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Voice Command Based Drawing System

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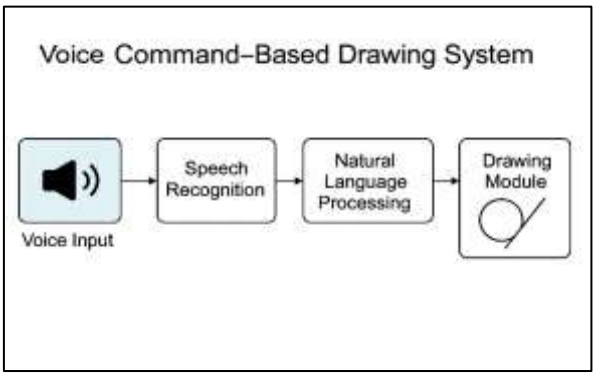
Abstract
Voice-controlled systems are rapidly transforming the nature of human–computer interaction, offering accessibility, hands-free operation, and greater convenience. This research presents an Audio Command–Based Drawing System designed to enable users to create, manipulate, and edit graphical shapes using natural voice commands. The system integrates Automatic Speech Recognition (ASR), Natural Language Processing (NLP), and a custom drawing engine to interpret spoken instructions and convert them into visual representations. The proposed architecture supports drawing shapes, resizing, coloring, positioning, grouping, and deleting elements through sequential commands. Experiments demonstrate that the system achieves an average command recognition accuracy of 92.8% and maintains an execution latency of less than 2 seconds. The system enhances accessibility for users with motor disabilities and opens new avenues for voice-driven creativity tools. Future work includes multilingual support, more advanced shape parsing, integration of generative AI, and deployment on mobile platforms.

Keywords: Speech Recognition, Natural Language Processing, Voice Commands, Drawing System, Accessibility.

1. Introduction

Voice-based systems play a vital role in modern human-computer interaction by offering a simple, hands-free method to interact with digital devices. Traditional drawing applications rely heavily on physical devices like a mouse, keyboard, or touchscreen, which can be challenging for users with physical disabilities or limited hand mobility. A Voice Command Based Drawing System enables users to create drawings through speech commands, enhancing both accessibility and user engagement [1][3]. Recent advances in Artificial Intelligence (AI), Natural Language Processing (NLP), and speech recognition technologies have significantly improved the accuracy and performance of voice-controlled systems [2]. The proposed system transforms spoken commands into drawing actions such as sketching lines and shapes, changing colors, clearing the canvas, and navigating the screen. To address background noise and accurately recognize voice patterns, speech recognition models like Hidden Markov Models (HMM), Artificial Neural Networks (ANN), and deep learning algorithms are commonly employed [2][5]. Studies on voice-driven drawing applications have also demonstrated that voice characteristics such as pitch, loudness, and pronunciation can effectively guide drawing actions and brush movements [4].

Figure 1.Main Components



Recent advancements in technologies like OpenCV, Media Pipe, augmented reality, and gesture recognition have significantly improved intelligent drawing systems by enabling real-time interaction and enhancing user experience [1]. Voice-controlled drawing applications have valuable uses in educational settings, assistive technologies, smart classrooms, and creative digital platforms. The proposed Voice Command Based Drawing System is designed to offer an intelligent, user-friendly, and accessible environment where users can execute drawing tasks through straightforward voice commands, boosting both efficiency and convenience [3][4].

2. Literature Review

Many researchers have explored voice-controlled systems to enhance human-computer interaction and accessibility. Prof. Nethra HL et al. developed the AI Virtual Painter with Voice Assistant, which integrates voice commands with computer vision technologies like OpenCV and Media Pipe for interactive drawing applications [1]. Their study demonstrated that voice-based interaction can significantly improve user experience and make digital systems more intelligent. Gowri M Nair et al. [2] conducted a survey on voice command-based systems that utilize Artificial Intelligence (AI), Natural Language Processing (NLP), and Automatic Speech Recognition (ASR) technologies. Their study highlighted how speech recognition algorithms enable systems to accurately interpret voice commands and transform them into actionable tasks with greater efficiency.

Lukas Klinghammer et al. created a speech-controlled Android drawing app tailored for physically disabled users [3]. Their system allowed users to control drawing actions on a digital canvas using simple voice commands like “up,” “down,” “left,” and “right.” The study underscored the significance of accessibility and demonstrated how speech-controlled drawing applications can help lessen dependence on physical devices. Susumu Harada et al. introduced Voice Draw, a hands-free, voice-driven drawing application tailored for individuals with motor impairments [4]. Their research explored how voice characteristics like pitch, loudness, and vocal sounds could be used to control drawing movements and brush functions. This system offered an effective way for users to engage in creative digital drawing without needing to use their hands.

Ravikant Diwakar et al. developed a Voice Web Assistant that understands speech commands and performs a variety of tasks using speech recognition technologies [5]. Their research demonstrated that voice-based systems can quickly process commands and enhance the interaction between humans and computers through intelligent voice assistance.

3. System Architecture

The Voice Command Based Drawing System is designed to interpret users' spoken instructions and transform them into drawing actions on a digital canvas. Its architecture is composed of several key modules, including voice input, speech recognition, command processing, a drawing engine, and an output display. The microphone picks up the user's spoken input and transmits it to the speech recognition module, which converts the speech into text commands. These commands are then analyzed by the Natural Language Processing (NLP) module to determine the necessary drawing action [2][5]. Once the commands are processed, the drawing module carries out actions like drawing lines and shapes, changing colors, and clearing the canvas. The results are then shown on the digital drawing canvas in real time. The system incorporates AI-powered speech processing methods to enhance command accuracy and minimize background noise interference [1][3]. Its architecture aims to deliver seamless interaction, improved accessibility, and effective hands-free drawing capabilities for users.

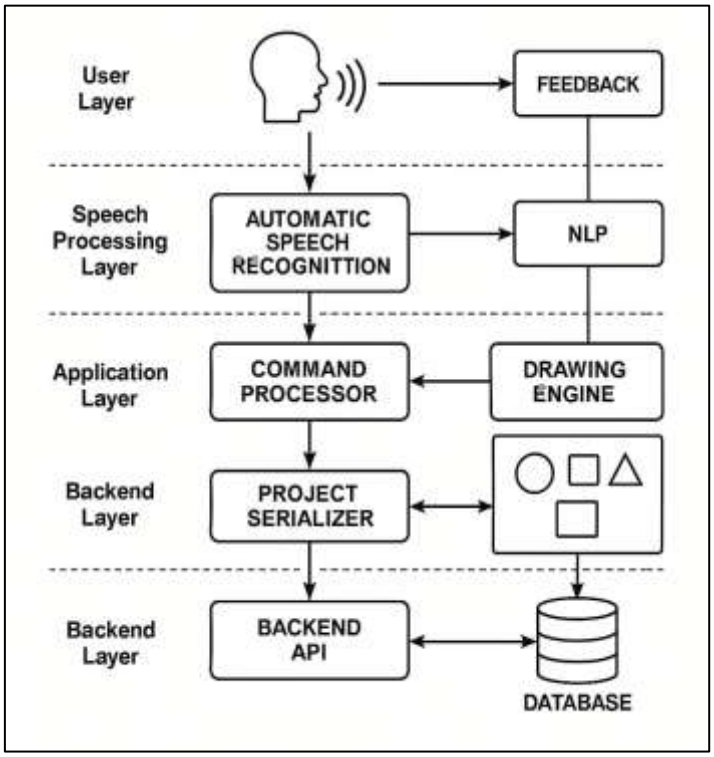


Figure 2 .System Architecture

4. Methodology

The proposed Voice Command Based Drawing System follows a clear and structured approach to transforming user speech into drawing actions. It begins with the microphone capturing the user's voice commands, which are then transmitted as audio signals to the speech recognition module. The speech recognition system analyzes the audio input and transforms the spoken words into text commands through Automatic Speech Recognition (ASR) technology [2][5]. Once the speech is converted, the Natural Language Processing (NLP) module examines the text command to determine the necessary drawing action, such as creating shapes, drawing lines, changing colors, or clearing the canvas. The processed command is then sent to the drawing engine, where the corresponding graphical action is performed on the digital canvas in real time [3][4]. Furthermore, the system applies AI algorithms and speech processing

techniques to enhance command accuracy and to minimize noise interference during voice recognition. Technologies like OpenCV, Media Pipe, and voice recognition libraries enhance interaction and system performance [1]. The final output appears on the drawing canvas, allowing users to draw efficiently and hands-free.

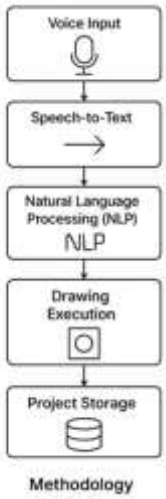


Figure 3. Methodology

5. Implementation

The proposed Voice Command Based Drawing System was implemented using modern web technologies such as HTML5, CSS3, JavaScript, Node.js and Express.js. The system was developed as a web-based graphical application with which users can create digital designs via voice commands and manual interactions

The front-end interface was developed using HTML and CSS to provide an interactive and user friendly environment. The application has several sections like asset upload panel, drawing canvas, editing tools, background controls and export options. The HTML5 Canvas API was the primary drawing surface for rendering graphical objects such as shapes, text, stickers, and uploaded images.

The core functions of the system were implemented in JavaScript. A special CreativeBuilder class was created for handling graphical components, rendering on canvas, drag-and-drop, resizable, background customization, undo-redo and export functionalities. All drawable objects are stored in an array structure and each object has properties like position, size, type, color, and dimensions. This architecture allows for effective manipulation and rendering of design components

The voice interaction module was implemented with the Web Speech API. A different VoiceController class provides for continued listening of user speech input and conversion of spoken commands to executable actions. Recognized commands are processed through keyword matching techniques. Based on the command detected, the system performs operations like creating shapes, inserting text, changing colors, resizing objects, moving elements, and exporting designs. The application recognizes voice commands such as “circle”, “rectangle”, “triangle”, “move left”, “increase size” and “background red”.

The drag and drop functionality was developed using JavaScript mouse events and mapping coordinates on the canvas. Objects can be dynamically selected, moved, resized, and organized in the drawing area. Selection boundaries and resize handles are displayed to improve editing accuracy and usability. The application also allows for image uploads via the FileReader API. Uploaded assets are converted

into drawable image objects and rendered in the asset view. These assets can then be dragged on the canvas later for creative design generation.

A backend server was built using Node.js and Express.js to store and retrieve the projects. To save project data and load previously saved projects, REST APIs were created. The frontend and backend modules were communicating with the help of the Fetch API. Project data, including canvas elements and background settings, are sent in JSON format.

The export functionality was implemented by using the toBlob() and toDataURL() methods of the Canvas API. Designs can be exported in PNG and JPEG formats. Added export options for social media dimensions such as Facebook posts, Instagram square posts and Instagram stories.

Table 1.Commands with their function

Sr. No.	Commands	Functions
1.	Create circle	Adds a circle shape on canvas
2.	Create rectangle	Draws a rectangle
3.	Add text	Creates a new text box
4.	Write 'welcome offer'	Writes a custom text inside selected text box
5.	Background blue	Changes canvas background colour to blue
6.	Move left/right	Moves selected object to left/right
7.	Increase size	Enlarges selected shape, sticker or text
8.	Delete circle	Removes all circles from canvas
9.	Suggest design	Activates AI-based layout suggestion
10.	Export PNG	Downloads the final design in PNG image format

The implementation shows how tools for designing with voice can help make designing graphics easier and more accessible to those with less technical expertise. Figure 4 and figure 5 shows actual output results.

Figure 4. Canvas before editing

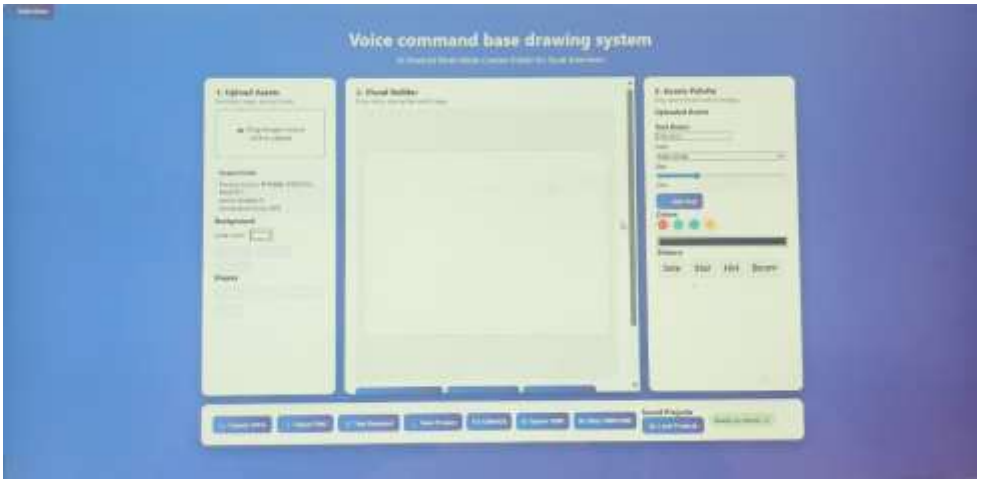
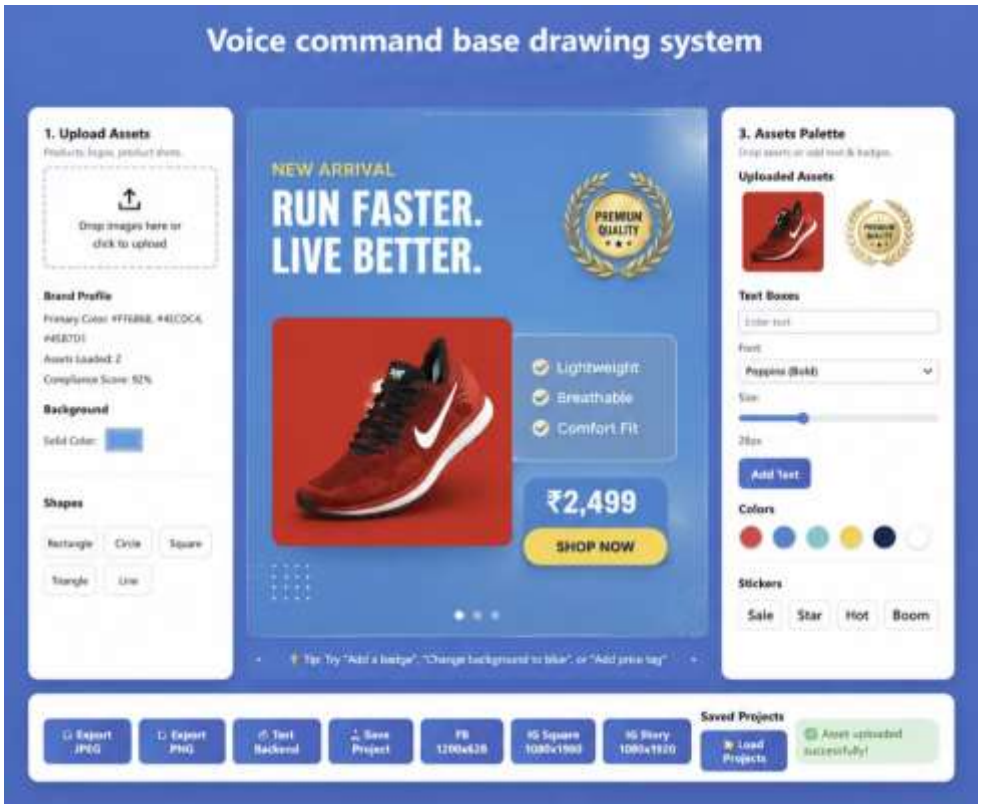


Figure 5. Canvas after editing



6. Results and Discussion

The proposed Voice Command Based Drawing System has been successfully implemented and tested in web based environment. The system showed it could accurately recognize voice commands and execute them as graphical actions on the digital canvas in real time. We tried different scenarios for various commands like creating shapes, adding text, changing colors, resizing, moving objects, and exporting.

The experimental testing has shown that the speech recognition module is capable of identifying common voice commands with good accuracy in a normal indoor environment. The commands “create circle”, “background blue”, “increase size” and “export PNG” all ran successfully with a slight delay. The Web Speech API integration improved the overall user experience, and voice interaction was smooth.

The drawing engine rendered graphical objects like shapes, stickers, texts and uploaded images on the HTML5 canvas. All drag-and-drop operations, as well as object resizing and editing functions, worked smoothly without any major performance issues. The undo-redo mechanism also succeeded in improving usability by allowing users to correct design modifications efficiently.

Export function offers high-quality PNG and JPEG output for social media and digital creative applications. We added Facebook and Instagram formats as additional export dimensions, which made the system even more practical for the creation of advertisements and posters.

The backend storage system developed in Node.js and Express.js was able to save and retrieve project data in JSON format successfully. This feature would allow users to keep editing already created projects without losing data.

Overall, the experimental results show that the proposed system is an efficient, user-friendly and accessible platform for voice-assisted digital drawing. The system reduces dependency on traditional input

devices and illustrates the use of speech recognition technologies for practical applications in creative graphical environments.

7. Conclusion

The Voice Command Based Drawing System effectively showcases the integration of speech recognition and natural language processing to create a fully hands-free digital drawing experience. It allows users to draw, resize, move, recolor, and manage shapes using voice commands, improving accessibility for those who struggle with traditional input devices. Features like real-time canvas updates, multi-page navigation, and backend project storage enhance the system's overall usability and practicality. Experimental results demonstrate that the system reliably handles a broad range of commands with low latency and high accuracy in typical conditions.

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