ECHOSPHERE AI THE ULTIMATE VOICE COMPANION USING PYTHON

submitted in partial fulfillment of the requirements
for the award of the degree in

MASTER OF COMPUTER APPLICATIONS

by

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DEPARTMENT OFCOMPUTER APPLICATIONS

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DECLARATION

I **DASHWIN.P (234012101022),** hereby declare that the Project Report entitled "**ECHOSPHERE AI : THE ULTIMATE VOICE COMPANION USING PYTHON**" is done by me under the guidance of Dr./Mr./Ms. **NAGARATHINAM A** is submitted in partial fulfillment of the requirements for the award of the degree in MASTER OF COMPUTER APPLICATIONS.

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of Mr.**DASHWIN.P** Reg. No. **(234012101022),** who has carried out the project entitled **"ECHOSPHERE AI : THE ULTIMATE VOICE COMPANION USING PYTHON**" under our supervision from February 2025 to June 2025.

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LIST OF ABBREVIATIONS

ABBREVIATION	DEFINITION
IDE	Integrated Development Environment
GUI	Graphical User Interface
API	Application Programming Interface
CNN	Convolutional Neural Network
DNN	Deep Neural Network
HOG	Histogram of Oriented Gradients
OTP	One-Time Password
UI	User Interface
UX	User Experience
DB	Database
UAT	User Acceptance Testing
GDPR	General Data Protection Regulation
SQL	Structured Query Language

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ABSTRACT

Voice assistants represent a groundbreaking advancement in the realm of human-computer interaction, redefining the way people interact with technology. These software programs are capable of recognizing, interpreting, and responding to spoken language, allowing users to control devices, retrieve information, and perform tasks using only their voice. This innovation has made technology more intuitive and accessible, leading to widespread adoption across a variety of platforms and demographics. In the modern era, the integration of voice assistants has become almost seamless with daily life. Whether embedded in smartphones, smart speakers, or other connected devices, these assistants offer users a convenient way to execute commands hands-free. From setting reminders and making calls to controlling smart home appliances and playing music, voice assistants provide solutions that are not only time-saving but also user-friendly. Their ability to understand natural language allows for a more conversational interaction, which feels more human-like and less technical, especially for non-tech-savvy users. The popularity of voice assistants has been further accelerated by the global pandemic, which forced people indoors and increased dependence on digital devices. Even children as young as five years old have become familiar with voice-enabled features, as smartphones and smart devices became essential tools for learning, entertainment, and communication during lockdowns. This early exposure has made voice assistants a part of daily routines for all age groups, indicating a shift in how future generations will interact with technology. Another key advantage of voice assistants lies in their accessibility features. For individuals with physical disabilities or mobility challenges, voice assistants act as a bridge to digital empowerment. Tasks that typically require physical interaction, such as turning lights on or off, adjusting room temperatures, or accessing information online, can now be accomplished effortlessly through voice commands.

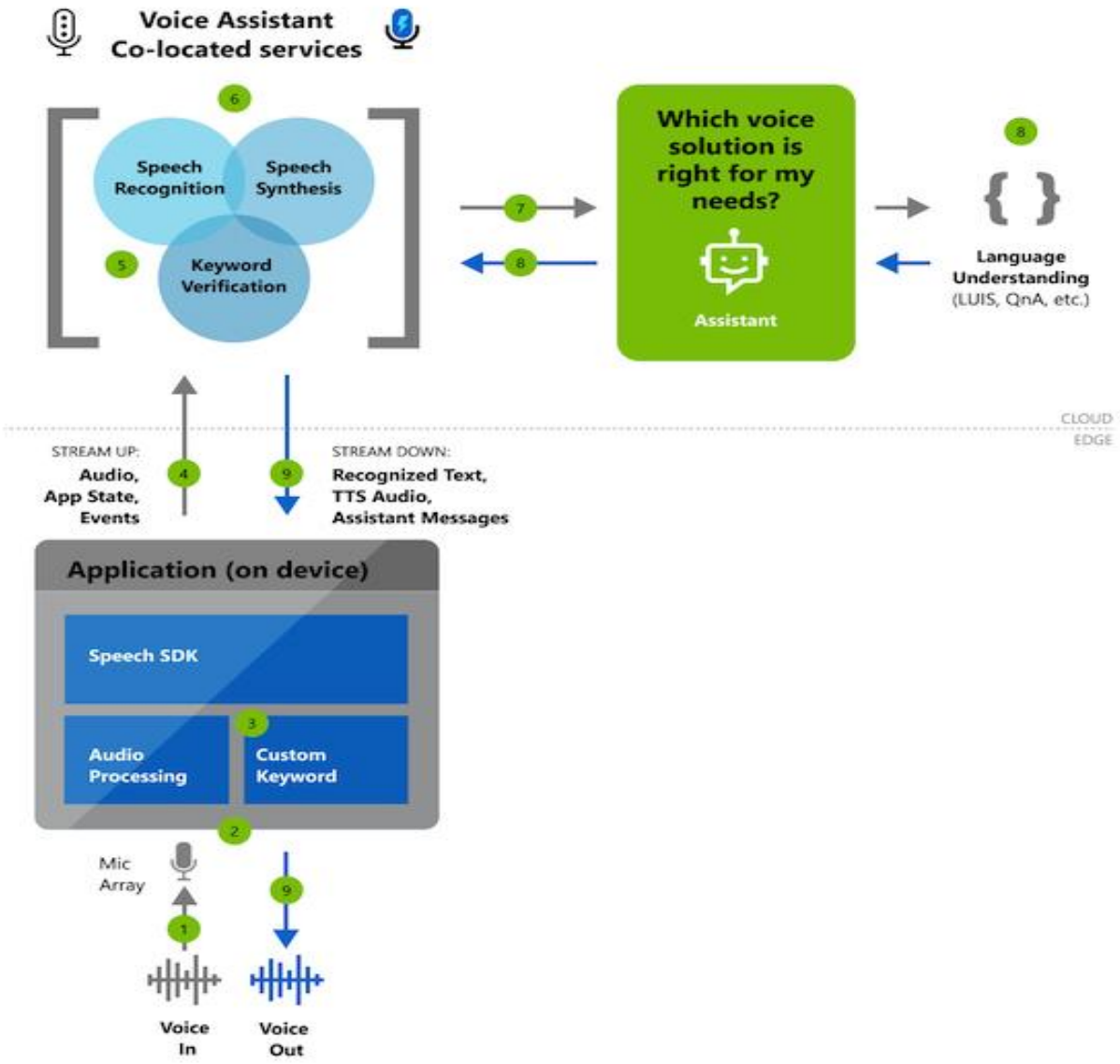
CHAPTER 1

INTRODUCTION

In recent years, the advancement of artificial intelligence (AI) and natural language processing (NLP) has transformed the way humans interact with machines. Among the most prominent outcomes of this technological evolution is the development of **voice assistants** intelligent systems that allow users to perform tasks, retrieve information, and control digital environments through voice commands. Voice assistants such as Amazon's Alexa, Apple's Siri, Google Assistant, and Microsoft's Cortana have become integral parts of modern smart devices, providing users with hands-free, efficient, and context-aware digital experiences. The ability to interact with machines using natural language is no longer a futuristic concept; it is a reality that continues to evolve, shaping how individuals navigate both their personal and professional lives.

A voice assistant is fundamentally a software agent that can perform tasks or services based on verbal commands. It utilizes several AI technologies such as speech recognition, speech synthesis, machine learning, and language understanding to convert human voice into executable actions. These assistants can be integrated into a variety of platforms including smartphones, laptops, smart speakers, and even home automation systems, thereby offering convenience, accessibility, and improved user engagement. They are especially beneficial for individuals with disabilities, enabling greater independence through voice-based control over devices and services. The hands-free nature of these systems also enhances productivity, allowing users to multitask while interacting with their devices. The primary motivation for developing a personalized voice assistant, such as **NOVA**, stems from the growing demand for customizable, lightweight, and offline-capable alternatives to mainstream voice assistants. While commercial assistants are powerful, they often come with privacy concerns, heavy hardware dependencies, and limited flexibility in terms of personal modifications or open-source integrations. NOVA aims to bridge this gap by providing a simple yet effective solution that can perform essential tasks such as retrieving weather updates, searching online content, telling jokes or facts, opening files or applications, calculations, and more—all through a user-friendly voice interface. It is designed to operate on personal desktops and laptops, ensuring compatibility and ease of access without the need for expensive hardware or always-on internet connectivity. This project showcases the implementation of NOVA using **Python**, chosen for

its simplicity, large library support, and wide acceptance in AI and automation domains. Libraries such as speech recognition, pyttsx3, Wikipedia, and selenium have been integrated to enable speech-to-text conversion, text-to-speech response, information retrieval, and browser automation respectively. APIs like Wolfram Alpha and OpenWeatherMap are used to enhance NOVA's functionality and provide real-time information to users. The assistant listens for a predefined wake word and remains active to receive and respond to commands, simulating the behavior of popular commercial systems while offering the advantage of customization and transparency. In summary, this project demonstrates how voice-enabled technology can be developed and deployed in an academic or personal context, showcasing the powerful intersection of AI, human-computer interaction, and system automation. As the world continues to embrace voice-first computing, the development of flexible, open, and intelligent assistants



like NOVA paves the way for more personalized and efficient digital ecosystems.

1.1.OVERVIEW

A disease is a condition that affects the individual functioning of body totally. Diseases if neglected will lead to the death of an individual. Diseases can be identified by the symptoms of the body of an individual. Health is the most important in every human's life. Weekly or monthly check up of one's health is most important for the prevention and also to stay healthy. Healthcare is the most crucial parts of the human life. Nowadays, so many are not willing to go to hospital, due to work overload and negligence of their health. The doctors and nurses are putting up maximum efforts to save people's lives without even considering their own loves. There are also some villages which lack medical facilities.

1.2.OBJECTIVE

- To enable natural language interaction between the user and the system using speech recognition and text-to-speech technologies.
- To automate common tasks such as opening applications, retrieving information from the internet, managing system functions, and playing media content.
- To improve accessibility for differently-abled individuals by reducing reliance on physical input devices like keyboards and mice.
- To implement a modular design allowing the integration of additional features such as weather updates, jokes, news reading, and basic computational capabilities.
- To utilize Python programming and its relevant libraries (e.g., speech recognition, pyttsx3, Wikipedia, web browser, wolfram alpha, etc.) for a lightweight yet powerful assistant that can run offline or with minimal network requirements.

1.3.SCOPE

- Speech Recognition: Capturing and interpreting voice commands using natural language processing techniques.
- Text-to-Speech Synthesis: Generating human-like audio responses for queries and system prompts.
- System Operations: Executing basic commands such as opening files/folders, launching

applications, and managing system power states (e.g., shutdown or restart).

- Information Retrieval: Searching Wikipedia, Google, and YouTube for requested content and presenting summarized results through speech.
- Real-Time Data Access: Fetching current news, weather forecasts, and factual data using public APIs.
- Entertainment Features: Providing jokes, random facts, and games to improve user engagement.
- Offline Functionality: Core features will work without requiring a continuous internet connection, making the assistant more versatile.
- Custom Command Integration: The architecture supports adding new functionalities, voice profiles, or integrating with IoT devices in future versions

CHAPTER 2
SYSTEM ANALYSIS

2.1.Problem Definition

The modern era of rapid technological advancement, the demand for more intuitive and hands-free interaction with computing devices has increased significantly. Traditional methods of interacting with computers—through keyboard and mouse—pose limitations in terms of speed, accessibility, and convenience, particularly for users with physical disabilities or multitasking requirements.

Despite the availability of commercial voice assistants like Google Assistant, Amazon Alexa, and Apple Siri, these solutions are often platform-specific, require persistent internet connectivity, or are embedded in expensive hardware devices. Moreover, these systems may not offer full customization or integration with local desktop environments, especially for developers and researchers seeking tailored functionality for specific use cases.

Furthermore, physically challenged users often struggle with day-to-day digital tasks due to the lack of accessible and user-friendly software solutions that can be controlled solely by voice. Similarly, in multitasking environments, such as during work or while driving, traditional input methods become impractical and unsafe

2.2.Existing System

From the above literature survey, we have inferred that all the systems existing predict only particular diseases namely lung disease, breast cancer, heart disease, diabetes by implementing various algorithms on the particular datasets. After implementing various algorithms, the most accurate one is selected and it is used for prediction of disease. Sometimes, we may get confused of what algorithm to use. Also, all the systems find only the particular disease and not the disease based on the symptoms.

Disadvantages

- Dependency on Keyword-Based Commands The assistant relies heavily on predefined keywords to recognize and execute specific actions. If the command does not match the expected pattern or lacks required keywords, the system may fail to respond appropriately.
- Lack of Context Awareness The system does not currently support contextual understanding or memory of past interactions. Each command is treated independently, limiting the assistant's ability
- Limited Natural Language Understanding (NLU) Compared to advanced commercial voice assistants that utilize deep learning for conversational AI, this system has limited ability to understand natural, free-flowing language, idioms, or complex sentence structures.
- Basic User Interface The assistant operates through the command line or terminal interface, which might not appeal to all users. There is no advanced graphical user interface (GUI) to enhance interaction or visualize command output.
- Security and Privacy Concerns Voice data, especially when processed online or through third-party APIs, may raise concerns about data privacy. Without advanced security features like encryption or anonymization, sensitive information could be at risk.
- Language and Accent Limitations The current version is optimized for English commands with neutral accent. Users speaking other languages or with strong regional accents may experience recognition errors, reducing accessibility.
- Lack of Multimodal Interaction The assistant is designed to work solely with voice input and output. There is no support for other input methods like gestures or facial recognition, which could further enhance usability.

2.3.Proposed System

The proposed system is a desktop-based Smart Voice Assistant named NOVA (Next Gen Optimal Voice Assistant) that enables users to interact with their computer using natural voice commands. This system is designed to provide a seamless, hands-free experience for performing routine tasks, retrieving information, and automating operations. By leveraging Python programming and various open-source libraries, the system aims to deliver functionality similar to commercial voice assistants while remaining lightweight, customizable, and platform-flexibl

Advantages

- Enhanced Accessibility The assistant greatly aids users with physical disabilities or mobility impairments by enabling voice-controlled access to essential computer functions and services, thus promoting digital inclusivity.
- Time Efficiency By eliminating the need to manually search for information or navigate menus, users can complete tasks faster using voice commands. For example, asking the assistant to open applications, search the web, or calculate equations saves considerable time.
- Multifunctional Capabilities NOVA supports a broad range of functionalities—from playing music, retrieving news and weather updates, telling jokes, performing calculations, to opening system files—making it a versatile tool for daily use.
- Customizable and Extensible Being open-source and built using Python, the assistant can be easily customized or enhanced. Developers can add new features, integrate APIs, or modify existing commands to suit their personal or organizational needs.
- Offline Functionality Unlike many commercial assistants that require continuous internet access, NOVA supports basic offline features such as opening local files, telling jokes, or performing system-level commands, making it useful even in low-connectivity environments.
- Low Cost and Open Source The entire system is developed using free and open-source Python libraries. This removes the cost barrier associated with commercial voice assistants and encourages wider adoption in educational or budget-conscious environments.
- Natural Language Interaction The assistant allows users to communicate naturally using speech, reducing the learning curve and making it easier for non-technical users to operate the system effectively.
- Educational and Developmental Use This project serves as an excellent learning tool for students and developers who wish to understand the workings of voice interfaces, Python programming, API integration, and speech technologies.
- Platform Independence for Development Although optimized for Windows, the system can be adapted for use on Linux or macOS platforms with minimal changes, due to the cross-platform nature of Pytho

CHAPTER 3 REQUIREMENT SPECIFICATION

3.1.HARDWARE SPECIFICATION

Component	Specification
Processor	Intel Core i5
RAM	4GB
Operating System	Windows/Mac
Input Device	Microphone

3.2.SOFTWARE SPECIFICATION

These software components work together to support:

Operating System	Windows 7 or above
Programming Language	Python 3.5 or above

LIBRARIES

• Speech recognition- It allows computers to understand human language. Speech recognition is a machine's ability to listen to spoken words and identify them. We can then use speech recognition in Python to convert the spoken words into text, make a query or give a reply. Python supports many speech recognition engines and APIs, including Google Speech Engine, Google Cloud Speech API. Command to install :- pip install Speech Recognition

• WolfarmAlpha- Wolfram Alpha is an API which can compute expert-level answers using Wolfram's algorithms, knowledgebase and AI technology. It is made possible by the Wolfram Language. The WolfarmAlpha API provide a web-based API allowing the computational and presentation capabilities of Wolfram Alpha to be integrated into web, mobile and desktop applications. Command to install :- pip install wolfram alpha

• Rand facts- Rand facts is a python library that generates random facts. We can use randfacts.get_fact() to return a random fun fact. Command to install :- pip install Rand facts

• Pyjokes- Pyjokes is a python library that is used to create one-line jokes for the users. Informally, it can also be referred as a fun python library which is pretty simple to use. Command to install :- pip install pyjokes

• Datetime- This module is used to get the date and time for the user. This is a built-in module so there is no need to install this module externally. Python Datetime module supplies classes to work with date and time. Date and datetime are an object in Python, so when we manipulate them, we are actually manipulating objects and not string or timestamps.

• Random2- Python version 2 has a module named "random". This module provides aPython 3 ported version of Python 2.7's random module. It has also been back-ported to work in Python 2.6. In Python 3, the implementation of Rand range() was changed, so that even with the same seed you get different sequences in Python 2 and 3.

• Math- This is a built-in module which is used to perform mathematical tasks. For example, math. Cos() which returns the cosine of a number or math.log() returns the natural logarithm of a number, or the logarithm of number to base.

• Warnings- The warning module is actually a subclass of Exception which is a built- in class in Python. A warning in a program is distinct from an error. Conversely, a warning is not critical. It shows some message, but the program runs.

• OS- The os module is a built-in module which provides functions with which the user can interact with the os when they are running the program. This module provides a portable way of using operating system-dependent functionality. This module has functions with which the user can open the file which is mentioned in the program.

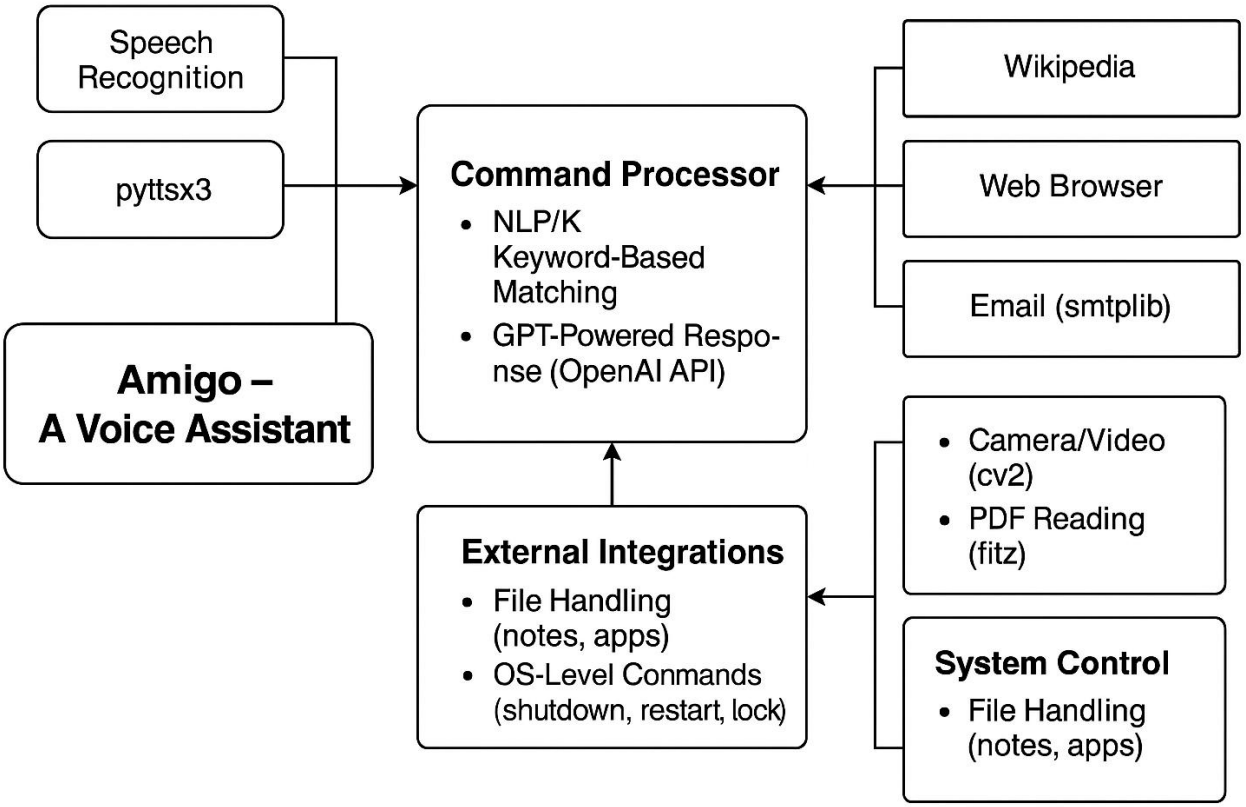
• Serial- This module encapsulates the access for the serial port. It provides backends for Python running on Windows, OSX, Linux, BSD and Iron Python. The module named “serial” automatically selects the appropriate backend. Command to install :- pip install py serial

• Time-This module provides many ways of representing time in code, such as objects, numbers, and strings. It also provides functionality other than representing time, like waiting during code execution and measuring the efficiency of our code. This is a built-in module so the installation is not necessary.

• Wikipedia :-This is a Python library that makes it easy to access and parse data from Wikipedia. Search Wikipedia, get article summaries, get data like links and images from a page, and more. Wikipedia is a multilingual online encyclopedia. Command to install :- pip install Wikipedia

CHAPTER 4 SYSTEMDESIGN

4.1.Architecture Diagram



Workflow Explanation

Voice Input

• The user speaks a command.

• This voice input is captured by a microphone and sent to the Speech Recognition Module.

Speech Recognition Module

• This module (likely using speech recognition in Python) converts speech to text.

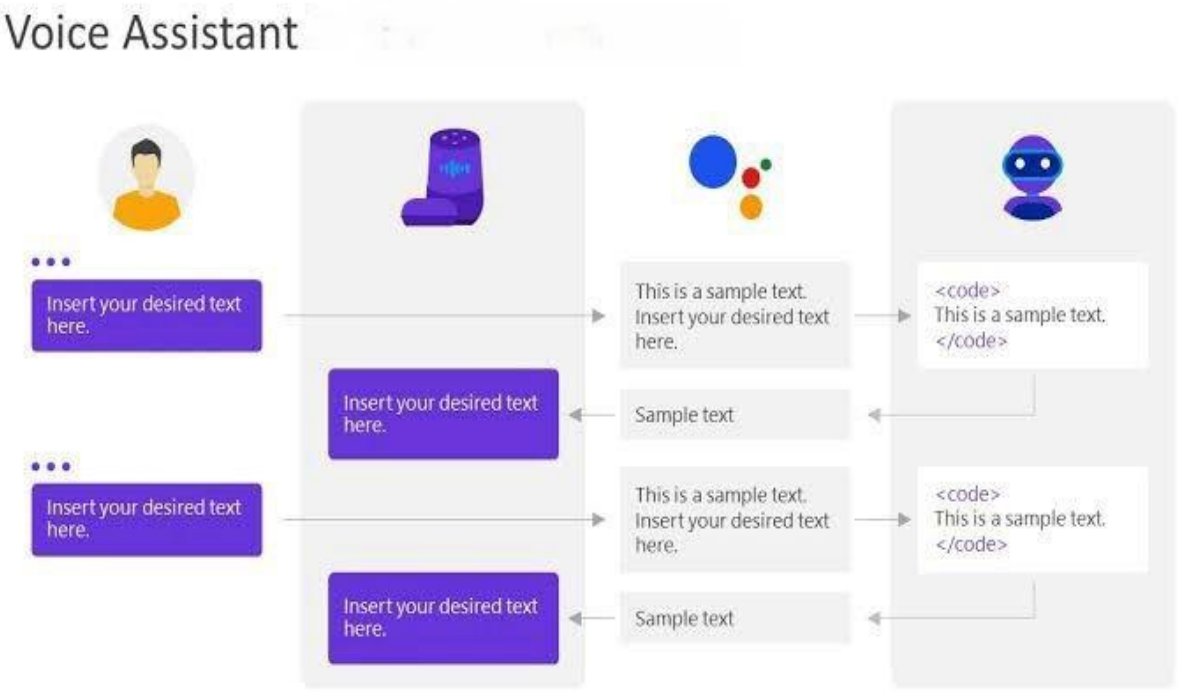
• The interpreted text is passed on to NOVA — the core assistant engine.

Text to Speech Module

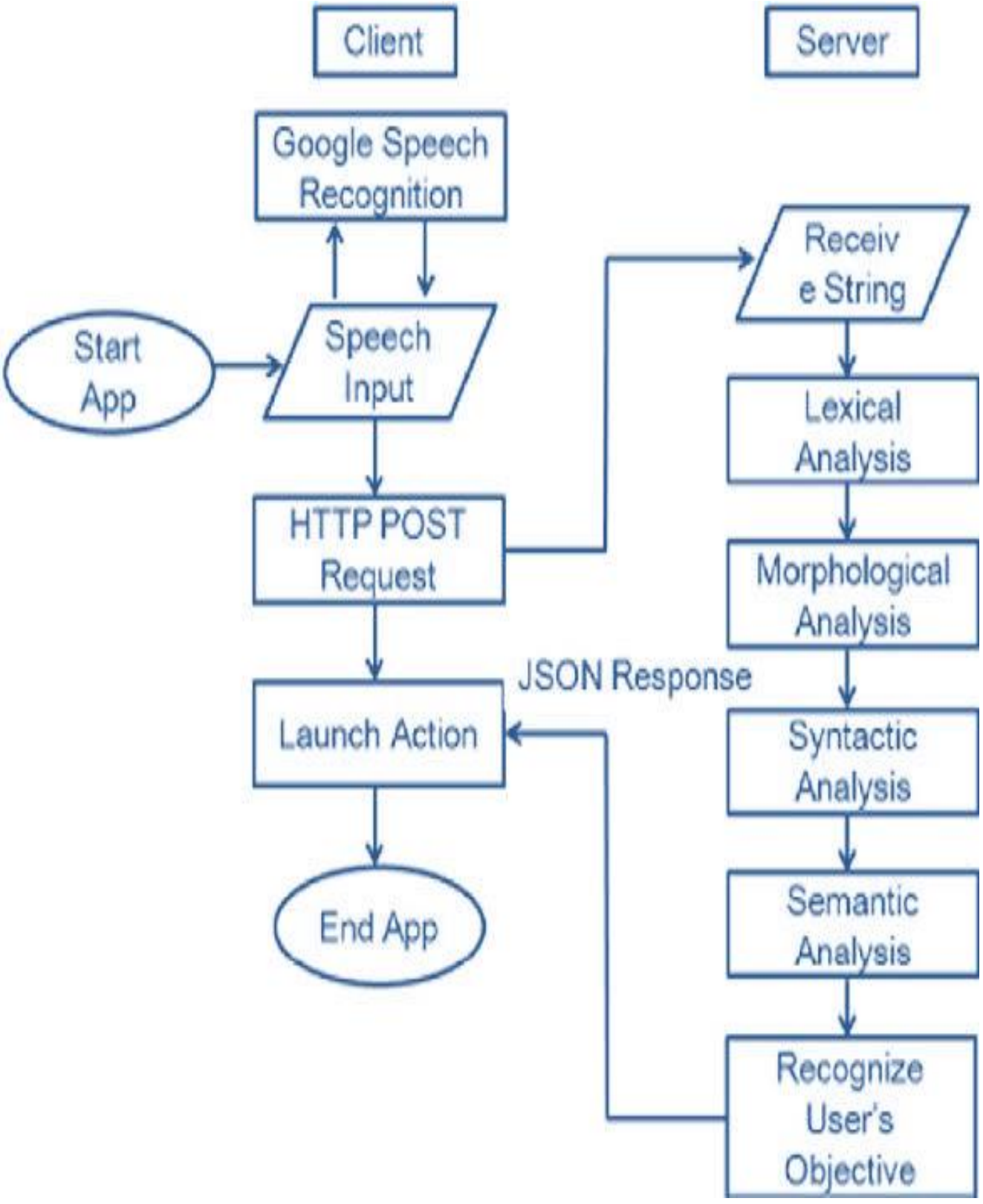
• After processing the command and retrieving results, this module (e.g., pyttsx3) converts the text response back to speech.

• The response is then played through speakers or another audio output device.

Example Of Voice Assistant:



4.2.Data Flow Diagram


Client
Server
Google Speech Recognition
Receiv e String
Start App
Speech Input
Lexical Analysis
HTTP POST Request
Morphological Analysis
JSON Response
Launch Action
Syntactic Analysis
End App
Semantic Analysis
Recognize User's Objective

4.3.Use Case Diagram

This diagram represents the **functional flow** of a **Voice Assistant System**, highlighting how user commands are processed from input to output. Here's a detailed explanation of each component and the overall interaction:

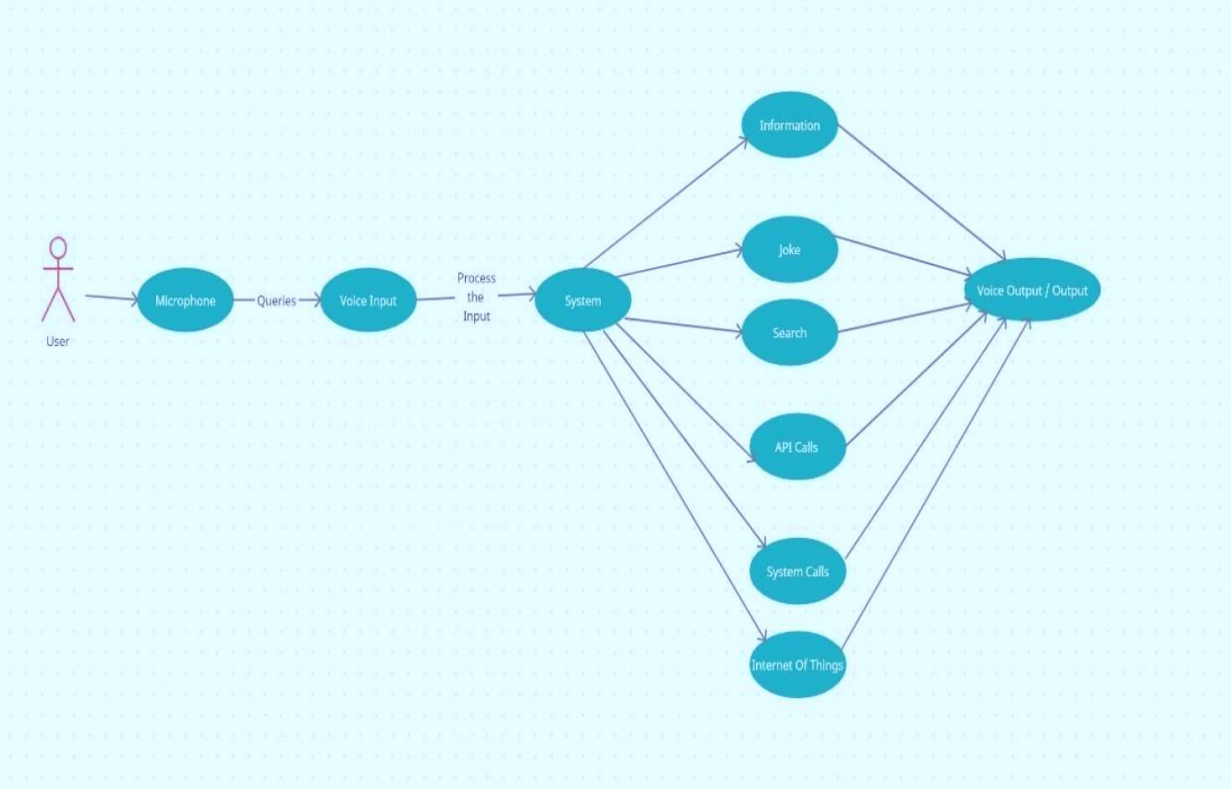
User Input Path

- **User**:
  Initiates the interaction with the system using their voice.
- **Microphone**:
  Captures the **user's voice** and passes it to the system as audio input.
- **Voice**
  Handles the **conversion of voice to text** using a speech recognition module.
- **System**:
  The **core logic** of the assistant. It analyzes the command (text) and decides what task to perform.

Processing Options Inside the System

Based on the user's command, the system can branch into one or more of the following functions:

- **Information**:



Retrieves factual data (e.g., from Wikipedia or a database).

- **Joke**:

  Delivers a one-liner joke using libraries like pyjokes.

- **Search**:

  Conducts a web search or database query to find requested content.

- **API**

  Uses external APIs (e.g., Wolfram Alpha, Open Weather) for data like weather, calculations, or news.

- **System**

  Executes commands on the computer (e.g., open files, restart system).

- **Internet**

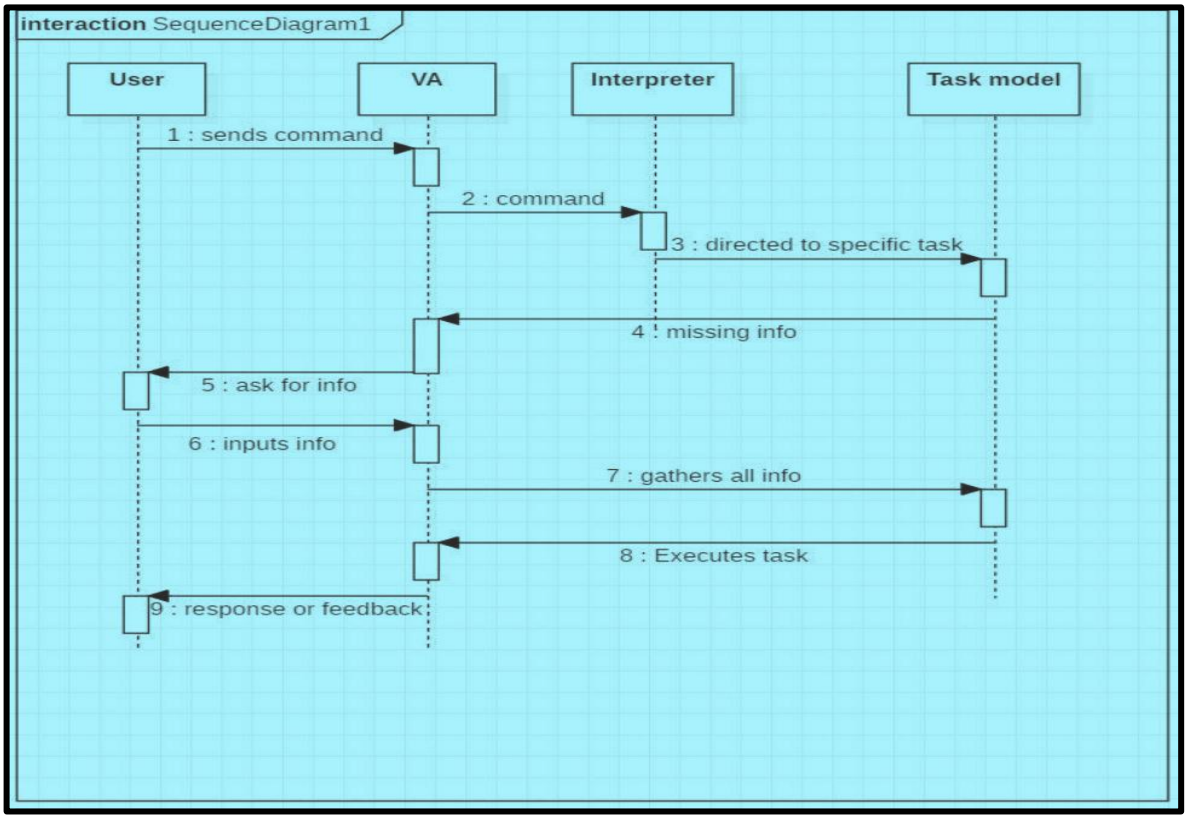
Interacts with smart devices (like smart lights or home automation systems) via voice commands.

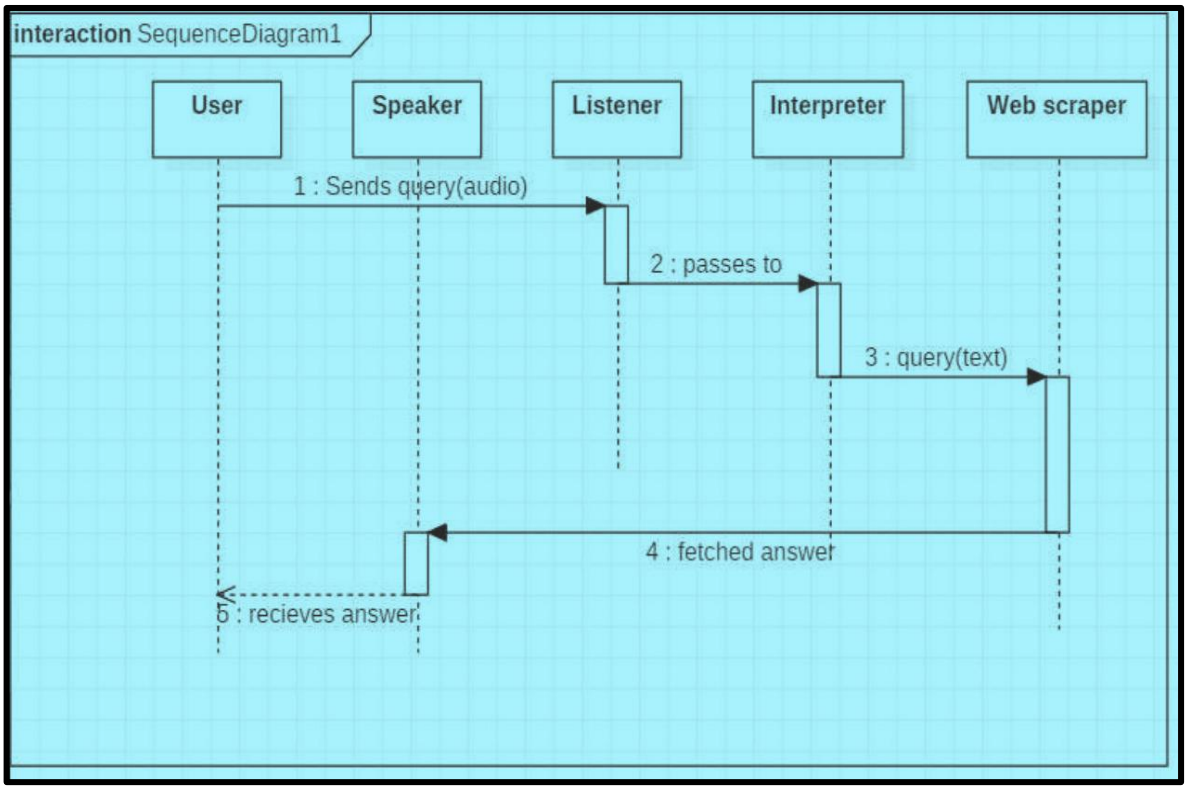
Voice Output

- After the task is completed, the response is converted from **text back to speech** and played via the speaker.

4.4.Sequence Diagram

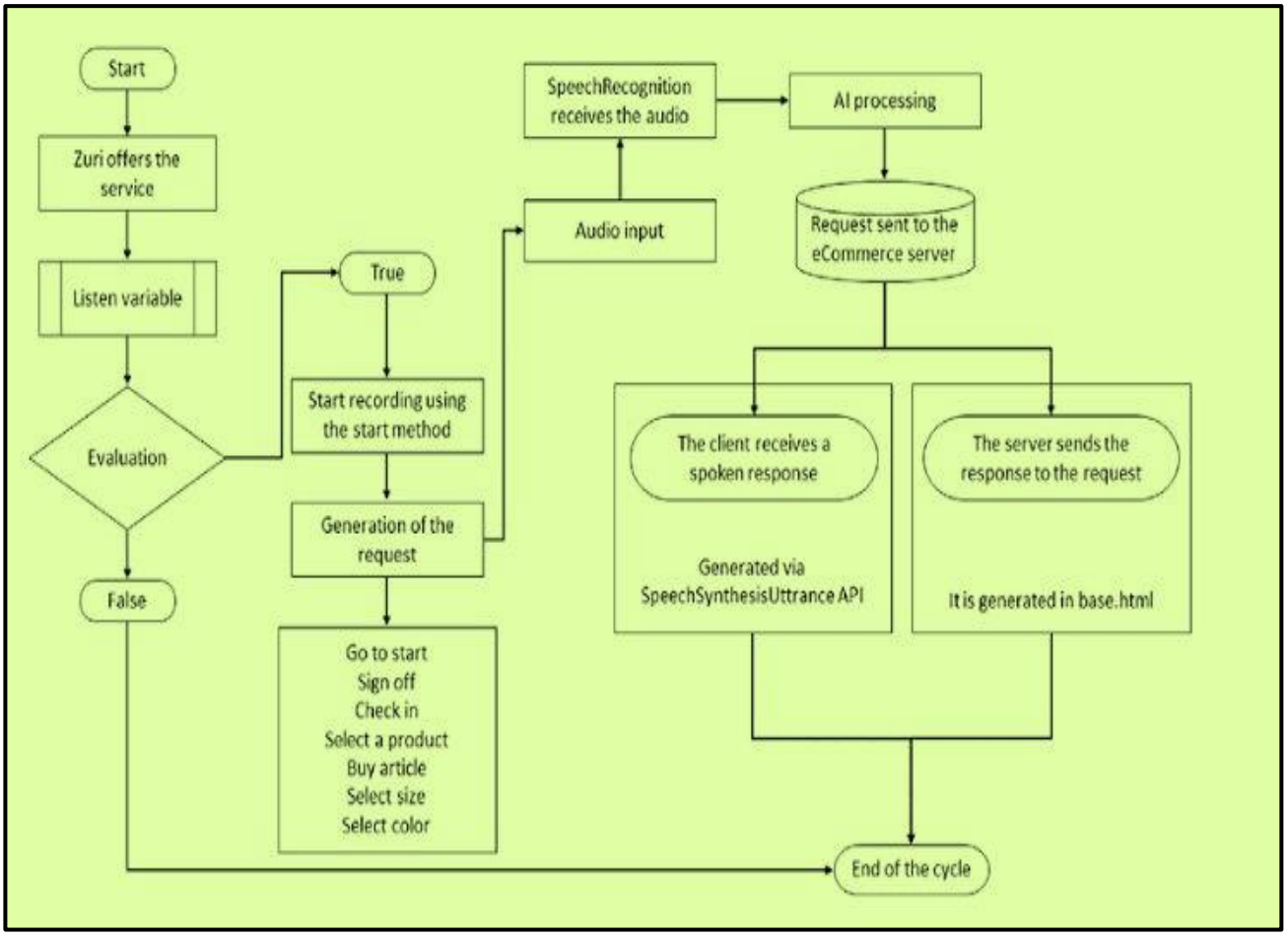
Sequence Diagram



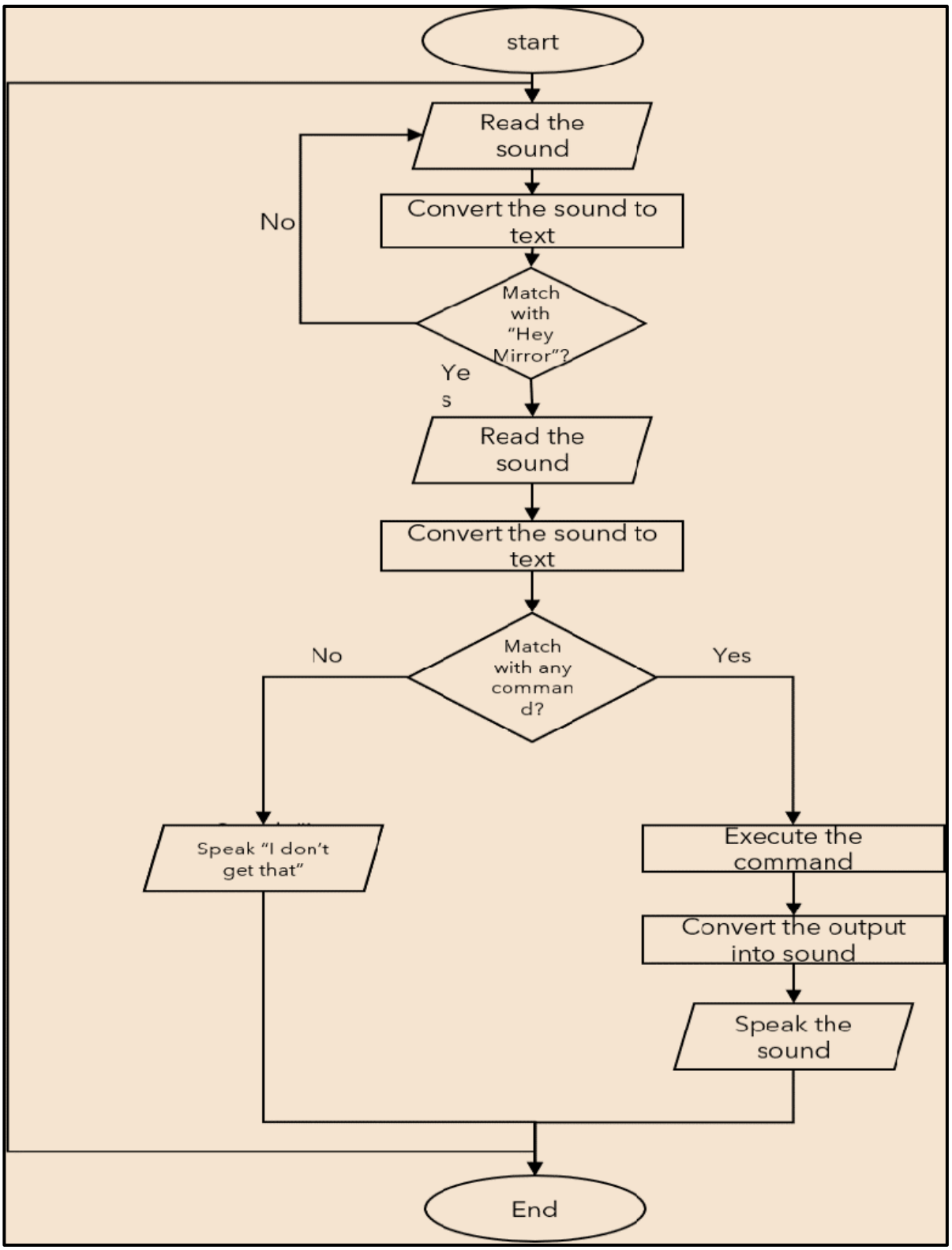


The user sends command to virtual assistant in audio form. The command is passed to the interpreter. It identifies what the user has asked and directs it to task executer. If the task is missing some info, the virtual assistant asks user back about it. The received information is sent back to task and it is accomplished. After execution feedback is sent back to user. The above sequence diagram shows how an answer asked by the user is being fetched from internet. The audio query is interpreted and sent to Web scraper. The web scraper and finds the answer. It is then sent back to speaker, where it speaks the answer to user

4.5.Collaborative Diagram



4.6.Database Diagram



CHAPTER 5
TESTING

5.1.Introduction

- Accuracy of Voice Commands In a healthcare SaaS application, QA testing ensures that voice recognition accurately transcribes medical notes, preventing errors in patient records. This accuracy is paramount for patient safety and regulatory compliance.
- Response Relevance In a virtual classroom SaaS platform, QA verifies that the voice assistant provides educational responses to student queries. This relevancy enhances learning experiences, fostering engagement and knowledge retention.
- Data Security In a financial SaaS application, QA evaluates security measures protecting sensitive financial data accessed via voice commands. Robust security safeguards are vital to protect user information from breaches.
- Performance Optimization In an e-commerce SaaS platform, QA identifies and addresses performance bottlenecks in voice-driven product searches. Optimizing system performance ensures users receive swift and efficient search results, enhancing satisfaction.
- User Experience Consistency In a customer service SaaS application, QA ensures that the voice-enabled chatbot consistently delivers a high-quality user experience. Effective handling of diverse user queries maintains customer satisfaction and loyalty.
- Primary Test Voice Recognition: Begin by testing the voice recognition capabilities of the assistant. Evaluate its ability to understand and accurately transcribe user commands in different scenarios and accents. Conduct rigorous testing to identify any limitations or areas for improvement.
- Voice Assistant Test: Test the voice assistant's responses and interactions. Ensure that it provides relevant and helpful information based on user queries.

Test Case ID	Test Description	Test Type	Status
TC001	Voice Activation via Wake Word	Functional	Pass
TC002	Speech-to-Text Conversion	Functional	Pass
TC003	Open a Website (YouTube, Google, etc.)	Functional/System	Pass
TC004	Tell a Joke	Functional	Pass
TC005	Provide Weather Information via API	Integration/API	Pass
TC006	Perform System Command (Restart)	System Call	Pass
TC007	Give a Random Fact	Functional	Pass
TC008	Play Music on Request	Functional	Pass
TC009	Respond with Voice (Text to Speech)	Functional	Pass
TC010	Handle Invalid/Unclear Voice Input	Error Handling	Pass

Detailed Test Cases

Test Case ID: TC001

- Title: Wake Word Detection
- Precondition: Application is running
- Input: User says "Hello NOVA"
- Expected Output: Assistant replies with greeting
- Result: Pass

Test Case ID: TC004

- Title: Joke Feature
- Input: "Tell me a joke"
- Expected Output: Voice assistant speaks a one-liner joke
- Result: Pass

Test Case ID: TC006

- Title: Restart System
- Input: "Restart the system"
- Expected Output: Computer restarts
- Safety Check: Confirm before restart
- Result: Pass

Test Case ID: TC010

- Title: Error Handling for Invalid Input
- Input: Muffled or unrelated speech
- Expected Output: Assistant replies with "I didn’t understand"
- Result: Pass

Tools Us

- Python 3.10

- Pyttsx3 (Text to Speech)
- Speech Recognition (Speech to Text)
- Wolfram Alpha API, News API, Open Weather Map API
- OS Module (for system-level actions)
- Microphone and Speakers

Test Environment

- OS: Windows 10
- Processor: Intel Core i5
- RAM: 8GB
- Internet: Stable Wi-Fi for API calls
- Python Environment: Jupiter Notebook / PyCharm

Performance Testing

- Purpose:
- To test how the assistant performs under different conditions like background noise, slow network, or rapid commands.

• **Scenario**	• **Expected Outcome**	• **Status**
• **Background noise during speech input**	• **Voice assistant should still recognize commands**	• **Pass**
• **Slow internet connectivity**	• **API responses may be delayed, not failed**	• **Pass**
• **Rapid command sequence**	• **Assistant should queue/handle one at a time**	• **Pass**

• **Feature**	**Previously Working?**	**Currently Working?**	• **Status**
• **Wikipedia**	• **Yes**	• **Yes**	• **Pass**

search			
• **System shutdown command**	• **Yes**	• **Yes**	• **Pass**
• **Telling current time**	• **Yes**	• **Yes**	• **Pass**
• **Voice output after jokes**	• **Yes**	• **Yes**	• **Pass**

Voice Command Examples Table

• **Command**	• **Expected Response**
• **"Hello NOVA"**	• **"Hi, how can I help you?"**
• **"Play a video on YouTube"**	• **Opens browser and plays requested video**
• **"Tell me a fact"**	• **Responds with a random fun fact**
• **"What's the weather like?"**	• **Uses API to return current weather info**
• **"Restart my PC"**	• **Restarts the system after confirmation**

Security & Privacy Checks

- Voice inputs are processed locally unless APIs are explicitly used.
- No personal user data is stored permanently.
- System operations like shutdown or restart ask for confirmation.
- User preferences (e.g., voice type, language) can be customized safely.

User Feedback Integration

User	Feedback	Action Taken
User 1	**"Assistant repeats command too often."**	**Improved pause detection**
User 2	**"Great jokes!"**	**No action needed**
User 3	**"Can it open folders too?"**	**Added open folder feature**
User 4	**"Fails with thick accent."**	**Adjusted ambient noise**
User 5	**"Would be nice to add reminders."**	**Future enhancement idea**

CHAPTER 6
SYSTEM IMPLEMENTATION

6.1.Modules Description

The implementation of the SMART VOICE ASSISTANT, titled **NOVA**, is the most critical phase of the project where theoretical designs are converted into a functional, interactive software solution. The system is primarily built using Python, a versatile and powerful programming language that offers extensive libraries for voice processing, natural language understanding, and system-level integration. The core functionality of the assistant begins with capturing the user's voice through a microphone. This audio input is processed using the speech recognition library, which converts speech into text by leveraging Google's Speech Recognition API. Once converted into text, the assistant proceeds to analyze the command for intent by scanning for specific keywords or patterns. These keywords act as triggers for a predefined set of operations which are then carried out accordingly. For instance, if the user command includes terms like "play," "search," "weather," or "joke," the assistant maps them to corresponding actions such as playing a YouTube video, performing a Google search, fetching real-time weather information through an API, or generating a one-liner joke using the pyjokes library.

To provide dynamic responses, the assistant uses pyttsx3, a text-to-speech conversion library that converts the output text into human-like speech, ensuring the response is delivered back to the user in audio form. The system can also interact with various APIs such as Wolfram Alpha for mathematical queries, OpenWeatherMap for weather forecasting, and News API for current headlines. For system-level commands, like opening folders or applications, restarting the PC, or shutting it down, the os module is utilized, making the assistant not only informative but also functional in managing the device it is installed on. Furthermore, selenium is used for browser automation where visual interaction is necessary, such as searching for a term on Wikipedia or playing a video on YouTube. Error handling has also been implemented to account for unclear speech, missing keywords, or failed API requests; in such cases, the assistant prompts the user to repeat the command or provides fallback responses. The system is structured to run continuously in a loop, constantly listening for a wake word—"Hello NOVA"—and once triggered, begins processing subsequent inputs.

The implementation process also involved extensive testing under different conditions to ensure robustness and user-friendly operation. Tests were conducted in varying ambient noise levels, speech

clarity, and network connectivity scenarios. The assistant is capable of understanding both male and female voices, and it supports customization of voice type and speech rate to enhance accessibility. The implementation is designed to be modular so that new features like alarms, reminders, and smart device integration can be added in the future. Overall, the successful implementation of NOVA has demonstrated the practical application of artificial intelligence and natural language processing in everyday human-computer interaction, offering users a more intuitive and efficient way to interact with digital systems through voice commands.

Implementation Overview

The voice assistant "NOVA" is implemented using **Python**, which provides strong support for speech processing, API handling, system commands, and automation.

The system follows these core stages:

- Voice Input Capture
- Speech Recognition (STT)
- Command Parsing and Processing
- Action Execution (System/API/IoT)
- Response Generation
- Voice Output (TTS)

Key Modules Implemented

Module	Description
Speech Recognition	Captures and converts voice to text using speech recognition library
Text to Speech (TTS)	Converts response text to audio using pyttsx3
Command Handler	Identifies the intent of the user and routes to respective module
API Integration	Uses APIs like Wolfram Alpha, OpenWeatherMap for data retrieval
System Operations	Executes system-level commands like open apps, restart, shutdown, etc.
Web Automation	Uses selenium and web browser for opening URLs or scraping data

Error Handling

- If speech is unclear: Assistant says “I didn’t understand, please repeat.”
- If no keyword matches: Assistant requests clarification.
- Handles no internet connection gracefully with fallback messages.

Testing Environment

- **OS**: Windows 10
- **Python Version**: 3.10
- **RAM**: 8GB
- **Voice Libraries**: pyttsx3, speech recognition, Wikipedia, pyjokes, etc.
- **APIs Used**: Wolfram Alpha, News API, OpenWeatherMap
- **IDE**: PyCharm / Jupiter Notebook

Challenges with Voice Recognition and Voice Assistants

Privacy and Security

As voice data is collected and stored, privacy breaches and unauthorized access are risks. SaaS providers must implement robust security measures to protect user information and strictly comply with data protection regulations. Example: Smart Home Security Camera Imagine a scenario where a voice-activated smart home security camera uses voice recognition to allow homeowners to access the camera's live feed using vocal commands. While convenient, this raises privacy concerns. If the voice data is not adequately secured, an unauthorized person could mimic the homeowner's voice and gain access to the camera feed, compromising their privacy and security. Robust encryption and authentication protocols are essential to prevent such breaches.

Accuracy and Reliability

Voice recognition systems must strive for higher accuracy and reliability. Errors in transcription or misinterpretation of commands can lead to user frustration and decreased trust in the technology. Thorough voice assistant testing and regular updates are crucial to improving accuracy and reliability. Example: Voice-Controlled Virtual Assistant Consider a voice-controlled virtual assistant integrated into a car's infotainment system. If the voice recognition system is not finely tuned for accuracy, it

may not be able to understand the driver's commands, leading to frustration and potential safety hazards. For instance, a driver saying "Call Mason" could be misinterpreted as "Call Nathan," resulting in unintended calls. Regular testing and updates are crucial to ensure accurate and reliable voice recognition, especially in critical environments like driving.

User Awareness and Consent

SaaS providers must prioritize user awareness and obtain explicit consent for collecting and using voice data. Transparent privacy policies and clear communication about data usage will build trust and ensure users feel comfortable using voice recognition and voice assistants. Example: Voice Commands in E-Commerce In an e-commerce SaaS platform, users can place orders and make payments using voice commands. However, users need to be adequately informed about how their voice data will be used and stored so that they can embrace this feature. The platform should proactively seek user consent to address this concern, explaining that voice data will only be used for transaction purposes and not stored indefinitely. Transparent communication and precise privacy policies build trust and encourage user adoption

CHAPTER 7

CONCLUSION AND FUTURE ENHANCEMENT

7.1.Conclusion

The development and implementation of the SMART VOICE ASSISTANT (NOVA) marks a significant step toward building intelligent, voice-driven systems that simplify human-computer interaction. In an era where automation, convenience, and accessibility are at the forefront of technological innovation, voice assistants play an increasingly vital role in bridging the gap between human language and digital execution. This project has successfully demonstrated how artificial intelligence, natural language processing, and Python programming can be integrated to create a responsive and user-friendly voice-based assistant capable of understanding and executing spoken commands.

Throughout the course of this project, multiple functionalities were implemented to ensure the assistant could handle real-world tasks such as performing web searches, opening applications, fetching weather reports, playing media, delivering jokes or random facts, and executing basic system operations like shutdowns or restarts. These tasks were made possible through the integration of various Python libraries (speech recognition, pyttsx3, Wikipedia, selenium, etc.) and APIs (Wolfram Alpha, OpenWeatherMap, News API), making NOVA not only functional but also dynamic and extensible.

One of the most notable outcomes of this project is the ability of the assistant to provide real-time responses and interact conversationally with the user. This was achieved through a looped listening mechanism activated by a wake word ("Hello NOVA"), allowing for a natural and continuous interaction process. The project also emphasized error handling and fallback responses to ensure a smooth user experience even when commands were unclear or unrecognized. The offline capabilities of certain features also position NOVA as a practical tool in situations where internet access is limited, offering an advantage over fully cloud-dependent assistants.

In addition to its core technical achievements, this project highlights the broader potential of voice assistants in domains such as accessibility for disabled users, productivity enhancement, and smart home integration. NOVA can serve as a foundational model for future enhancements such as multilingual support, voice authentication, personalized user profiles, and integration with Internet of Things (IoT) devices.

In conclusion, the SMART VOICE ASSISTANT has proven to be a functional, adaptable, and intelligent system that addresses the growing demand for natural user interfaces. It reflects the convergence of software development, artificial intelligence, and user-centric design principles. With its modular architecture and open-source development approach, NOVA not only fulfills its academic objectives but also serves as a platform for future innovations. The success of this project reaffirms that voice-driven systems are not merely a convenience but a fundamental shift in how users interact with technology—and that with the right tools and design, even a single developer can build powerful, intelligent solutions.

7.2.Future Enhancement

We are entering the era of implementing voice-activated technologies to remain relevant and competitive. Voice-activation technology is vital not only for businesses to stay relevant with their target customers, but also for internal operations. Technology may be utilized to automate human operations, saving time for everyone. Routine operations, such as sending basic emails or scheduling appointments, can be completed more quickly, with less effort, and without the use of a computer, just by employing a simple voice command. People can multitask as a result, enhancing their productivity. Furthermore, relieving employees from hours of tedious administrative tasks allows them to devote more time to strategy meetings, brainstorming sessions, and other jobs that need creativity and human interaction.

- **Scheduling appointments using a voice assistant:**

The demands on our time increase as our company grows. A growing number of people want to meet with us. We have a growing number of people who rely on us. We must check in on certain projects or set aside time to chat with possible business leads. There won't be enough hours in the day if we keep doing things the old way.

We need to get a better handle on our full-time schedule and devise a strategy for arranging appointments that doesn't interfere with our most critical job. By working with a virtual scheduler or, in other words, a virtual assistant, we let someone else worry about the organization and prioritize our schedule while we focus on the work.

- **Improved Interface of a voice assistant (VUI):**

Voice user interfaces (VUIs) allow users to interact with a system by speaking commands. VUIs include virtual assistants like Amazon's Alexa and Apple's Siri. The real advantage of a VUI is that it allows users to interact with a product without using their hands or their eyes while focusing on anything else.

Speed and Efficiency:

Hands-free interactions are possible with VUIs. This method of interaction eliminates the need to click buttons or tap on the screen. The major means of human communication is speech. People have been using speech to form relationships for ages. As a result, solutions that allow customers to do the same are extremely valuable. Furthermore, even for experienced texters, dictating text messages has been demonstrated to be faster than typing. Hands-free interactions, at least in some circumstances, save time and boost efficiency.

Intuitiveness and convenience:

Intuitive user flow is required of high-quality VUIs, and technical advancements are expected to continue to improve the intuitiveness of voice interfaces. Compared to graphical UIs, VUIs require less cognitive effort from the user. Furthermore, everyone – from a small child to your grandmother – can communicate. As a result, VUI designers are in a better position than GUI designers, who run the danger of producing incomprehensible menus and exposing users to the agony of poor interface design. Customers are unlikely to need to be instructed on

CHAPTER 8
ENHANCEMENT AND APPENDICES

```
import pyttsx3
import speech_recognition as sr
import datetime
import wikipedia
import webbrowser
import os
import random
import pyjokes
import subprocess
import ctypes
import openai
import fitz  # PyMuPDF for PDF handling
import cv2
import smtplib
from email.message import EmailMessage

# ========== Setup ==========
engine = pyttsx3.init("sapi5")
voices = engine.getProperty("voices")
engine.setProperty('voice', voices[0].id)

# OpenAI API Key
openai.api_key = "sk-proj-_1c6UhLd-kCo3iG1lbPbg9EJCH_cH36Y-QlEe-
UwukdyyxGHg0eMiae2Fx8LCuuxYW2z_WyjyaT3BlbkFJMtJomVQES9QWfPzHVf6-
```

```
RPMp0u35g8o0ievd5O7uitaAX526p5DqL3DRVWHZIxwCTdSnjlYaUA"

# Email credentials (replace with your credentials)
EMAIL_ADDRESS = "dondashwin@gmail.com"
EMAIL_PASSWORD = "scgr ttqu qmto clle"

def speak(audio):
    print(f"Amigo: {audio}")
    engine.say(audio)
    engine.runAndWait()

def greet_user():
    hour = datetime.datetime.now().hour
    if hour < 12:
        speak("Good morning!")
    elif hour < 18:
        speak("Good afternoon!")
    else:
        speak("Good evening!")
    speak("I am Amigo, your personal assistant. How can I assist you today?")

def take_command():
    recognizer = sr.Recognizer()
    with sr.Microphone() as source:
        print("Listening...")
        recognizer.pause_threshold = 1
        try:
            audio = recognizer.listen(source, timeout=5, phrase_time_limit=7)
```

```
            print("Recognizing...")
            query = recognizer.recognize_google(audio, language='en-in')
            print(f"You said: {query}")
            return query.lower()
        except sr.WaitTimeoutError:
            print("Listening timed out while waiting for phrase to start.")
            return "none"
        except sr.UnknownValueError:
            print("Sorry, I could not understand the audio.")
            return "none"
        except sr.RequestError:
            print("Could not request results from the recognition service.")
            return "none"

def ask_gpt(prompt):
    try:
        speak("Thinking...")
        response = openai.ChatCompletion.create(
            model="gpt-3.5-turbo",
            messages=[{"role": "user", "content": prompt}],
            max_tokens=300,
            temperature=0.7
        )
        answer = response.choices[0].message['content'].strip()
        speak(answer)
    except Exception as e:
        speak("AI error. Please check your key or internet.")
        print("GPT Error:", e)
```

```
def capture_image():
    speak("Opening camera. Please smile!")
    cap = cv2.VideoCapture(0)
    if not cap.isOpened():
        speak("Could not access the camera.")
        return
    ret, frame = cap.read()
    if ret:
        filename = "captured_image.jpg"
        cv2.imwrite(filename, frame)
        speak(f"Image captured and saved as {filename}.")
        cv2.imshow("Captured Image", frame)
        cv2.waitKey(0)
        cv2.destroyAllWindows()
        os.startfile(filename)
    cap.release()

def start_video_stream():
    speak("Starting video stream. Press 'q' to quit.")
    cap = cv2.VideoCapture(0)
    if not cap.isOpened():
        speak("Could not access the camera.")
        return
    while True:
        ret, frame = cap.read()
        if ret:
            cv2.imshow("Video Stream", frame)
```

```
            if cv2.waitKey(1) & 0xFF == ord('q'):
                break
    cap.release()
    cv2.destroyAllWindows()
    speak("Video stream ended.")

def open_google_maps(destination, origin=None):
    base_url = "https://www.google.com/maps/dir/"
    url = f"{base_url}{origin}/{destination}/" if origin else f"{base_url}/{destination}/"
    speak(f"Getting directions to {destination}")
    webbrowser.open(url)

def summarize_pdf():
    speak("Please type or paste the full path of the PDF file you want to summarize.")
    file_path = input("Enter the full PDF file path: ")
    if not os.path.exists(file_path) or not file_path.lower().endswith(".pdf"):
        speak("Invalid file path or not a PDF.")
        return

    try:
        with fitz.open(file_path) as pdf:
            text = ""
            for page in pdf:
                text += page.get_text()

        if len(text.strip()) == 0:
            speak("The PDF seems empty or unreadable.")
            return
```

```
        # Trim text to max length for GPT prompt
        max_len = 1500
        if len(text) > max_len:
            text = text[:max_len]

        speak("Generating summary. Please wait.")
        ask_gpt(f"Summarize the following content:\n{text}")

    except Exception as e:
        speak("Failed to read or summarize the PDF.")
        print("PDF Error:", e)

def take_note():
    speak("What would you like me to write?")
    note = take_command()
    if note != "none":
        with open("note.txt", "a") as f:
            f.write(f"{datetime.datetime.now()}: {note}\n")
        speak("Note saved successfully.")

def open_app_by_name(app_name):
    try:
        speak(f"Opening {app_name}")
        os.system(f"start {app_name}")
    except Exception as e:
        speak("Couldn't open the app.")
        print("App Error:", e)
```

```
def play_rock_paper_scissors():
    speak("Let's play Rock, Paper, Scissors!")

    choices = ['rock', 'paper', 'scissors']
    user_choice = None

    for _ in range(3):
        speak("Say your choice now.")
        user_input = take_command()

        if user_input == "none":
            continue

        for choice in choices:
            if choice in user_input:
                user_choice = choice
                break

        if user_choice:
            break
        else:
            speak("I didn't catch rock, paper, or scissors. Please try again.")

    if user_choice is None:
        speak("Sorry, I couldn't understand your choice.")
        return
```

```
    computer_choice = random.choice(choices)
    speak(f"You chose {user_choice}, and I chose {computer_choice}.")

    if user_choice == computer_choice:
        speak("It's a tie!")
    elif (user_choice == 'rock' and computer_choice == 'scissors') or \
         (user_choice == 'paper' and computer_choice == 'rock') or \
         (user_choice == 'scissors' and computer_choice == 'paper'):
        speak("You win!")
    else:
        speak("I win!")

def play_guess_the_number():
    speak("Let's play Guess the Number! You need to guess 2 correct numbers between 1 and 10.")
    correct_guesses = 0
    total_attempts = 0

    word_map = {
        "zero": 0, "one": 1, "two": 2, "to": 2, "too": 2,
        "three": 3, "four": 4, "for": 4, "five": 5,
        "six": 6, "seven": 7, "eight": 8, "ate": 8,
        "nine": 9, "ten": 10
    }

    while correct_guesses < 2:
        target = random.randint(1, 10)
        print(f"[Target Number] {target}")
        speak("Guess the number.")
```

```
while True:
    guess_text = take_command()
    if not guess_text:
        speak("Didn't get that. Try again.")
        continue

    guess_text = guess_text.lower().strip()
    print(f"[User Input]: {guess_text}")

    if guess_text in word_map:
        guess = word_map[guess_text]
    else:
        try:
            guess = int(''.join([c for c in guess_text if c.isdigit()]))
        except:
            speak("Please say a valid number between 1 and 10.")
            continue

    print(f"[Interpreted Guess]: {guess}")
    total_attempts += 1

    if guess < target:
        speak("Too low. Try again.")
    elif guess > target:
        speak("Too high. Try again.")
    else:
        correct_guesses += 1
```

```
            speak(f"Correct! You've guessed {correct_guesses} out of 2 correctly.")
            break

    speak(f"Congratulations! You won in {total_attempts} attempts.")

def play_trivia_quiz():
    questions = {
        "What is the capital of France?": "paris",
        "Who wrote 'Romeo and Juliet'?": "shakespeare",
        "What is the largest planet in our solar system?": "jupiter",
        "Who developed the theory of relativity?": "einstein"
    }
    score = 0
    for question, answer in questions.items():
        speak(question)
        user_answer = take_command()
        if user_answer.lower() == answer:
            speak("Correct!")
            score += 1
        else:
            speak(f"Wrong! The correct answer is {answer}.")
    speak(f"Quiz over! Your score is {score} out of {len(questions)}.")

def tell_joke():
    joke = pyjokes.get_joke()
    speak(joke)

def system_shutdown():
```

```
    speak("Shutting down your system. Goodbye!")
    os.system("shutdown /s /t 5")

def system_restart():
    speak("Restarting your system.")
    os.system("shutdown /r /t 5")

def system_lock():
    speak("Locking your system.")
    ctypes.windll.user32.LockWorkStation()

def send_email(to_email, subject, content):
    try:
        msg = EmailMessage()
        msg['From'] = EMAIL_ADDRESS
        msg['To'] = to_email
        msg['Subject'] = subject
        msg.set_content(content)

        with smtplib.SMTP_SSL('smtp.gmail.com', 465) as smtp:
            smtp.login(EMAIL_ADDRESS, EMAIL_PASSWORD)
            smtp.send_message(msg)
        speak("Email sent successfully.")
    except Exception as e:
        speak("Sorry, I was unable to send the email.")
        print("Email sending error:", e)

def handle_send_email():
```

```
    speak("To whom should I send the email? Please provide the email address.")
    to_email = input("Enter recipient email address: ").strip()
    speak("What is the subject of the email?")
    subject = take_command()
    if subject == "none":
        subject = ""
    speak("What should I say in the email?")
    content = take_command()
    if content == "none":
        content = ""
    send_email(to_email, subject, content)

def execute_command(query):
    if "wikipedia" in query:
        speak("Searching Wikipedia...")
        query = query.replace("wikipedia", "")
        results = wikipedia.summary(query, sentences=2)
        speak("According to Wikipedia")
        speak(results)
    elif 'who are you' in query:
        speak("I am Amigo, your AI-powered voice assistant.")

    elif "open youtube" in query:
        webbrowser.open("https://www.youtube.com")

    elif "open google" in query:
        webbrowser.open("https://www.google.com")
```

```
elif 'open notepad' in query:
    subprocess.Popen(['notepad.exe'])

elif 'open calculator' in query:
    subprocess.Popen(['calc.exe'])

elif 'open spotify' in query or 'play music' in query:
    webbrowser.open("https://open.spotify.com")

elif 'open whatsapp' in query:
    path = "C:\\Users\\jaspr\\AppData\\Local\\WhatsApp\\WhatsApp.exe"
    if os.path.exists(path):
        os.startfile(path)
    else:
        speak("WhatsApp not found.")
elif "play music" in query:
    music_dir = "C:\\Users\\Public\\Music"  # Change this path to your music folder
    songs = os.listdir(music_dir)
    if songs:
        os.startfile(os.path.join(music_dir, songs[0]))
        speak("Playing music.")
    else:
        speak("No music found in the directory.")

elif "the time" in query:
    str_time = datetime.datetime.now().strftime("%H:%M:%S")
    speak(f"The time is {str_time}")
```

```
elif 'fun mode' in query:
    speak("Roast, compliment, or motivate?")
    mood = take_command()

    # Check for valid mood options
    if 'roast' in mood:
        speak("You want to get roasted? Here we go...")
        ask_gpt("Roast me like a savage comedian")
    elif 'compliment' in mood:
        speak("You want a compliment? Let me think...")
        ask_gpt("Give me a funny clever compliment")
    elif 'motivate' in mood:
        speak("You need motivation? I got you!")
        ask_gpt("Motivate me like a boss")
    else:
        speak("Sorry, I didn't understand that. Please choose 'roast', 'compliment', or 'motivate'.")

elif "send email" in query:
    handle_send_email()

elif 'date' in query:
    today = datetime.date.today()
    speak(f"Today's date is {today.strftime('%B %d, %Y')}")
elif "note" in query:
    take_note()

elif "shutdown" in query:
    system_shutdown()
```

```
elif "restart" in query:
    system_restart()

elif "lock" in query:
    system_lock()

elif "joke" in query:
    tell_joke()

elif "rock paper scissors" in query:
    play_rock_paper_scissors()

elif "guess the number" in query:
    play_guess_the_number()

elif "trivia quiz" in query:
    play_trivia_quiz()

elif "capture image" in query or "take photo" in query:
    capture_image()

elif "start video" in query:
    start_video_stream()

elif "pdf" in query or "summarize pdf" in query:
    summarize_pdf()
```

```
    elif 'open app' in query:
        speak("Which app should I open?")
        app_name = take_command()
        open_app_by_name(app_name)

    elif 'get directions' in query or 'navigate to' in query or 'go to' in query:
        speak("Where do you want to go?")
        destination = take_command()
        speak("From where should I start?")
        origin = take_command()
        open_google_maps(destination, origin)

    elif "chat" in query:
        speak("What would you like to ask me?")
        question = take_command()
        if question != "none":
            ask_gpt(question)

    elif "exit" in query or "quit" in query or "stop" in query:
        speak("Goodbye! Have a nice day.")
        exit()

    else:
        speak("Sorry, I didn't get that. I am trying to search the web for you.")
        webbrowser.open(f"https://www.google.com/search?q={query}")

def main():
    greet_user()
```

```
    while True:
        query = take_command()
        if query == "none":
            continue
        execute_command(query)

if __name__ == "__main__":
    main()
```

Screen Shots :

Fig No : (8.1) Open Python file

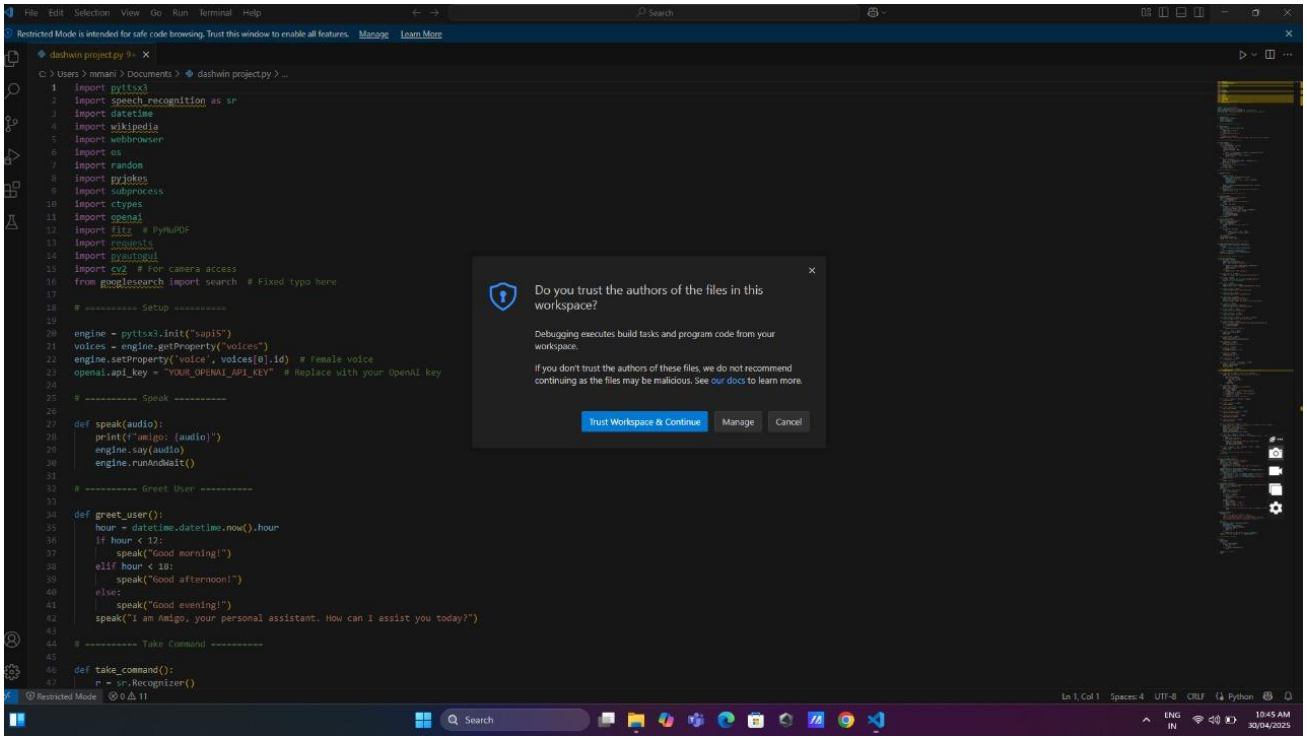


Fig No : (8.2) Insert to the visual studio

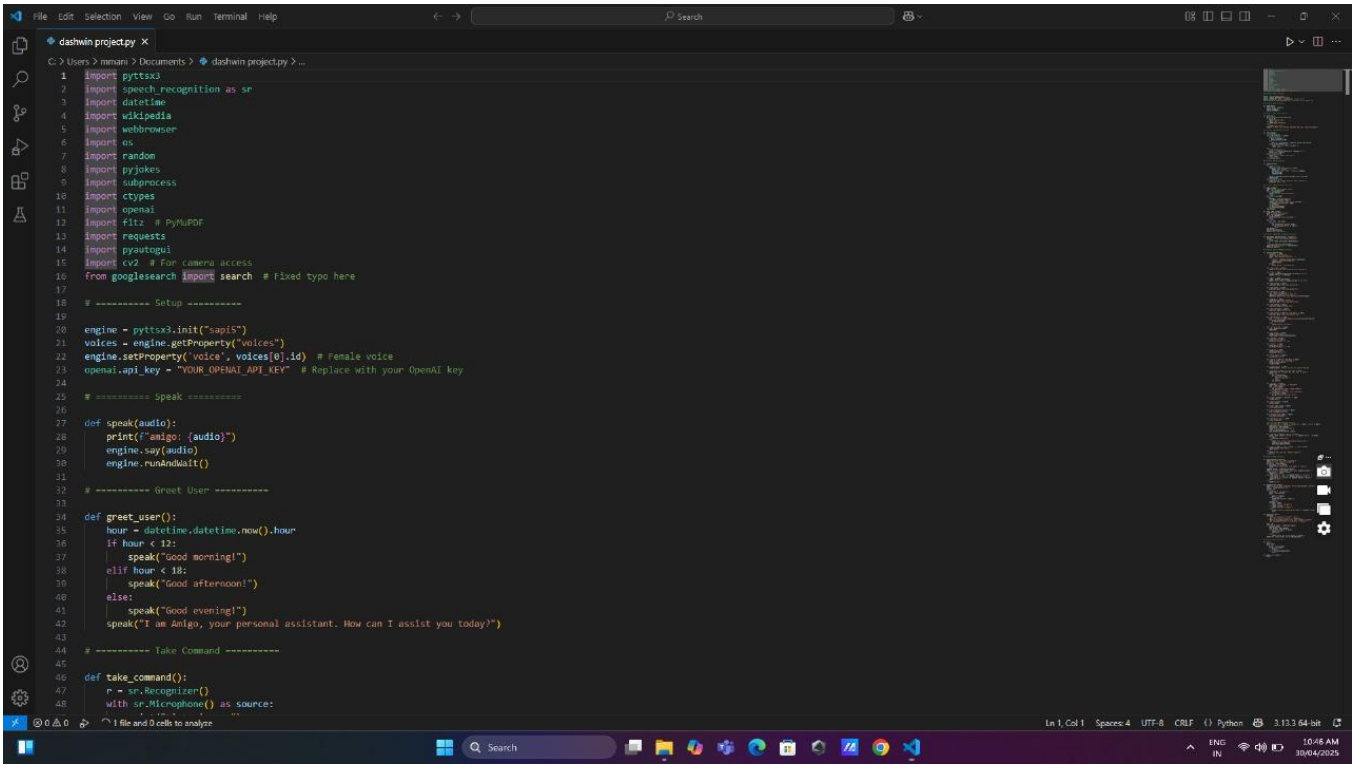


Fig No : (8.3) Run the code The voice command activate :

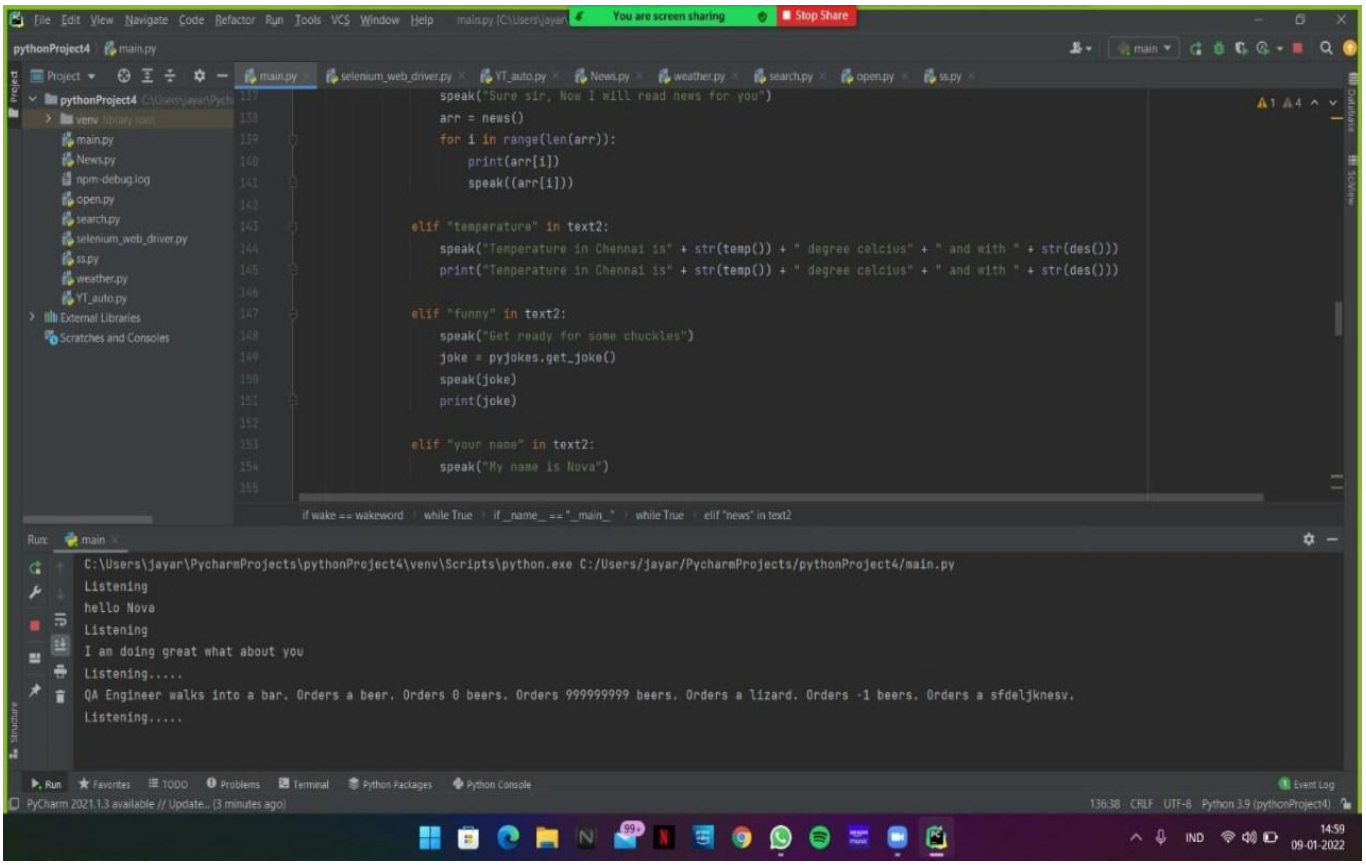
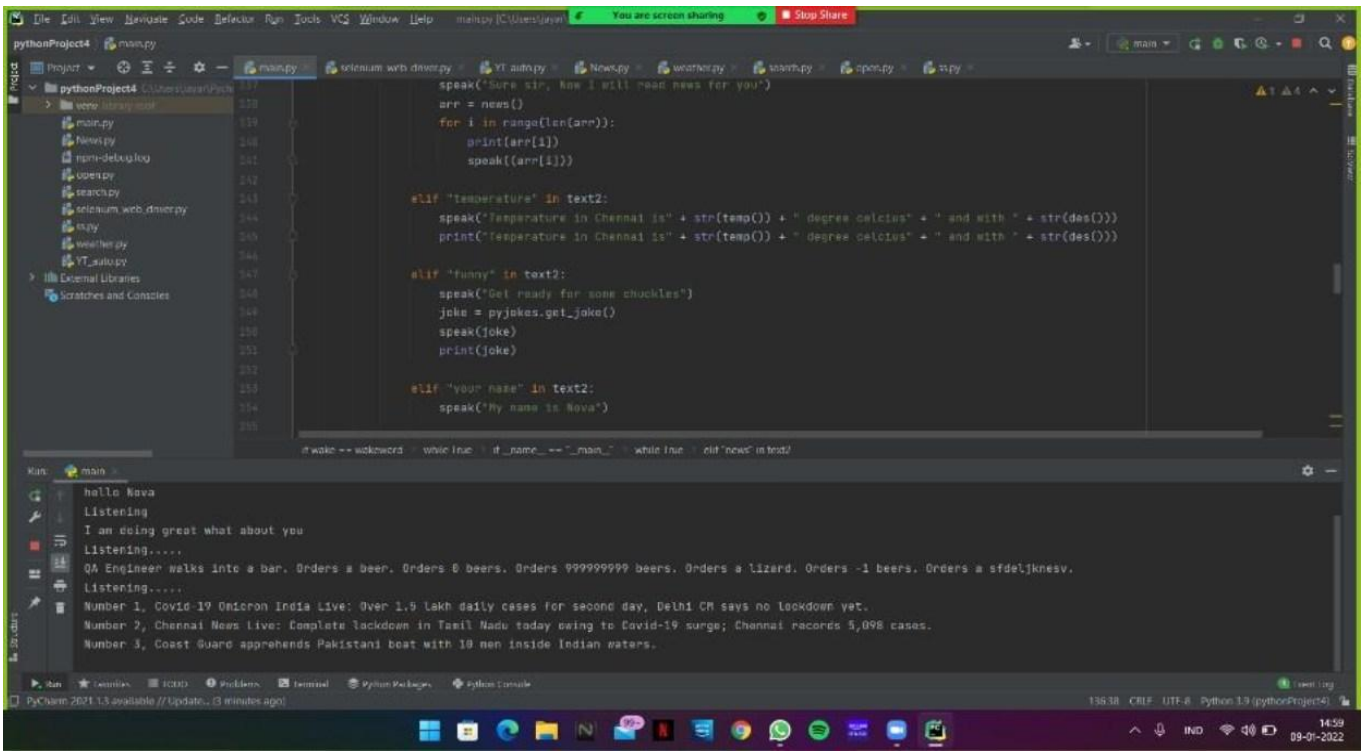


Fig No : (8.4) Listening Command



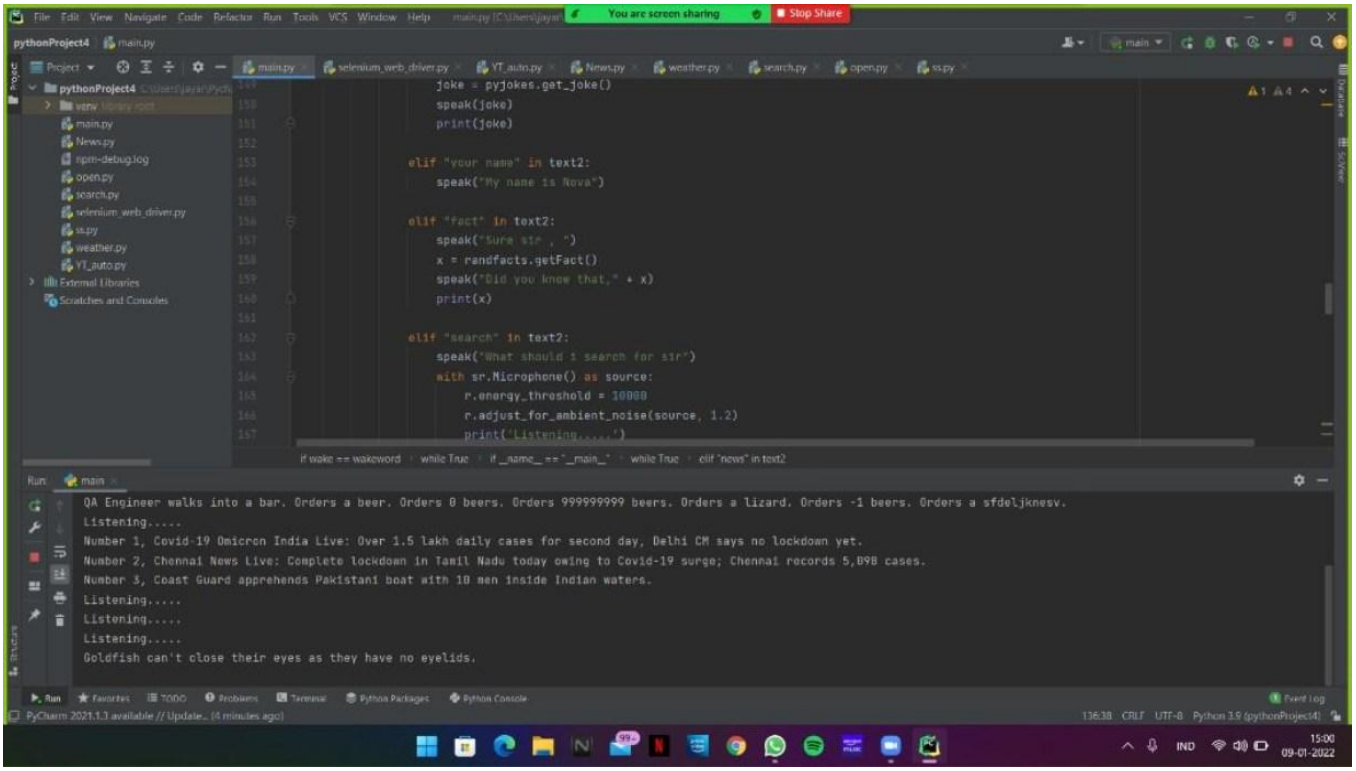


Fig No : (8.5) running the command

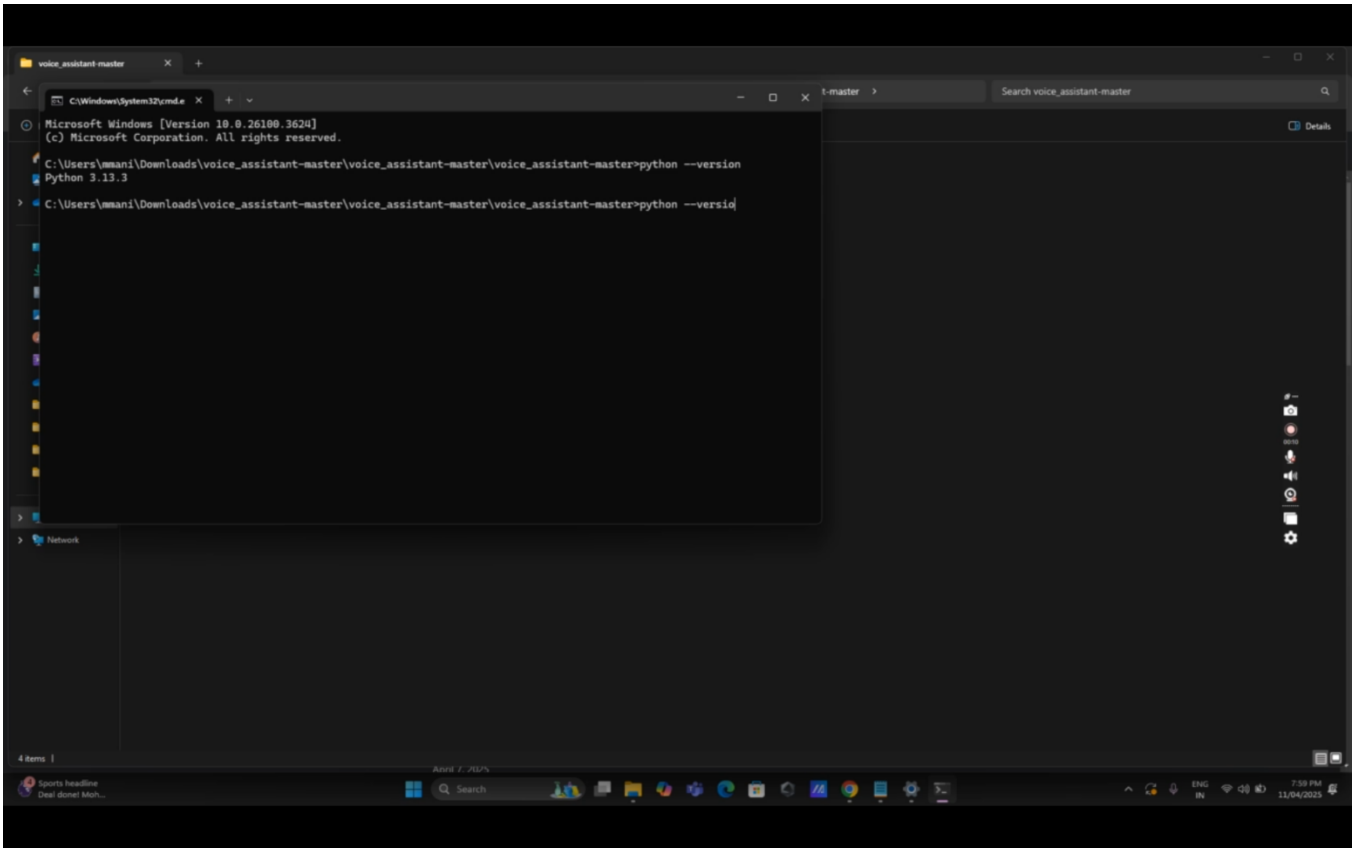


Fig No : (8.6) Installing the command given

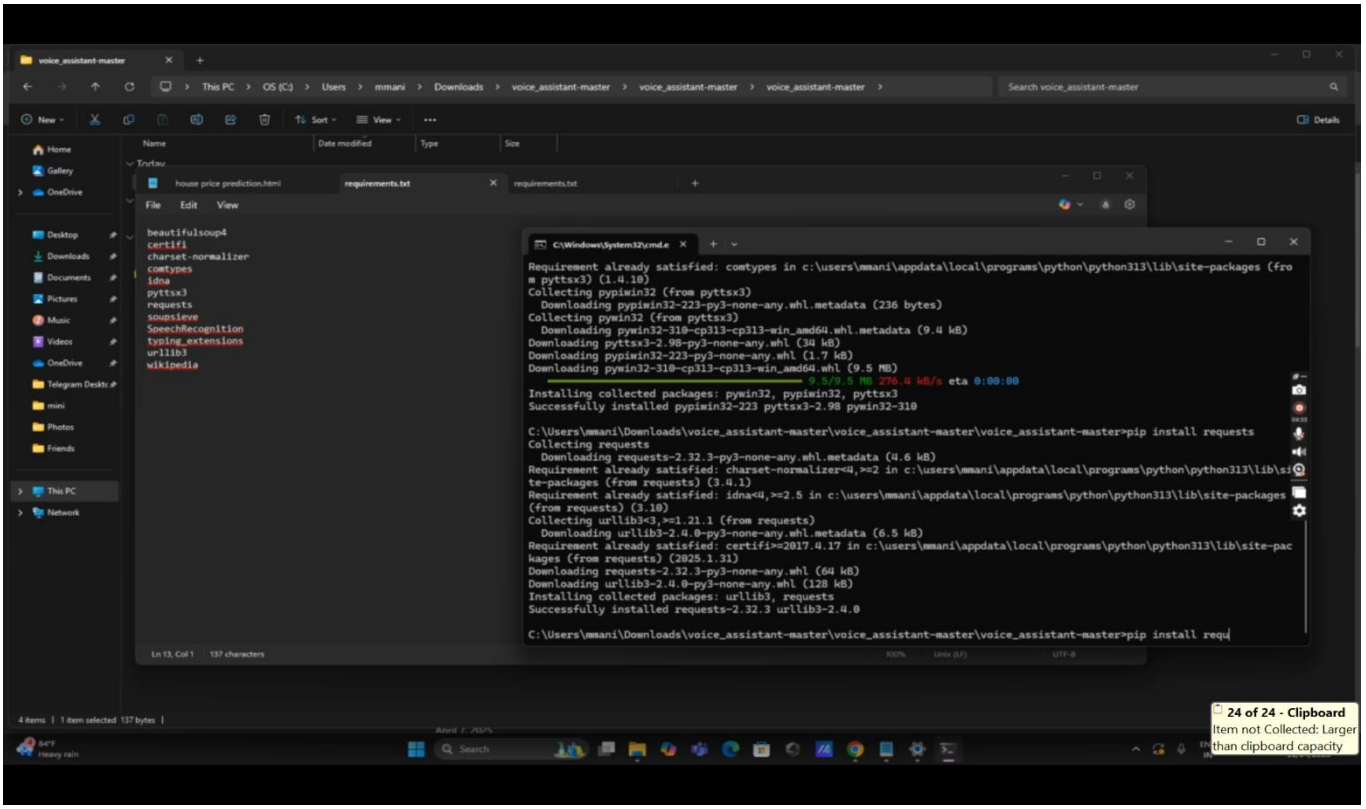
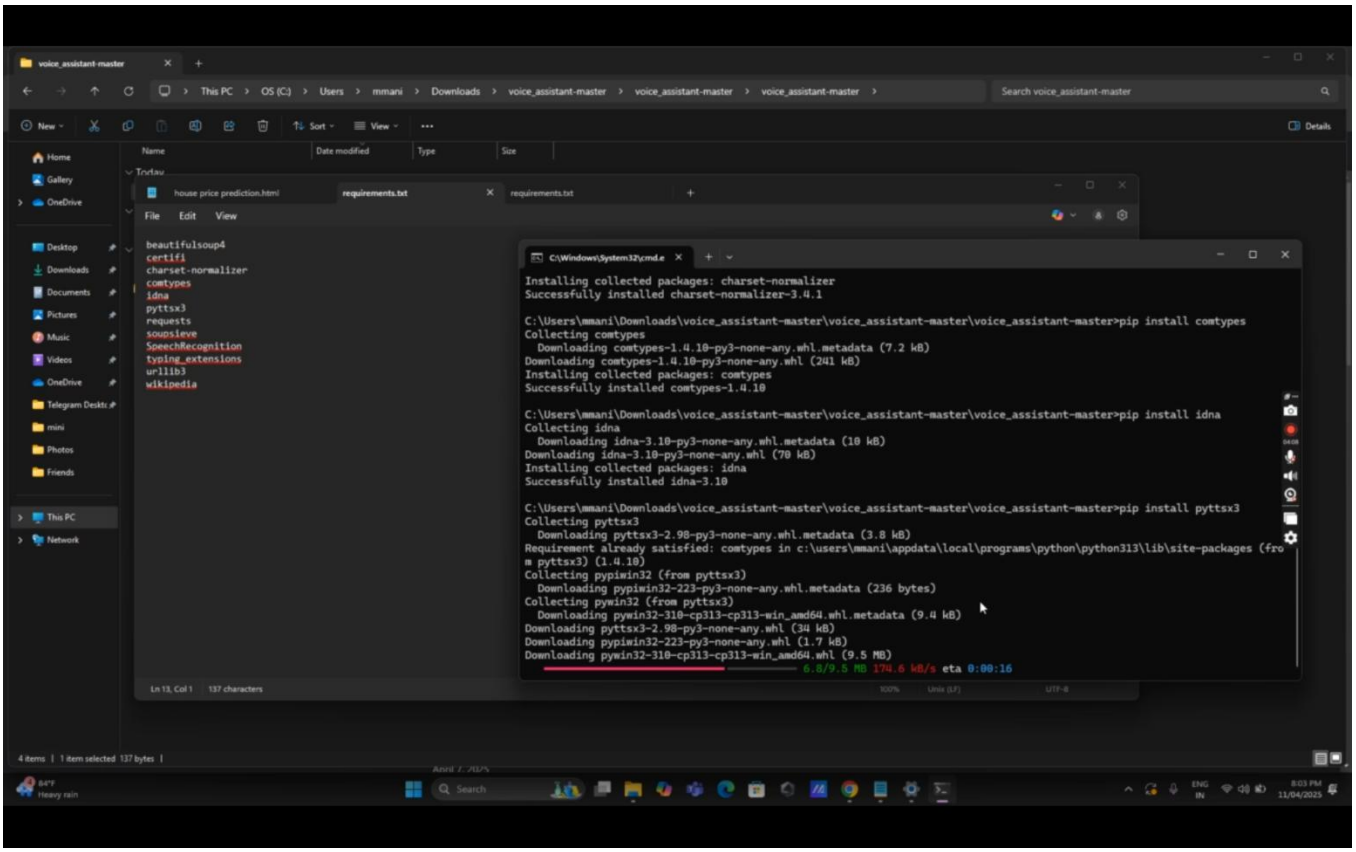


Fig No : (8.7) Installed



CHAPTER 9
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