOVA" (Next-Gen Optimal Voice Assistant) is essential in our modern lives.

Let's delve into understanding the design of a use case diagram for this system. In this scenario, each user acts as an actor in the diagram, interacting with NOVA, the voice assistant. The core functionality of NOVA lies in its ability to understand and respond to user queries. Users communicate with NOVA through a microphone, which captures their spoken commands. The assistant then utilizes a speech-to-text module to convert the spoken words into text format for further processing. Subsequently, NOVA processes the text through various modules and executes the necessary actions based on the user's request.

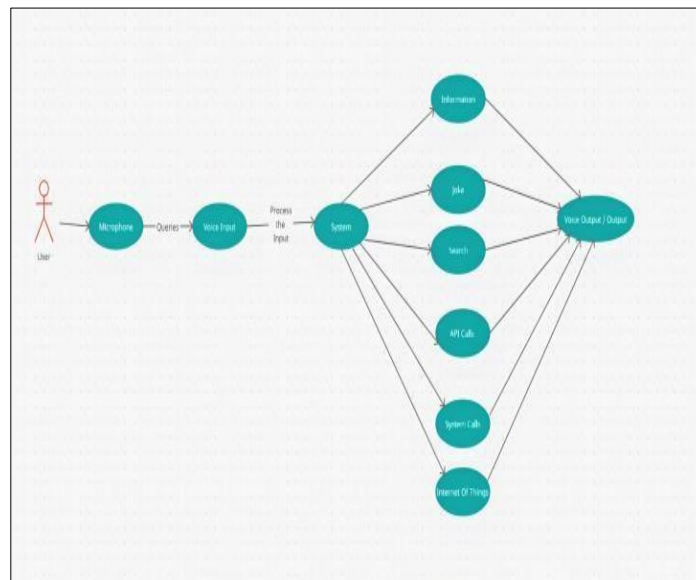


Figure 1 Use Case Diagram

In essence, the design of this use case diagram illustrates how users interact with NOVA, the voice assistant, to accomplish various tasks seamlessly. Through the integration of advanced technology, NOVA simplifies everyday activities and enhances user experience through voice-controlled interactions.

Mandatory features of a Voice Assistant

Must provide the user any information which they ask for

Sometimes, we just need information quickly, right? Like, imagine you're working on a project and you need some details from the internet. It could take forever to find and read through everything. But with a voice assistant, bam! You've got what you need in a flash. So yeah, having a voice assistant definitely saves time.

Telling the day's hot news in the user's location

You know how it is, you want to catch up on what's happening in your area but flipping through channels or scrolling through news websites takes ages. It's like, can't we just get to the good stuff? That's where a voice assistant comes in clutch. It dishes out the news from your neck of the woods or whatever news you're into, no fuss, no muss.

Telling some joke to chill up the moment

Everyone's had those tense moments, right? Like when you're stressed or you've had a spat with someone close to you. Sometimes, all it takes is a good joke to break the ice or lighten the mood. They say laughter's the best medicine, and honestly, it's hard to argue with that.

Opening the file/folder which the user wants

Life's busy, man. We've all got stuff to do and not enough time to do it. Ever find yourself scrambling to find a file or folder on your computer? It's a hassle. But with a voice assistant, you just tell it what you need and bam, there it is. No more wasting time hunting for stuff, just get it done and move on.

Telling the temperature/weather at the user's location

Knowing the weather might seem like a small thing, but it's actually pretty important. Like, it helps you plan your day, right? If it's gonna rain, you grab an umbrella. If it's sunny, you bust out the shades. AI voice assistant that gives you the scoop on the weather. That's just practical.

Searching for what the user asks

We all have questions, right? And sometimes, we need answers fast. Google stuff can take forever, but asking your voice assistant? Quick and easy. Plus, it's handy for keeping up with what's going on in the world. Just tell it what you want to know and voila, there's your answer.

Internet of Things

Okay, imagine this: you're chilling at home and you want to turn on the fan, but the switch is way over there and you can't move. Bummer, right? But with IoT, you can just tell your voice assistant to do it for you. It's not just about convenience, it's about making life easier for everyone, especially those who might need a little extra help. And that's pretty cool.

These are the important features of the voice assistant but other than this, we can do a sample of stuffs with the assistant.

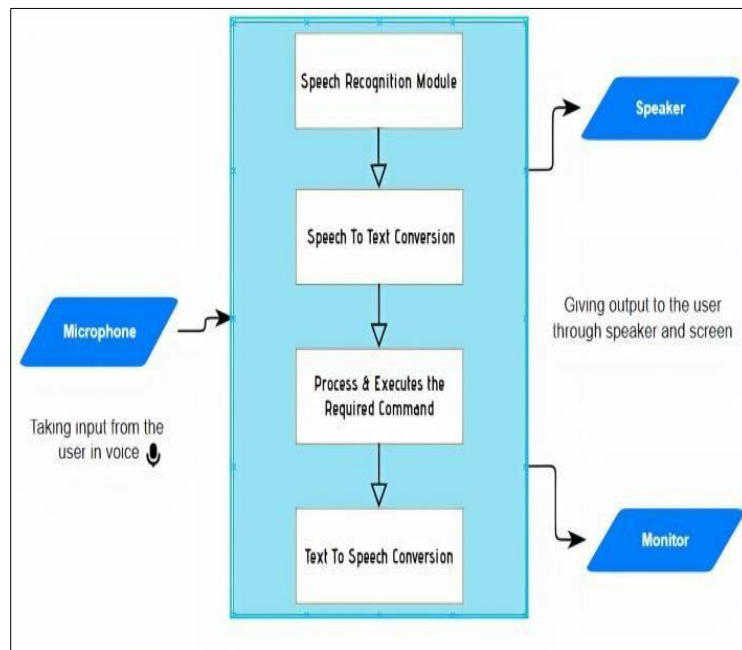


Figure 2 Workflow Model

The user uses a recording device to provide a voice inputs, and the virtual assistant responds by using the awakening word to initiate Speech to Text (STT) and translating what the user says into text. It also comprehends the sound input and continues to carry out the task that the user has repeatedly stated, delivering it through TTS, which stands component via artificial intelligence (AI) voice commands.

Limitations

In the modern technology the universe, as well voice-controlled devices have been around for a while, and the platforms that are already in place have very few shortcomings.

Sometimes, the voice recognition feature doesn't work perfectly. You know, when you ask the assistant something, it doesn't always get it right on the first try. Sometimes you have to repeat yourself, or it might misunderstand what you're saying and give you the wrong answer. Like, it can't always tell the difference between words that sound the same but have different meanings, like "their" and "there".

Another issue is background noise. You ever notice how you have to be in a quiet room to talk to the voice assistant? That's because it gets confused when there's a lot of noise in the background. It might mix up your words with someone else's or with other sounds in the room, which can cause errors and mess things up.

And then there's security. It's kind of scary to think about, but anyone who can talk to the device can get access to your personal stuff. I mean, it can read out your emails, calendar events, and all sorts of private info. That's a big security concern right there. Plus, there are other risks too, like hackers trying to intercept your conversations and mess with the assistant. It's something we've got to watch out for.

4. Implementation of proposed work

4.1. Why Python is used

We chose Python as the foundation for our voice assistant because its support for Object Oriented Programming simplifies development, making it less daunting to create the assistant. Python's versatility allows us to tailor the assistant's queries to suit each user's unique needs. Speech Recognition is crucial, as it converts audio into text for the assistant to understand user requests. Python's widespread adoption extends its capabilities beyond a single task, enabling us to delve into complex domains like Artificial Intelligence, Machine Learning, natural language processing, and data science, thanks to its extensive libraries.

The programming language Python is used in so many different contexts so it is not limited to a single task. Due to its increasing popularity, it is now able to participate in a few of the most common and intricate procedures, such as data analysis, machine learning (ML), artificially intelligent (AI), and processing natural languages. For all the libraries this project would require, Python has a ton of them.

Apart from these, there are many more things we can accomplish with the voice assistant, however these are its key functions. A list of functions that the helper can perform is as follows:

Play any clip that the user requests to see.

Presenting a random information at the beginning of the day so that the user may start their job in an educational manner and discover something new. Playing games is one of the functions that every assistant will have so that the customer may pass the time during their leisure time in an enjoyable manner.

Users may overlook turning off a system that may hold important data, however with a voice-controlled assistant, we may do this without departing the location of the device by simply providing the virtual assistant the instruction to do so.

What can this Voice Assistant do?

As discussed about the mandatory features to be listed in voice assistant are implemented in this work, brief explanation is given below.

4.2. API calls

The News Request API is a straightforward JSON-based Restful (Representations Status Transfers) API that allows us to locate and retrieve news items from all over the internet. We used API credentials to obtain news data from this API. It may be utilized for distributing the most recent news on news websites, look for the most recent news on a certain subject, and get the weather prediction from open climate map platforms that employ widely known APIs. Equipped

with convolutional machine learning, this system can furnish all the meteorological data required for making informed decisions for any part of the world. which is capable of precisely retrieving data and providing the user with outcomes.

4.3. System Calls

This functionality allows us access to our desktop, calculators, process manager, commands prompts, and users folders via the Operating System (OS) and the Internet Browser Modules. This can also launch the Chrome browser and reboot the computer.

4.4. Content extraction

By applying a web driver modules from Selenium, which offers every possible implementation for the web drive, such as looking for a particular clip for playback, to acquire particular details in Google, or via the website Wikipedia, this may execute information extracting from the website YouTube, the website Wikipedia, and Google Chrome. The virtual assistant starts by asking the individual using it what it may accomplish for them. When a user asks the web browser to search for anything, the internet opens, uses an element's path to locate the query for that element, and the individual clicks that element. The user requests that the assistant look for something, and the assistance types it out.

Following the request's input, the virtual assistant uses the search button's route to click on the button in the same manner that it pressed on the search window. The helper uses a web browser in this manner. When a user requests the virtual assistant to begin playing a video from YouTube, for instance, the assistance starts YouTube in the web browser, looks up the video the user requested for playback, and then hits the search icon. Using the clip's route, it taps on the very first clip.

4.5. Serial modules

Ultimately, the Internet of Things (IoT) functionality for the current endeavor was implemented using the serial port component.

It is a component that uses COM5 and port number 11 to obtain accessibility the Arduino board's serial port for communication.

Algorithm

-Speech Recognition Module

We're working with a class called Recognizer. What it does is pretty neat: it takes audio files and turns them into text. Then, we use a module to convert that text into speech.

One important thing to note is the energy threshold function. This basically sets a level for how much sound is needed to be considered speech. Anything below that level is seen as silence, while anything above it is recognized as speech.

Now, the Recognizer instance we're using is smart. It adjusts itself to the background noise, making sure to pick up on the audio we want, even in a noisy room. And there's this cool feature called duration. It's like a dynamic adjustment for the energy threshold. Basically, it changes based on the audio it's processing, so it's always at the right level to catch speech while filtering out background noise.

Texts into Voice & Voice into Texts

A Python text-to-speech the conversion tool is called Pyttsx3. You may use certain instructions to adjust the Speech, Speed, and Loudness. Utilizing the Voice Identification API in the programming language Python, we may transform lengthy or big audio recordings into text for additional processing. Python has an API for recognizing speech. Talk TTS Engines and Sapi5 are provided, and they may handle the same data.

-Processes and Performs the Necessary Command

The aforementioned command is spoken recognizing software translated into text, which is then saved in a temporary file. After using temp to analyze the user's text, it determines what the user requires depending on the input given and executes the while loop. These instructions are carried out in this manner.

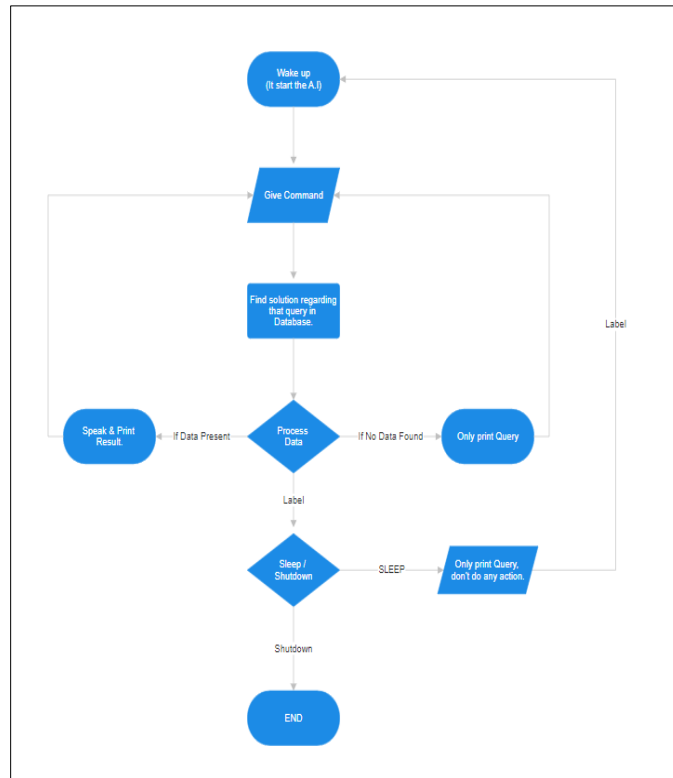


Figure 3 Flow Chart

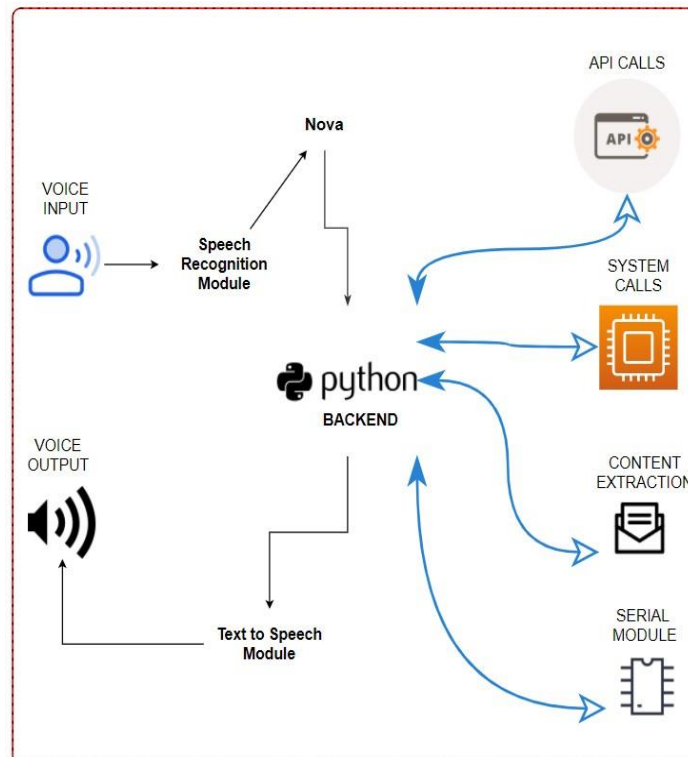


Figure 4 Architecture Diagram

Table 1 Working Table

Component	Description
A.I VOICE ASSISTANT MODULE	
Speech Input Process	Microphone captures user voice commands.
Speech Recognition and Interpretation	Python processes spoken words using speech recognition libraries.
Natural Language Understanding (NLP)	NLP algorithm deciphers user intent and context.
COMMUNICATION HUB	
Encoding and Decoding	Convert Commands for compatibility between Python & Arduino.
ARDUINO HOME AUTOMATION	
Device Control	Actuator interface with home appliances based on received command.
USER FEEDBACK MODULE	
Voice Output	Speaker produces spoken responses acknowledging command or providing information.
INTERACTION FLOW	
User speaks command	Capture by Speech Input processing Module.
Speech Recognition	Convert spoken words to text.
Arduino Action	Control devices based on received command.
Feedback	Voice response or visual indicators confirm the action to the user.

Table 2 Basic Working Commands

Commands	Working
Wake up	It starts Listening, take command & speak Result Accordingly.
Turn on LED	LED turn ON by given command to Arduino
Turn off LED	LED turns OFF by given command to Arduino.
Search " " on Google, YouTube, Wikipedia	Search it on these and speak + print result.

5. Results and discussion

In this report, we've outlined the project work on our voice assistant, highlighting its usefulness and potential reliability in completing various tasks for users.

We've emphasized how this technology can seamlessly integrate into our daily lives, making it easier for individuals to manage their homes and tasks efficiently. As we've discussed, the voice assistant is continuously evolving, offering hope for even greater advancements in the near future.

We're pleased to report that the development of the software is nearing completion, and initial testing has shown promising

Results. While some additional development may be needed for further improvements, we anticipate that our voice assistant will continue to grow in usefulness and become a significant technology in today's ever-evolving world.

The primary goal of this work is to integrate additional intelligent applications into it in order to further enhance the virtual assistant beyond its current state. Customers will therefore save a significant amount of effort. To sum up, let me say that we will do all in our power to provide one of the greatest voice-controlled assistants available.

As we look to the future, it is evident that the marriage of AI voice assistance and home automation will continue to evolve, presenting endless opportunities for innovation and improvement. From enhancing convenience and efficiency to promoting sustainability and security, the possibilities are truly endless. Through ongoing research and development, coupled with a commitment to user-centric design, we can unlock the full potential of these technologies, ushering in a new era of intelligent living where homes truly become extensions of ourselves.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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