



"Air-Art": Real-time Hand Gesture Drawing and Recognition

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Project Guide
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1. Introduction

- "Air-Art" is a project aimed at transforming digital interaction through hand gestures. Comprising three modules, our system offers real-time capabilities for drawing and recognition.
- The 'Air Canvas' module enables users to draw in the air using MediaPipe.
- The 'Numbers and Alphabets Recognition' module identifies handwritten characters.
- The 'Air Drawing Recognition' module recognizes air-drawn sketches with a Convolutional Neural Network.

1. Introduction

Motivation:

- Enhance Digital Art: Improve the digital art creation experience by introducing natural hand gestures.
- Overcome Traditional Input Limits: Address the limitations of conventional methods like mouse and keyboard.
- Immersive Experience: Bridge the gap between physical drawing and the digital canvas.
- Foster Creativity: Provide users with a natural and expressive way to unleash their creativity.

1. Introduction

Objectives:

- To develop real-time drawing capabilities using hand tracking technology.
- To implement accurate recognition algorithms for interpreting hand-drawn characters.
- To explore the potential of Convolutional Neural Networks (CNNs) for recognizing air-drawn sketches.
- To integrate advanced machine learning for precise gesture recognition.

2. Literature Survey of the existing system

Sr No.	Title	Author	Year	Outcomes	Methodology	Result
1	AIR CANVAS application using open CV	Druzhkov, Erukhimov, V.L. Zolotikh	2021	The system has the potential to challenge traditional writing methods. It eradicates the need to carry a mobile phone in hand to jot down notes, providing a simple on-the-go way to do the same.	Detecting the contours, finding the center coordinates of large contour and keep storing them in the array for next frames. Finally, draw the points stored in an array on the frames and canvas.	This project makes the user to have an interactive environment where the user can draw whatever he wants by choosing his required colors from the displayed ones.

2. Literature Survey of the existing system

Sr No.	Title	Author	Year	Outcomes	Methodology	Result
2	An economical air writing system converting finger movements to text using web camera. [2]	P. Ramasamy, G. Prabhu, and R. Srinivasan	2016	To create a virtual canvas to sketch. In future, this is useful for making kids to learn drawing in schools in an interactive way.	<ol style="list-style-type: none">1. Palm detection2. Hand landmark identification. Drawing without any help of external devices such as keyboard, stylus, pen or handgloves.	The project is based on a visual based pointing method which allows drawing in air using camera.

2. Literature Survey of the existing system

Sr No.	Title	Author	Year	Outcomes	Methodology	Result
3	An economical air writing system converting finger movements to text using web camera.[3]	Yusuke Araga, Makoto Shirabayashi, Keishi Kaida, Hiroomi Hikawa	2012.	To provide instant on-screen feedback for a responsive interaction.	Authors in report suggested a method in which an LED is mounted on the user's finger, and the web camera is used to track the finger. Augmented segmented desk interface approach for interaction was proposed.	Open CV helps to reduce the process of image processing to detect the positions of fingers. This can also be used as base project for various system that require hand tracking.

3. Limitations of existing systems

1. Fingertip detection

The existing system only works with your fingers, and there are no highlighters, paints, or relatives. Identifying and characterizing an object such as a finger from an RGB image without a depth sensor is a great challenge.

2. Lack of pen up and pen down motion

The system uses a single RGB camera to write from above. Since depth sensing is not possible, up and down pen movements cannot be followed. Therefore, the fingertip's entire trajectory is traced, and the resulting image would be absurd and not recognized by the model. The difference between hand written and air written 'G' is shown in Figure 1.



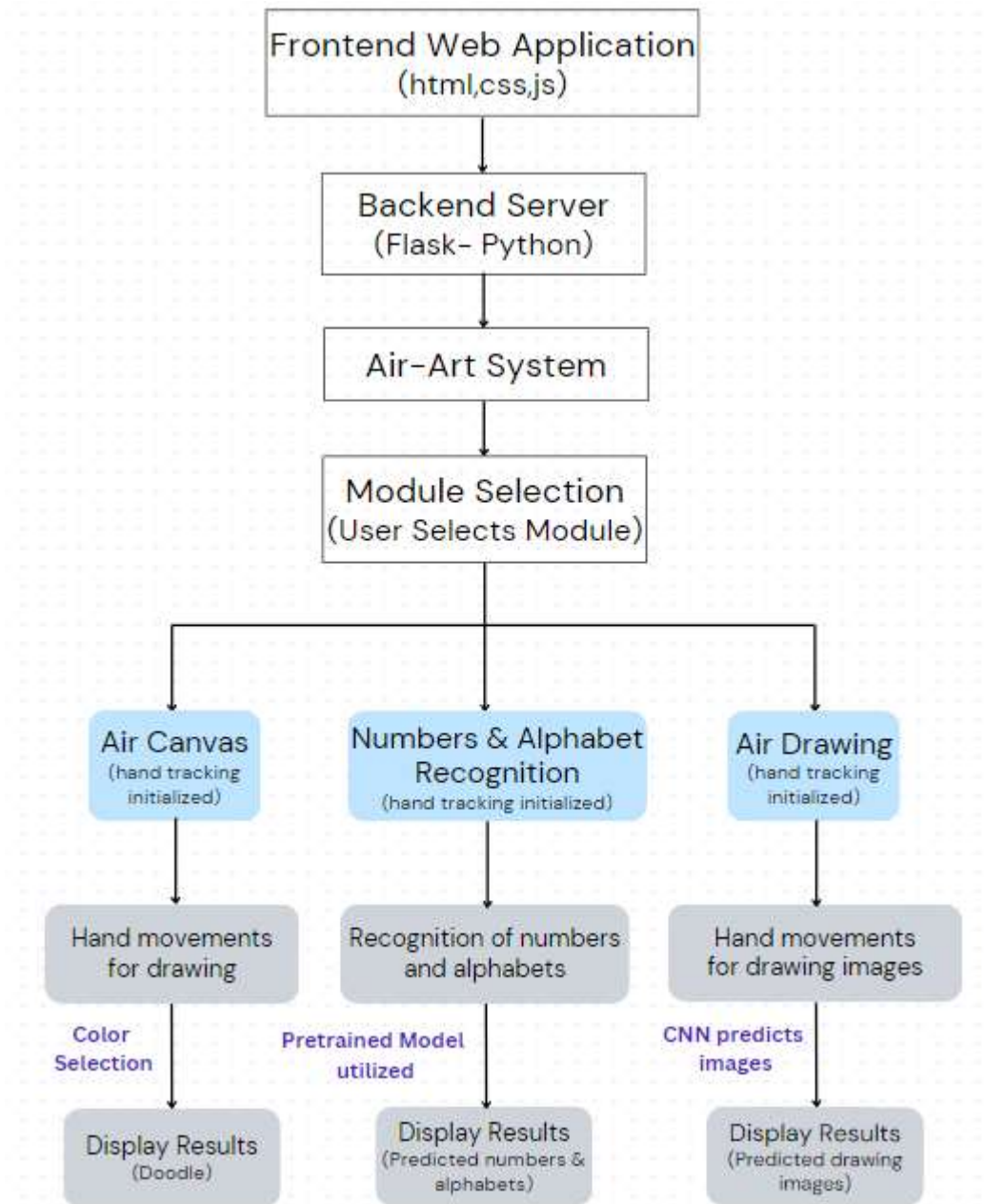
3. Controlling the real-time system

Using real-time hand gestures to change the system from one state to another requires a lot of code care. Also, the user must know many movements to control his plan adequately.

4. Problem Statement

- The VR industry is facing a challenge in the limited availability of devices designed to assist disabled or differently-abled individuals.
- Researchers are investigating the concept of a virtual keyboard implemented through a camera as a substitute for physical keyboard hardware.
- In multilingual countries like India, where physical keyboards for various languages are expensive, a camera-based keyboard can support multiple languages.

5. System Design



5. System Design

Main Window:

- Air-Art Displays three buttons for module selection: "Air Canvas", "Numbers and Alphabets Recognition", and "Air Drawing Recognition using CNN".
- Users click buttons to choose desired module.

Module - 1: Air Canvas

- User selects "Air Canvas".
- Hand tracking starts using OpenCV and Mediapipe.
- Hand movements translate to drawing actions on screen.
- Colors can be selected for drawing.
- User ends session by closing the window.

5. System Design

Module - 2: Numbers and Alphabet Recognition

- User selects "Numbers and Alphabets Recognition".
- Hand tracking initiated with OpenCV and Mediapipe.
- Handwritten numbers and alphabets are recognized.
- Pretrained TensorFlow and Keras models ("bModel.h5" and "bestmodel.h5") are utilized.
- Recognition results displayed.
- User ends session by closing the window.

5. System Design

Module - 3: Air Drawing using CNN

- User selects "Air Drawing".
- Hand tracking initiated with OpenCV and Mediapipe.
- Hand movements used to draw images.
- CNN predicts images using the Quick-Draw dataset.
- Results displayed.
- User ends session by closing the window.

6. Technologies and methodologies

Main Window : Air-Art

Technologies:

- HTML5
- CSS3
- JS (ES6)
- Bootstrap (v5.3.3)
- Flask (v3.0.3)

Methodologies:

- Integration of all the modules

6. Technologies and methodologies

Module 1: Air Canvas

Technologies:

- OpenCV (v4.9.0)
- Mediapipe (v0.10.11)

Methodologies:

- Real-time hand tracking using MediaPipe
- Drawing on air by selecting different colors

6. Technologies and methodologies

Module 2: Numbers and Alphabet Recognition

Technologies:

- OpenCV (v4.9.0)
- Mediapipe (v0.10.11)
- TensorFlow (v2.16.1)
- Keras (v3.2.0)

Methodologies:

- Handwriting recognition using pre-trained models
(bModel.h5 - alphabets, bestmodel.h - numbers)

6. Technologies and methodologies

Module 3: Air Drawing

Technologies:

- OpenCV (v4.9.0)
- Mediapipe (v0.10.11)
- TensorFlow (v2.16.1)

Methodologies:

- Training a Convolutional Neural Network (CNN) model using Google's Quick-draw dataset

7. Implementation

AirArt

Close



Air Canvas

Experience the magic of digital artistry with Air Canvas, where your fingertips become the brushes and the air becomes your canvas.

Start



Letter Recognition

Letter - Number Recognition

Effortlessly identify and interpret handwritten characters and digits, enabling seamless integration of manual input into digital applications.

Start

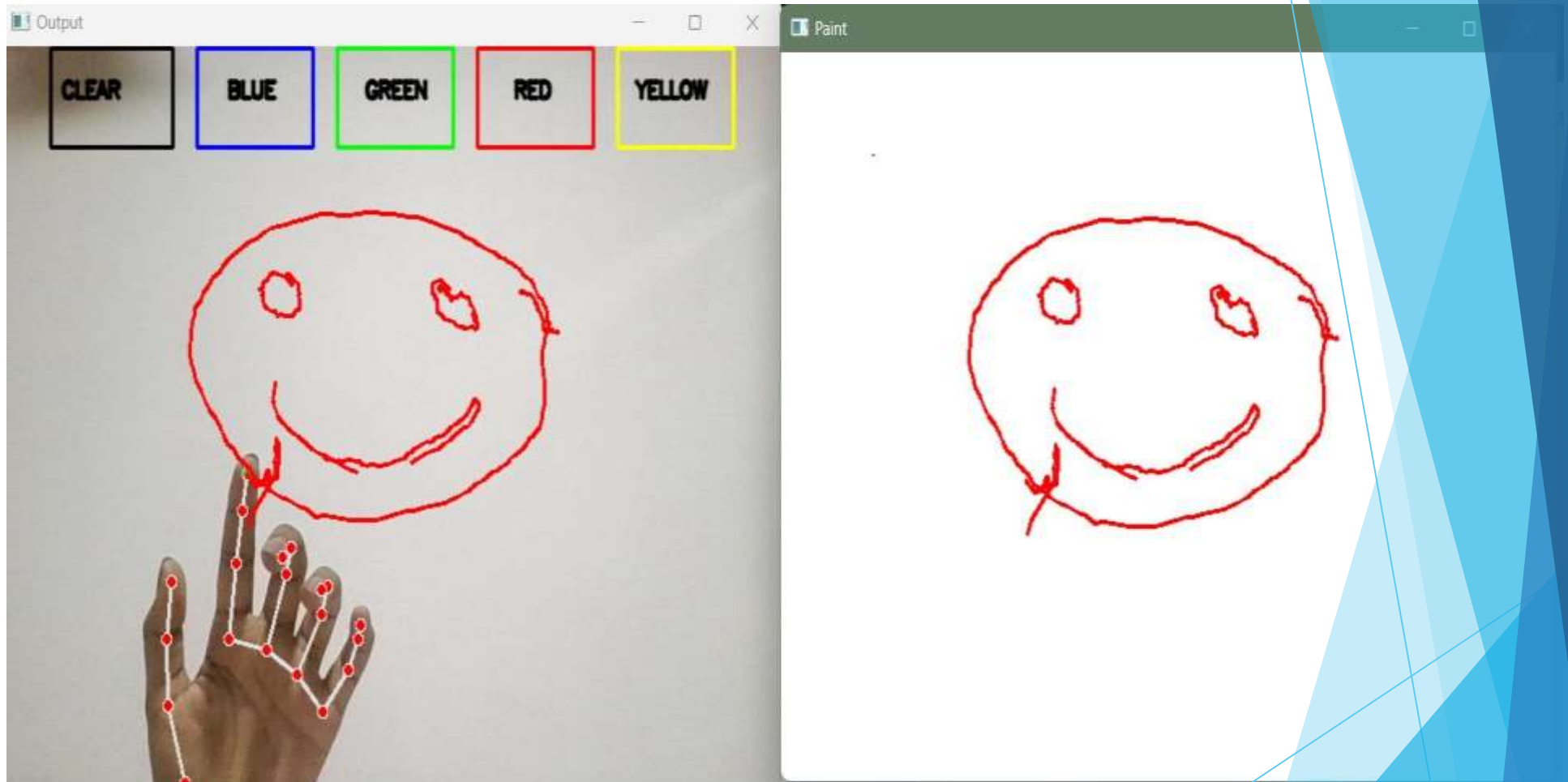


Air Drawing

Automatically interpret hand-drawn sketches and strokes, facilitating intuitive creation and interaction in digital environments.

Start

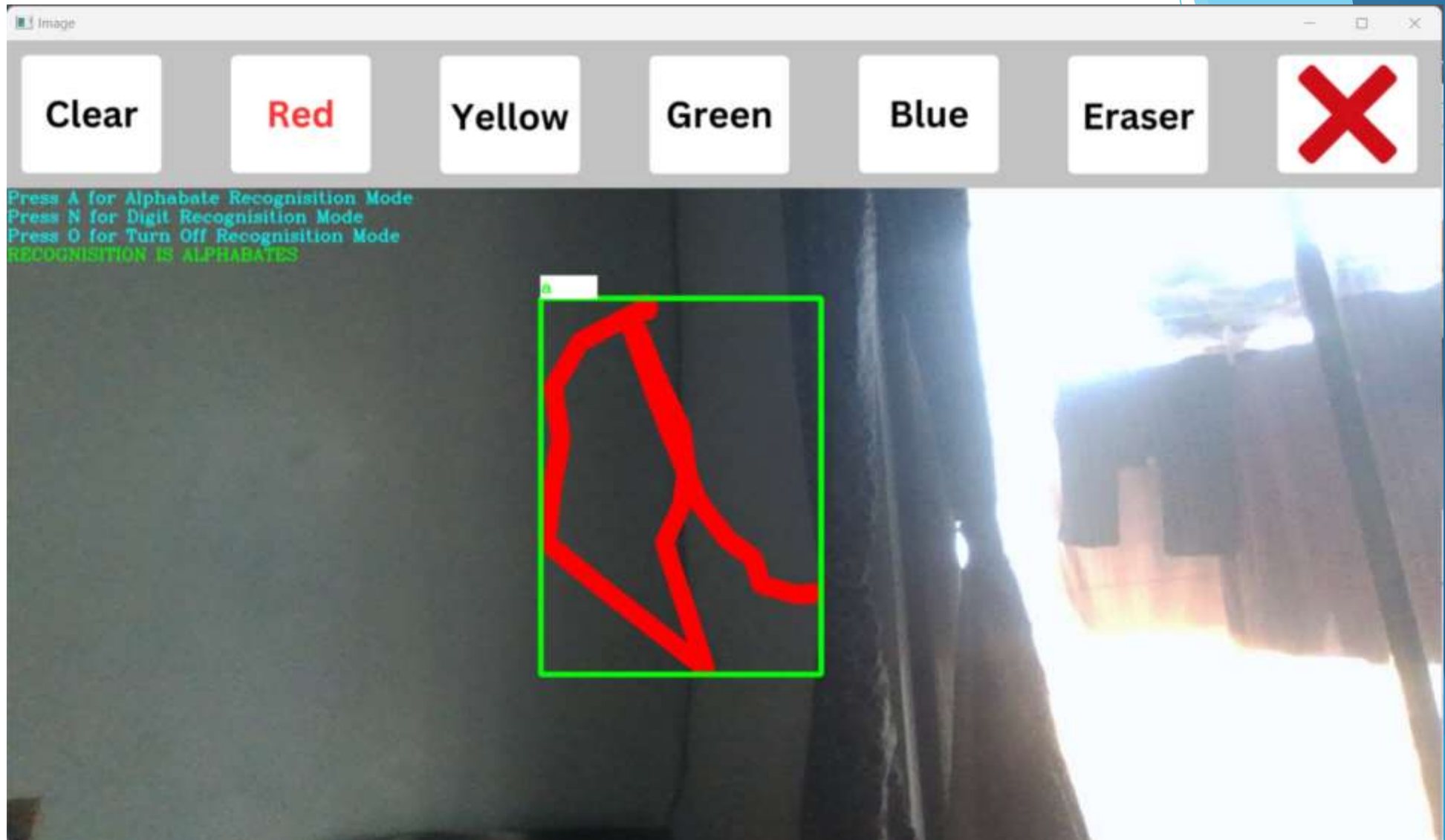
7. Implementation



7. Implementation



7. Implementation



8. Conclusion

- Air-Art provides a unique and innovative interface for users to interact with digital content using hand gestures and drawings in the air.
- Air-Art encourages creative expression by providing users with a canvas to draw freely in the air, choose different colors, and explore their artistic abilities without the need for physical tools like pens or paper.
- Air-Art has diverse applications ranging from entertainment and education to art and design, making it suitable for various users, including artists, educators, students, and hobbyists.

9. References

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- [6]P. Ramasamy, G. Prabhu, and R. Srinivasan, "An economical air writing system is converting finger movements to text using a web camera," 2016 International Conference on Recent Trends in Information Technology (ICRTIT), Chennai, 2016, pp. 1-6

Thank You...!!