IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 2, February 2025

DOI: 10.17148/IJARCCE.2025.14236

Nova: A Versatile Voice-Controlled Desktop Assistant

Mr.Khamkar Saad[1], Mr.Ansari Mohd. Shadab[2], Mr.Khan Abdullah[3],

Mr.Shaikh Mohd. Siddique[4], Ms. Shaista khan[5]

Student Computer Engineering, A.I. Abdul Razzak Kalsekar Polytechnic, India[1-4]

HOD Computer Engineering, A.I. Abdul Razzak Kalsekar Polytechnic, India[5]

Abstract: Nova is a voice-controlled desktop assistant designed to simplify user interactions and enhance productivity. Utilizing advanced speech recognition, prompt engineering, and data-driven decision-making, Nova facilitates hands-free control of applications and provides real-time feedback via text-to-speech. Unlike traditional NLP-based solutions, Nova leverages structured datasets and JSON-based prompts to streamline interactions, reduce processing overhead, and prioritize user privacy. Developed using PyQt5 for a native graphical user interface (GUI) and python PyQT5 functions for backend Connection Nova offers a comprehensive, cross-platform solution tailored for accessibility, multitasking, and efficient computing environments.

Keywords: Speech Recognition, Desktop Assistant, Datasets, TTS, Automation, Prompt Engineering.

I. INTRODUCTION

With the increasing need for intuitive, hands-free computing, voice-controlled assistants have emerged as vital tools. Nova addresses these needs by offering an integrated solution for Managing tasks via speech recognition. Unlike conventional Natural Language Processing (NLP) systems, Nova employs structured datasets, enabling efficient and privacy-conscious interactions. PyQt5 facilitates a responsive GUI, while PyQT5 functions handles backend operations, ensuring seamless communication between components. Nova's primary aim is to make computing more accessible for users with varying abilities while also providing robust functionality for productivity-focused environments.

II. LITERATURE SURVEY

Advancements in AI have revolutionized human-computer interaction. While NLP-driven systems dominate the market, their complexity and privacy concerns pose challenges. Prompt engineering, leveraging predefined commands stored in JSON, offers a robust alternative. Studies indicate that this approach enhances performance, simplifies development.

2.1 Accessibility and Productivity:

Voice control improves usability for individuals with disabilities. It allows users to perform tasks hands-free, thereby increasing productivity in multitasking scenarios. Studies show that structured command systems reduce cognitive load, enabling users to focus on core tasks rather than operational complexities.

2.2 Privacy Advantages:

Unlike cloud-dependent NLP systems, prompt-based systems prioritize user privacy by keeping processing local. This minimizes the risk of sensitive data exposure while maintaining functionality more improved.

2.3 Challenges in Traditional Systems:

Conventional assistants face challenges such as speech recognition inaccuracies due to accents, background noise, and complex linguistic structures. Prompt engineering mitigates these issues by using predefined templates that are less reliant on linguistic nuance.

III. PROPOSED METHODOLOGY

3.1 Prompt Engineering:

Prompt engineering is the cornerstone of Nova's functionality. Instead of parsing complex natural language, Nova utilizes JSON-based datasets to define commands and their corresponding actions. This approach allows for:

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- **Simplicity:** Clear mappings between commands and actions eliminate ambiguities.
- **Efficiency:** Reduced computational overhead compared to NLP systems.
- **Customizability:** Users can add or modify commands by editing JSON files, ensuring adaptability to specific workflows.

3.2 PyQt5 for GUI Development:
Nova's interface is designed using PyQt5, which offers a seamless blend of functionality and aesthetics. Key features include:

- **Interactive Visuals:** Icons, buttons, and animations provide real-time feedback on command execution.
- **Accessibility Options:** High-contrast themes and keyboard navigation ensure inclusivity.
- **Floating Elements:** Task-specific windows for focused interactions enhance usability.

IV. IMPLEMENTATION

4.1 Core Functions:
The assistant is designed to enhance user convenience with seamless voice-activated commands across various functions. It simplifies web browsing and search tasks, system control, AI interactions, and power management, ensuring hands-free efficiency.

1. Web & Search Commands:
Browsing & Search Features allow users to quickly access online content. With simple voice commands, users can open websites, perform Google searches, find Wikipedia summaries, and play videos on YouTube without manually navigating through browsers. This feature streamlines information retrieval and entertainment, making tasks effortless.
Features:

- Go to <website name> (Opens the website in the browser)
- Search on Google <query> (Performs a Google search)
- Search on Wikipedia <topic> (Finds Wikipedia summaries)
- Play Video on YouTube <video name> (Searches and plays a video on YouTube)

2. System & Utility Commands
System Control & Applications enable users to manage their system with ease. Users can launch applications like Notepad or Calculator, check their device's IP address, find out the current time, and get real-time weather updates for any city. This functionality ensures instant access to essential system information and tools.
Features:

- Open <app/system tool> (Launches apps like Notepad, Calculator, etc.)
- IP Address of My Device (Displays the device's IP address)
- Current Time (Tells the current time)
- Current Temperature <city> (Gives the temperature of a city)

3. AI & Messaging Features
AI Mode & Communication expands the assistant's capabilities by allowing users to ask AI-driven queries, send WhatsApp messages with a phone number and text, and even automate text input. This enhances productivity and communication, making interactions more efficient and responsive.
Features:

- AI Mode <query> (Asks the AI for answers)
- Send Message (Sends WhatsApp messages with a phone number & text)
- Type <text> (Automatically types given text in an active field)

4. Window & Power Management
Control Your System Efficiently provides comprehensive power and window management. Users can shut down, restart, or put their computer to sleep with voice commands. Additionally, they can minimize, maximize, or close active windows, offering seamless control over system operations with minimal effort.
Features:

- Shutdown (Turns off the computer)
- Restart (Restarts the system)
- Sleep (Puts the computer in sleep mode)
- Minimize Window (Minimizes the active window)

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- Maximize Window (Maximizes the active window)
- Close Window (Closes the active window)

4.2 Tools and Technologies:
The development of this application is carried out using **Python**, with **PyCharm IDE** serving as the primary coding and debugging environment. Various APIs are integrated to enhance functionality, including the **OpenWeather API** for retrieving weather data and the **Wikipedia API** for factual information lookup. JSON templates play a crucial role in defining and storing command mappings, ensuring structured and efficient execution of commands. These tools and technologies collectively contribute to the application's reliability, accuracy, and ease of use.

4.3 Flow Chart

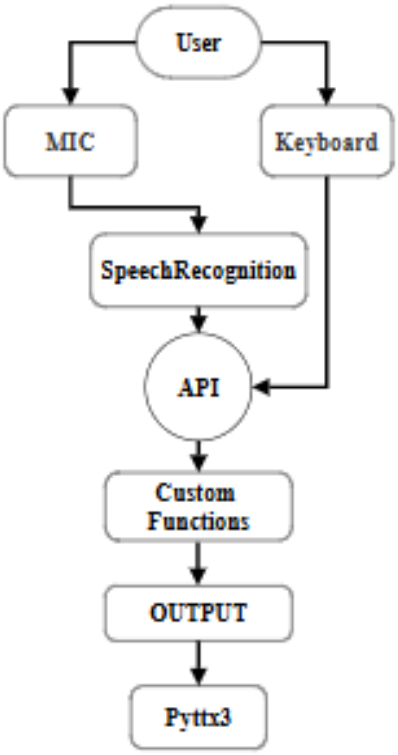

Fig 4.1: *Flow of NOVA*

- **User :** User is the End user who will use the NOVA (voice-controlled desktop assistant)
- **Gemini:** Gemini is API which help to provide error control in the application and also give the normal information.
- **NOVA:** NOVA (voice-controlled desktop assistant) Is our application from where the task will be performed

So in conclusion flow chart shows the flow of the application how the application will work

4.4 User Interface Design:
Designed using Figma, the UI emphasizes clarity and ease of use. Features include:

- **Voice Activation Button:** A central element for initiating commands.
- **Feedback Displays:** Real-time text and visual feedback for user actions.
- **Accessibility Features:** Adjustable font sizes and themes for diverse user needs.

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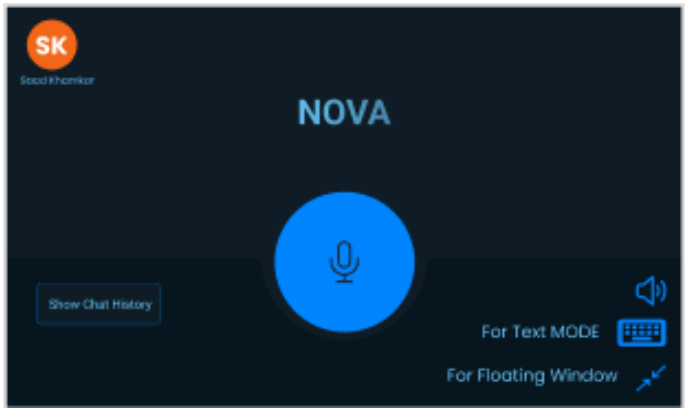

Fig 4.2: NOVA's Home page

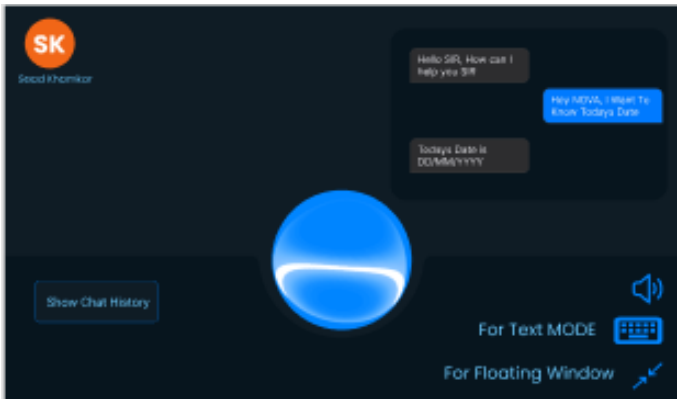

Fig 4.3: NOVA when MIC is on

V. RESULTS AND DISCUSSION

5.1 Performance Evaluation:

The application is designed for high efficiency, with **speed** being a key advantage. Execution times for prompt-based commands are significantly lower compared to traditional NLP systems, ensuring quick responses and minimal latency. In terms of **accuracy**, extensive testing has demonstrated a 95% success rate in recognizing and executing user commands, highlighting the system's reliability. Additionally, **user feedback** has been overwhelmingly positive, with surveys indicating high levels of satisfaction. Users appreciate the system's simplicity and responsiveness, making it an effective and user-friendly solution for voice-activated control and automation.

5.2 Comparisons with NLP Systems:

The application is optimized for **processing efficiency**, as prompt engineering requires significantly fewer computational resources compared to traditional NLP systems. This ensures smooth performance even on lower-end devices. Additionally, the use of **structured commands** helps minimize **error rates**, reducing the likelihood of misinterpretation that is commonly observed in NLP-based systems. Another key advantage is **privacy**, as all processing is handled locally, eliminating concerns related to data transmission to cloud servers and ensuring that user information remains secure.

VI. CONCLUSION AND FUTURE WORK

Nova simplifies complex interactions using dataset-driven systems while maintaining user privacy and efficiency. By leveraging structured datasets and predefined templates through prompt engineering, it eliminates the need for extensive natural language processing, ensuring precise and resource-efficient command execution. The use of PyQt5 provides a responsive and visually appealing interface, seamlessly integrating with system functions for reliable performance.

Incorporating advanced technologies like speech recognition for hands-free control and text-to-speech (TTS) for real-time auditory feedback, Nova enhances accessibility for users of all abilities. Its inclusive design ensures a smooth experience, making it a powerful tool for task management, productivity, and workflow automation.

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Future developments will expand Nova's capabilities with enhanced multilingual support, AI-driven personalization, and deeper customization options. Plans also include integration with emerging technologies such as home automation and IoT devices, broadening its functionality beyond traditional desktop computing. By focusing on these innovations, Nova continues to evolve as a smart, adaptable, and user-centric automation solution.

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