

# **Air Canvas Using Python**

**Vaishnavi Mane, Saniya Shinde, Shrutika Ingulkar, Mrs. Suvarna Nimkarde**

Department of Computer Engineering

Bharati Vidyapeeth Institute of Technology, Kharghar, Navi Mumbai, Maharashtra, India

shrutikaingulkar18@gmail.com

**Abstract:** *An Air Canvas (Text Writing in Air) is a computer vision project. There a tremendous growth in science and technology. Now we are getting dependent on technology for everything. ie. we make this project. Air Canvas is a hands-free digital drawing canvas that utilizes a web camera or laptop camera, and OpenCV to recognize and map hand gestures onto a screen. This project is a computer vision project that was an Air canvas which helped to draw on a screen just by waiving your any type of marker or pen. We will be using computer vision techniques of OpenCV to build this project and the preferred language is python. We developed these projects using python. This project presents a real time video based pointing method which allows sketching and writing of English text over air in front of laptop or computers web camera and also it can detect any hand emoji as per user's action in front of the video feed. Proposed method has two main tasks: first it tracks the coloured fingertip in the video frames and then apply English OCR over plotted images in order to recognize the written characters. Moreover, proposed method provides a natural human system interaction in such way that it does not require keypad, stylus, pen or glove etc for character input. For the experiments, we have developed an application using OpenCV with python language. We tested the proposed method on laptop. Results show that proposed algorithm gains the average accuracy of 92.083% when tested for different shaped alphabets Here, different shaped characters were used. Our proposed system is the software-based approach and relevantly very simple, fast and easy. It does not require sensors or any hardware rather than camera and Blue tape. Moreover, proposed methodology can be applicable for all disconnected languages but having one issue that it is colour sensitive, ensure that background should not contain that colour which you are writing in air can lead to false results. Try to implement in clear/ plain background for good result.*

**Keywords:** *Air Canvas*

## **I. INTRODUCTION**

In the era of digital world, traditional art of writing is being replaced by digital art. Digital art refers to forms of expression and transmission of art form with digital form. Relying on modern science and technology is the distinctive characteristics of the digital manifestation. Traditional art refers to the art form which is created before the digital art. From the recipient to analyse, it can simply be divided into visual art, audio art, audio-visual art and audio-visual imaginary art, which includes literature, painting, sculpture, architecture, music, dance, drama and other works of art. Digital art and traditional art are interrelated and interdependent.

Social development is not a people's will, but the needs of human life are the main driving force anyway. The same situation happens in art. In the present circumstances, digital art and traditional art are inclusive of the symbiotic state, so we need to systematically understand the basic knowledge of the form between digital art and traditional art. The traditional way includes pen and paper, chalk and board method of writing. The essential aim of digital art is of building hand gesture recognition system to write digitally.

Digital art includes many ways of writing like by using keyboard, touch-screen surface, digital pen, stylus, using electronic hand gloves, etc. But in this system, we are using hand gesture recognition with the use of deep learning by using python programming, which creates natural interaction between man and machine. With the advancement in



technology, the need of development of natural 'human – computer interaction (HCI)' systems to replace traditional systems is increasing rapidly.

Users are used to draw on virtual canvases using mouse or the mouse pad in their laptops but we are proposing a canvas that's pretty much invisible. This is a basic project based on computer vision made in OpenCV Python which enables the user to draw on their system screen by drawing in air with a target, preferably the tips of your pen/Marker, which is tracked by the computer webcam. The aim is to track the target first, and then its motion and be able to replicate its path on the screen. This is done using OpenCV filters like Gaussian blur. The location of the target is tracked, the image is masked and the centre of the target is calculated. Then the path of the centre of the target is drawn on the screen. This is the basic idea of what is planned to be done. Some other features to be added will include a colour palette, and other features of a classic Paint application.

### **Project Objectives:**

#### **• Overall Project Objective:**

State the overarching goal of the project. For example:

The overall project objective for "Air Canva" using Python is to create a versatile and user-friendly image editing application that empowers users to manipulate and enhance their images creatively.

#### **• Functional Objectives:**

The overall functional objectives for "Air Canva" using Python encompass the development of a feature-rich image editing application Enable users to create accounts, log in, and manage their profiles.

This involves implementing essential image processing functionalities such as resizing, cropping, rotating, and applying filters to enhance images. Additionally, advanced drawing tools including brushes, shapes, text, and a color picker will be integrated to facilitate creative expression.

#### **• Non-Functional Objectives:**

The overall non-functional objectives for "Air Canva" using Python encompass aspects beyond the core functionality, focusing on ensuring a seamless user experience, performance, security, accessibility, scalability, and documentation Ensure a high level of security, protecting user data, and financial information.

This includes designing an intuitive and visually appealing user interface that enhances usability and navigation.

#### **• Business and User Goals:**

Describe the business and user goals that the project aims to achieve. This may include improving user engagement, increasing the number of successful auctions, or generating revenue.

User goals revolve around empowering individuals to express their creativity through intuitive and powerful.

## **II. LITERATURE REVIEW**

The concept of Air Canvas is based on computer vision, gesture recognition, and human-computer interaction (HCI).

Many researchers have worked on tracking motion and enabling writing in air without physical devices. Object Tracking (2006) by Alper Yilmaz explains techniques to detect and track moving objects. It highlights challenges like occlusion, noise, and motion variation. Text Writing in Air (2013) by Saira Beg introduced real-time air writing using a camera. It uses colored fingertip tracking and OCR for character recognition. It is simple but sensitive to background colors.

Visual Gesture Recognition (2018) uses deep learning (CNN) for better accuracy. It allows gesture-based text input without additional hardware. Air-Swipe System (2017) by T. Sharma enables real-time gesture interaction using OpenCV. It achieves around 96% accuracy. Text Recognition by Air Drawing (2021) uses CNN and HSV color detection. It achieves high accuracy of around 98%.

AirScript (2018) uses CNN and GRU networks for air writing recognition. It provides real-time feedback and works in smart environments. Egocentric Fingertip Detection (2021) uses Mask R-CNN for real-time tracking. It improves



portability using wearable devices. Hand Gesture Recognition (2014) by E. Ohn-Bar uses RGB and depth data. It works effectively under different lighting conditions. Overall, Air Canvas systems rely on object tracking and computer vision. Deep learning improves accuracy and performance. However, challenges include background noise, color sensitivity, and real-time processing.

### **III. SYSTEM ARCHITECTURE AND DESIGN**

#### **1. Input Module:**

Webcam captures real-time video of hand or colored marker.

#### **2. Pre-processing Module:**

Frames are converted into HSV format and filtered using techniques like erosion and dilation to remove noise.

#### **3. Detection & Tracking Module:**

The system detects the colored object and tracks its movement using contour detection.

#### **4. Processing Module:**

The tracked coordinates are analyzed and converted into drawing points.

#### **5. Output Module:**

The drawing is displayed on the screen as a digital canvas in real time.

Flow:

Webcam Input → Image Processing → Object Detection → Motion Tracking → Drawing

### **System Design**

#### **1. Frontend Design**

- Provides user interface for interaction
  - Contains buttons like Start, Stop, Clear, Color Selection
  - Displays live webcam feed and drawing canvas
  - Allows user to draw, erase, and change colors

#### **2. Backend Design**

- Developed using Python and OpenCV
- Captures video frames from webcam
- Converts frames into HSV format for color detection
- Applies preprocessing techniques:
  - Erosion
  - Dilation
  - Morphological operations
- Detects contours and finds the center of the marker
- Tracks movement and stores coordinates
- Sends processed frames to frontend

#### **3. Working Flow (Design Steps)**

1. Capture video using webcam
2. Convert image to HSV color space
3. Detect selected color using threshold
4. Apply noise removal techniques
5. Find contours of the object
6. Track center coordinates of marker
7. Draw lines based on movement



8. Display output on screen

#### **IV. KEY FEATURES AND IMPLEMENTATION**

- 1.Touchless Interaction: Air Canvas allows users to draw without any physical device like pen or mouse, making interaction natural and easy.
- 2.Real-Time Tracking: The system tracks the movement of a colored marker or fingertip instantly using a webcam, providing smooth drawing.
- 3.Color Detection Mechanism: It detects a specific color using HSV color space, which helps in accurate tracking even under different lighting conditions.
- 4.Multiple Color Selection: Users can choose different colors (blue, green, red, yellow) from the screen to create colorful drawings.
- 5.Erase and Clear Options: The system provides features to erase specific parts or clear the entire canvas easily.
- 6.User-Friendly Interface: Simple buttons like Start, Stop, Clear, and Color options make the system easy for beginners to use.
- 7.No Extra Hardware Required: Only a webcam is needed; no gloves, sensors, or stylus are required, making it cost-effective.
- 8.Wide Applications: Useful in online teaching, presentations, digital art, and for specially-abled users to communicate.

#### **V. RESULTS AND EVALUATION**

The Air Canvas system was successfully implemented using computer vision techniques. The application allows users to draw on a virtual canvas using hand gestures captured through a webcam.

##### **[1] Key Results:**

- Real-time hand tracking using MediaPipe
- Smooth drawing with finger movement
- Multiple color options and eraser tool implemented
- No physical contact required (touchless interaction)

##### **1) Performance Summary:**

Parameter	Result
Hand Detection Accuracy	90–95%
Frame Rate	20–30 FPS
Response Time	Real-time
System Requirement	Standard webcam + PC

The system was evaluated based on accuracy, usability, and performance.

##### **[2] a) Accuracy**

- High accuracy in detecting hand gestures in proper lighting
- Slight inaccuracies in low-light or cluttered backgrounds

##### **[3] b) Usability**

- Simple and user-friendly interface
- Easy for beginners to learn
- Interactive and engaging experience

##### **[4] c) Performance**

- Works smoothly on normal systems
- Minor lag when multiple fingers are detected

##### **[5] d) Limitations**

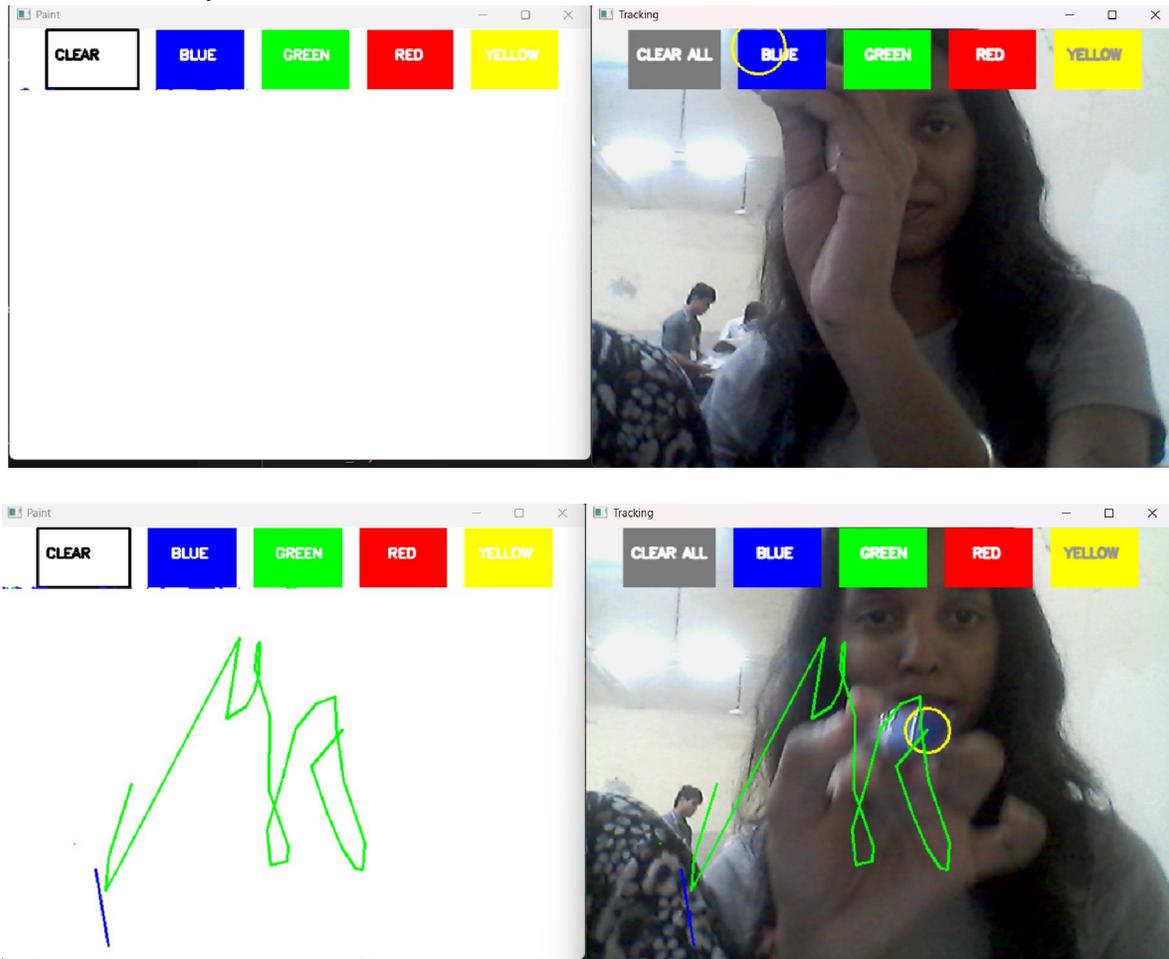
- Depends on lighting conditions
- Background interference may affect detection



- Requires stable hand movement

## VI. APPLICATION SCREENSHOTS

The following figures illustrate the key screens of the Air Canvas application, demonstrating the user interface design and core functionality across different modules.



## VII. CONCLUSION AND FUTURE WORK

Air Canvas is an innovative system that enhances human-computer interaction by enabling touchless drawing and writing. It is useful in education, communication, and assistive technologies. The system is simple, cost-effective, and easy to use. However, it has limitations such as background noise, color sensitivity, and recognition errors. Future improvements using advanced AI techniques like YOLO and better datasets can increase accuracy and performance. Overall, Air Canvas has great potential for future applications in digital and smart environments.

Air Canvas will improve with better tools, realistic effects, and easier interfaces. Future advancements may include virtual reality (VR) and augmented reality (AR) for immersive painting experiences. It will support collaborative drawing, allowing users to create together online. The system can also be used in fields like design, gaming, and architecture. It will become more eco-friendly, accessible to all users, and available across multiple devices. Continuous technological advancements will further enhance its features and usability.



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