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AIR CANVAS USING ARTIFICIALINTELLIGENCE

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***Abstract*— English text can be written and sketched over theair in front of the camera using a real-time video-based pointing technology known as air-canvas. The suggested method uses colour detection and tracking to follow the coloured fingertip in the video frames. A mask is created after the colour marker is identified. It also comprises the subsequent morphological processes of erosion and dilation on the finished mask. Erosion removes the impurities from the mask, and dilatation further repairs the main mask thathas been eroded.**

Keywords—Artificial Intelligence, Image detection, OpenCV, Computer Vision, Image Processing.

I. INTRODUCTION

Writing in the air has developed into one of the most fascinating and challenging research areas in the domains of pattern recognition and image processing in recent years. In many different applications, it can improve the interface between a machine and a human and offers a substantial contribution to the development of an automated process. Several studies have focused on cutting-edge tactics and methods that would hasten recognition while shortening processing time. Object tracking is considered to be a major issue in the field of computer vision. Object tracking systems are becoming more and more common as a result of the advancement of faster computers, the accessibility of low-cost, high- quality video cameras, and the demands for automated video analysis. Generally, the three fundamental components of a video analysis technique are object detection, tracking an object's movement from frame to frame, and behaviour analysis. Choosing an acceptable object representation, selecting tracking features, detecting objects, and tracking them are the four main factors to take into account. Several real-world applications, such as autonomous surveillance, video indexing, and vehicle navigation, depend on object tracking algorithms. Another application for object tracking is in human-computer interaction. The glove-based technique and the image-based method are the two primary methodologies that many algorithms from various universities have been properly categorised under.For an image-based approach to recognise the movements of the hand (or item), photos must be input. To design a basic prototype for a screen-painting drawing tool that utilises hand motion detection software. The primary goals are to use OpenCV to identify the pointer finger, map coordinates from hand recognition software to a graphic, and added features including colour and size adjustments, as well as haptic and on-screen buttons. When writing, drawing, scribbling, and other activities, we use a lot of paper. 93% of writing is done on paper derived from trees, 50% of company trash is paper, 25% of landfill waste is paper, and so on. The average quantityof water required to produce A4 size paper is 5 litres. The ecosystem is harmed by paper waste because it uses water, kills trees, and produces tonnes of garbage. These problems can be easily fixed with Air Writing. It will serve as a communication aid for those who have hearing loss. Moreover, no paper is needed when writing in the air. Everything is electronically stored.

II. LITERATURE SURVEY

Dr. M. Parameswar et al [1], In this project, they developed an Air Canvas that can draw anything out of it by merely using a camera to record the movement of a coloured marker. Here, the fingers are marked with a coloured item. They developed this project using OpenCV computer monitoring techniques. With its comprehensive libraries and simple syntax, the language Python that we have used can be applied to any language that is supported by OpenCV. In recent years, on-air writing has emerged as one of the most fascinating and challenging fields of image processing and pattern recognition. In a range of systems, it improves human-machine communication and makes it easier to build automated procedures. Many studies focus on cutting-edge techniques and techniques that can expedite processing while maintaining remarkably high identification accuracy. In computer vision, tracking an object

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is seen as a key challenge. Due to the development of quick computers, the accessibility of inexpensive, high-quality video cameras, and the requirement for automated video analysis, tracking techniques are becoming more and more popular. A motion-to-text converter that can be included into cutting-edge portable writing devices is what this project aims to produce.

N. Kavya et al [2], With the help of this project, Air Canvas, we can significantly reduce our reliance on the mouse and the difficulties that come with using it to sketch on modern platforms. We can swiftly and easily display our imagination by simply waving our hands around. By utilising straightforward methods or libraries like mediapipe, the project is made more effective than the present one. In this system, we've built an air canvas system using mediapipe, which is a useful method for tracking hand positions. With the help of Mediapipe, we can speed the picture processing necessary to determine the locations of fingers. There are several uses for this, including teaching and sketching. We may employ less hardware components, including touch displays and mice, as a result. This can also be used as the basis for a number of hand tracking systems. The project discussed in this essay also encourages people to be more imaginative. Now more than ever, we can educate others and produce works of art. This project can act as the starting point for a number of future hand monitoring initiatives. Other applications for this include the understanding of sign language and virtual mice.

Nishtha Dua al [3], In this paper, The system may measure the effectiveness of traditional writing methods. It eliminates the need for you to keep your phone in your pocket while taking notes and provides a practical way to do so when you're on the go. Also, it will be quite beneficial for those who are specially abled in terms of easing communication. The system will be simple enough to use for everyone, even old people or people who have problems using keyboards. The system's versatility will also be increased by the ability to control Internet of Things (IoT) devices. Also, it is possible to sketch in the air. Users of smart wearables will be able to interact with the digital world more successfully because to the technology. Augmented reality can bring text to life. Second, rather than using a set of fingertips to operate the real-time system, hand gestures that are followed by a pause can be used, as shown by [1]. Not to mention that our system periodically finds distant fingertips and changes their status. Air-writing systems must only follow the control movements of their master and cannot be deceived by nearby individuals. Also, we used the EMNIST dataset, despite the fact that it isn't a true dataset for air-characters. Future object identification methods like YOLO v3 may increase the accuracy and speed of fingertip recognition. The effectiveness of air-writing will increase with future developments in artificial intelligence.

Abhishek R et al [5], In this paper, This tool might challenge accepted writing practises. eliminates the need to carry a phone around to take notes and offers an easy way to do the same while driving. Once more, it will further the larger good by facilitating communication, particularly with those who are already familiar with them. Even those who have problems using the keyboard can utilise the application with ease. This programme will soon have the ability to control IoT devices. Air paintings are another option. People will be able to interact with the digital world more successfully while wearing smart clothing thanks to this programme. By presenting the unpopular reality of taxpayers, the content can become more engaging. Wind-writing programmes must obey their master's orders exclusively and must not be influenced by extraneous forces. The discovery algorithms listed below can be used by YOLO v3 to improve the speed and precision of fingerprint detection. Writing in the air will become more efficient in the future as artificial intelligence research develops.

III. METHODOLOGY

A. Hand Recognition:

The technique that was suggested employed the camera's depth and colour information to identify the shape of the hand. Even with the Opencv tool, gesture recognition is still possible. That remains a really difficult problem. This camera's resolution is only 640 x 480. When tracking a big object, like the human body, it works well. But it's difficult to follow something as small as a finger.

B. Used Tools & Libraries:

A free CV Python is a group of Python bindings designed to address computer vision problems. The general-purpose programming language Python was created by Guido Van Rossum, and it quickly gained popularity due in large part to its usability and comprehensible code. Concepts can be communicated with less code without sacrificing readability, according to the programmer. Compared to languages like C/C++, Python is slower. Every Open CV array form can be converted into and out of a Numpy array. NumPy, often known as the "Numerical Python" library, provides multidimensional array objects and a variety of methods for processing such arrays.Arrays can be manipulated logically and mathematically with NumPy. A Python package called NumPy. Numerical Python is the name of the phrase. It is a collection of operations for workingwith multidimensional arrays and objects.

C. Computer vision:

With computer vision, a branch of artificial intelligence (AI), computer systems may gather important data from digital images, videos, and other visual inputs, and act properly or make recommendations in reaction to the data. Computer vision grants robots the capacity for perception, observation, and comprehension, much like artificial intelligence does for

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humans. Similar to how human eyesight functions, so does computer vision. As opposed to employing retinas, optic nerves, and a visual brain, computers are trained to complete jobs far more quickly by using cameras, data, and algorithms. A system can quickly outperform people when it is trained to verify goods or monitor a production asset since it can analyse hundreds of products or processes per minute while identifyinghidden defects or problems.

A. Features of the Air Canvas:

In order to recognise the plotted image, the suggestedtechnique first employs OCR (Optical Character Reorganization), which recognises the motion of coloured fingers in video sequences. Almost all of the currently used finger tracking-based character recognition methods in the literature call for extra hardware, such as an LED pen or Leap Motion controller device, the suggested method is a software-based solution. Additionally, they recognise input characters using comparison operations, whereas our proposed system recognises characters using optical character recognition (OCR). Our computational time is much reduced as a result. Air canvas that utilises With the use of computer vision, you may draw on a screen by waving a finger equipped with a colourful tip or a plain coloured cap. When it comes to these computer vision projects, Open-CV saved the day. A smooth human-system interface is provided by the offered method. We can monitor any specific coloured pointer. Four distinct colours are available for the user to select from, and they can even be altered rapidly. Only one spot at the top of the screen is accessible for rubbing the board. After the application has done executing, there is no need to touch the computer. Copy the source in colour on paper: The proposed method mainly entails watching the index finger's movement in red. Now, take the variations between the photographs and extract the colour and object movement. Edge defence (EE): The edge enhancement technique makes the object localization algorithm robust to noise, various lighting conditions, obscuration, and object fading even in the low-contrast image.

Fig(1)X,Y – Co-Ordinates.

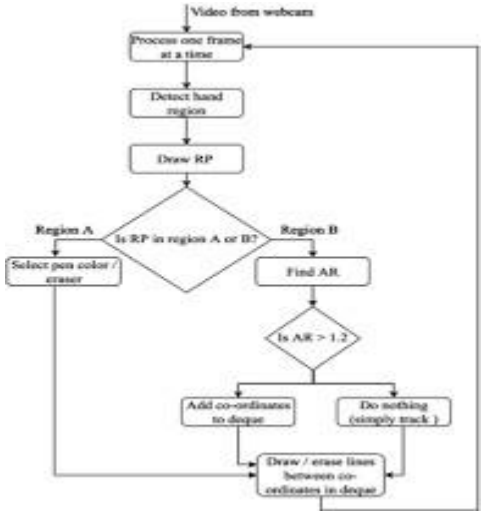
Fig(2)Plotted image

B.Algorithm:

After reading the frames, change the collected frames' colour space to HSV. (Simple to discern colours). Put the appropriate ink buttons on the canvas frame after it has been prepared. To locate the coloured marker mask, adjust the trackbar settings. Morphology procedures on the mask are used as a preprocess. both erosive and dilating. Get the greatest contour's centre coordinates and keep saving them in the array for subsequent frames to continue detecting contours. (Arrays for painting points on canvas). Lastly, draw the array's points onto the canvas and frames.

A. Colour Tracking:

Priorities come first finding the colour of the thing on the tip of the finger, the webcam's incoming image must be translated to the HSV colour space. The incoming image is converted to the HSV space in the code snippet below, which is an excellent choice. The Trackbars are used to set the HSV values to the necessary colour gamut for the coloured object we have selected with our finger. Below code, you can observe the various HUE and other



colour ranges. Trackbars have been put up; we will use the real-time value obtained from them to establish a range. This range is a numpy structure that is provided to the cv2.inrange function ( ). This process gives the coloured object's Mask back.

B. Contour Detection of Object:

So, in order to draw the Line, one must locate the centre of the Mask in Air Canvas. In order to tidy up the mask and make contour recognition easier, we are performing certain morphological operations to it in the code sample below.

C. Drawing the Line using the position of Contour (Frame processing):

The actual justification for this computer vision project, Make a Python deque first (A data Structure). The contour positions from each succeeding frame will be stored in a deque, and we'll use these points in conjunction with OpenCV's drawing algorithms to create a line. We can choose to press a button or draw on the sheet depending on where the shape is. The mouse pointer will trigger the associated method

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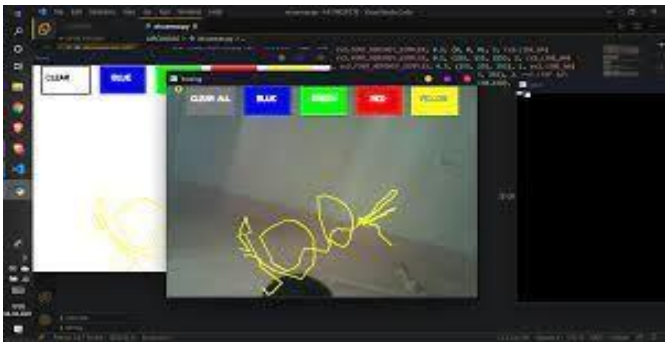
when it touches one of the buttons on the top of Canvas. Four buttons that were created using OpenCV are present on the canvas.

D. Algorithmic Optimisation:

Draw each point with its corresponding colour on each position stored in the deques. In order to clear the screen, this empties the deques. Red: Red colour is applied to the marker using a colour array. Green: The marker's colour is changed to Green using a colour array. Yellow: The marker is changed to the colour Yellow using a colour array. Blue: Changes the marker's colour to blue using a colour array.

V. Result

We have completed the remaining project design by enhancing the front code, introducing brush modification options, and removing any reliance on external devices (monitor, mouse, keyboard, etc.). Finally, we selected two screens that were easy to operate: one was a measuring screen, and the other was a drawing screen. The touch feature and two on-screen buttons should be included last. The "draw" button lets the user switch between active and inactive drawing so that he can stop and start sketching whenever he wants. Users can return to the original rating screen and begin new drawings or resize existing ones by clicking the "equalise" button. We eventually realised that the visual button we had built into the map was defective and would only function when we exerted more pressure. This module demonstrates how to use the draw feature by applying our customised window to a camera video.



V. Conclusion and Future Work

A video-based pointing technique that enables Computer cameras to write English text in the air. The suggested method seeks to follow a coloured finger tip in video frames and recognise written letters by organising images using English OCR. Additionally, by offering a natural human- system interface, the suggested solution does away with the need for input devices such a keyboard, pen, glove, etc. To restore order, all you need is a smartphone camera and the colour red. OpenCv and the python programming language were used to create a programme for the experiments. The suggested method recognises the exact alphabets with an average accuracy of 92.083%. The suggested patch reduced writing time by 55 ms per character on average. The suggested methodology can be used with any language, even those that are unrelated, but it has one significant flaw: because it is colour sensitive, any red background before the analysis begins may lead to incorrect results.

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