Air Canvas: Drawing in Air using AI
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Abstract—Drawing in Air has been one of the most fascinating and interesting research areas in the field of visual pattern recognition. Here, visual pattern recognition means to recognize movement of fingertips. It improves the interaction between man and computer in various applications. This idea will help in achieving the naturalness desired for Human Computer Interaction (HCI). Proposed method have two main tasks: first it tracks the fingers tip and second it plots the co-ordinates of finger-tip on the screen in any desired colour. It does not require any keypad, pen or glove rather than a camera. This idea of Air Canvas is beyond the traditional empty (white), rectangular and flat-dimensional canvas seen in traditional artworks. We are applying the techniques of computer vision in OpenCV to build this project. To achieve the goal of this project, the finger-tip tracking and detection process are used. Air canvas refers to virtually drawing through hand gesture on the air without touching anything which is recommended during COVID-19. This project will be a powerful means of communication for the deaf, specially-abled, senior citizens and children's for educational purposes.

Keywords- Air Canvas, finger-tip, OpenCV, HCI, Hand Tracking, etc.

I. INTRODUCTION
In today's generation, where technology has emerged to such a greater levels that HUMAN COMPUTER INTERACTION has become increasingly important part of our daily life. The inspiration came from the idea of dustless classroom for students to study in through the digital drawing/teaching methods. To develop this AI based Project, we will be using our trending techniques namely OpenCV and Python. Open cv is mainly known as an open source computer vision and machine learning software.

The library has more than 2400 best algorithms, which includes comprehensive set of classic and state-of-the-art computer vision and machine learning algorithms. Most of these algorithms are used to detect and recognize faces, identify objects, classify human activities in videos track camera movements, track moving objects, extract 3D one’s. Python is one of the high-level-general-purpose programming language. Object-oriented approach mainly to help programmers to write clear, logical code for small as well as large – scale projects. The essential aim of digital art is of building a system which will help in drawing digitally.

II. PROBLEM STATEMENT
To develop An AI based tool using techniques of OpenCV which can draw anything on any surface by just capturing the motion of a coloured marker with a camera. Here a coloured object at the tip of the finger is used as the marker.

III. PROJECT SCOPE
Given more time to work on this project, we would improve hand contour recognition, explore our original Air Canvas goals, and try to understand the multicore module. To enhance hand gesture tracking, we would have to delve more into OpenCV. There are many different methods of contour analysis, but in this particular algorithm, it may be worthwhile to take a look at the color histogram used to create the contours in question. Furthermore, we could experiment with different interpolation methods. PyGame includes a line drawing method (pygame.draw.line ()) that could prove useful in producing smoother, cleaner lines.

On the same vein, implementing a variety of brush shapes, textures, and even an eraser would make Air Canvas more robust as a drawing program. Allowing the user to save their final work or watch their drawing process as a playback animation could also be unique features that resemble real creativity software. Perhaps there would even be a way to connect Air Canvas to actual digital drawing programs such as Adobe Photoshop, Clip Studio Paint, or GIMP! Finally, we could make significant strides by figuring out how multicore processing works with in-order information processing.

IV. MOTIVATION
Writing in air is one of the most fascinating and challenging research areas in field of AI. These were the point which stricked our minds and from there we got the idea to do the project called air canvas-drawing in...
Drawing or Sketching using hand is everyone’s wish. Some or the other time we imagine writing in air using our hand. So, here came the project from this concept where we create a canvas and pick the colours required using our hand and draw the required design or write anything you wish.

V. METHODOLOGY

Writing in air has been one of the most fascinating and challenging research areas in the field of image processing and pattern recognition in the recent years. It contributes immensely to the advancement of an automation process and can improve the interface between man and machine in numerous applications.

Several research works have been focusing on new techniques and methods that would reduce the processing time while providing higher recognition accuracy. Object tracking is considered as an important task within the field of Computer Vision. The invention of faster computers, availability of inexpensive and good quality video cameras and demands of automated video analysis has given popularity to object tracking techniques.

Generally, video analysis procedure has three major steps: firstly, detecting of the object, secondly tracking its movement from frame to frame and lastly analysing the behaviour of that object. For object tracking, four different issues are taken into account; selection of suitable objects representation, feature selection for tracking, objects detection and object tracking. In real world, Object tracking algorithms are the primarily part of different applications such as: automatic surveillance, video indexing and vehicle navigation etc.

The project takes advantage of this gap and focuses on developing a motion-to-text converter that can potentially serve as software for intelligent wearable devices for writing from the air. This project is a reporter of occasional gestures. It will use computer vision to trace the path of the finger. The generated text can also be used for various purposes, such as sending messages, emails, etc. It will be a powerful means of communication for the deaf. It is an effective communication method that reduces mobile and laptop usage by eliminating the need to write.

VI. HAND TRACKING

Hand tracking is the process in which a computer uses computer vision to detect a hand from an input image and keeps focus on the hand’s movement and orientation. Hand tracking allows us to develop numerous programs that use hand movement and orientation as their input.

We tend to write the same code in different projects to perform hand tracking as part of our program. Creating a hand tracking module solves this problem since we write the code once. We then convert this piece of code into a module. We can import this module into any python project that we are working on and it will perform hand tracking.

1. Palm detection:
MediaPipe works on the complete input image and provides a cropped image of the hand.

2. Hand landmarks identification:
MediaPipe finds the 21 hand landmarks on the cropped image of the hand.

The 21 hand points that MediaPipe identifies are shown in the image below:

![Fig 1.](image_url)

VII. CODE REQUIREMENTS

This application is written in Python 3.6 and it uses the very famous OpenCV library. OpenCV is a computer vision and machine learning software library that includes many common image analysis algorithms that will help us build custom, intelligent computer vision applications.

VIII. VIDEO TRACKING

To perform video tracking, an algorithm analyzes sequential video frames and outputs the movement of targets between the frames. There are a variety of algorithms, each having strengths and weaknesses. Considering the intended use is important when choosing which algorithm to use. There are two major components of a visual tracking system: target representation and localization, as well as filtering and data association.

Video tracking is the process of locating a moving object (or multiple objects) over time using a camera. It has a variety of uses, some of which are: human-computer interaction, security and surveillance, video communication and compression, augmented reality, traffic control, medical imaging and video editing.
IX. LIBRARIES

1. Python OpenCV and Numpy
   OpenCV is a widely used open-source library for computer vision. It includes several ready-to-use computer vision algorithms. Python is becoming the standard programming language for AI, and NumPy provides data structures used to deploy OpenCV with Python. NumPy, which stands for Numerical Python, is a library consisting of multidimensional array objects and a collection of routines for processing those arrays. Using NumPy, mathematical and logical operations on arrays can be performed. NumPy is a Python package. It stands for Numerical Python.

2. Media Pipe:
   Media Pipe Hands is a high-fidelity hand and finger tracking solution. Media pipe is a cross-platform library developed by Google that provides amazing ready-to-use ML solutions for computer vision tasks. OpenCV library in python is a computer vision library that is widely used for image analysis, image processing, detection, recognition, etc. Media Pipe is able to achieve its speed thanks to the use of multi-threading. Such development techniques are generally difficult, but Media Pipe takes the reins and does them for you, so long as you follow good graph-making practices.

X. RESULT

XI. CONCLUSION

This project has the capability to challenge traditional drawing/writing methods. This project will be an excellent example for people to interact with the digital world. Air Canvas can make text come alive! This project is based on a visual based pointing method which allows drawing in the air using a camera. Hence, we are able to now draw, write in the air with the help of this project.

This work can further be improved by including saving users' final work or watching their process as a playback animation. This can also be a unique feature that resembles real creativity software. Therefore, we conclude that, we have successfully implemented this project.

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