A Immersive Virtual Reality Applications for Education: Design elements, lessons learned, and research agenda

Arul Jaya Prakash L[1], Nirmal Jega Selvi L[2], Sam Kamalesan D[3] Thiyagarajan M[4]
[1]*Department of Computer Science and Technology & Madanapalle Institute of Science and Technology*
[2]*Department of Computer & St.Mary's Matric. Hr. Sec. School*
[3]*Department of Computer Science and Engineering & Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology*
[4]*Department of Computer Science and Engineering & Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology*

Abstract **- Virtual Sketch is an application used to draw in the air by capturing the movement of a hued marker with the webcam feed. The shaded part at the tip of the finger is chiefly utilized as the marker. Opencv is used to develop the virtual sketch application. Python language is used for developing the application because it has thorough libraries and also it is simple to utilize and the linguistic structure. It is also very understandable as it tends to be carried out in any open cv upheld dialects. Real-time object detection and drawing processes are utilized to accomplish the objective of creating a virtual sketch. The feed of a webcam is utilized to detect the movement of the hand. Erosion and Dilation are the morphological procedures used to preprocess the data points of the detected hand. The data points which are detected are stored in an array for the drawing purpose at the end. In the end the sketch was displayed in dedicated paint window which was drawn by the user**

Key Words: **Computer Vision, Python, Erosion, Dilation, Color Tracking, Mask, Motion Detection, Interpreter, Numpy, Mediapipe, Frames**

1. INTRODUCTION

Sketching on Air is possible through our trending technology namely open cv, 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 a 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, and extract 3D ones. Python is one of the high-level-general-purpose programming language. The object-oriented approach mainly helps programmers to write clear, logical code for small as well as large–scale projects. In this project, we are performing morphological operations a set of operations that process images based on shapes. These apply a structuring element to an input image and generate an output image. The very basic morphological operations are two: Erosion and Dilation. Erosion does eliminate away from the boundaries of the foreground object. Mainly used to diminish the features of an image. Dilation mostly increases the object area. Used to make the features get elevated. That's what to guarantee, the point of interaction is incredibly clear and justifiable by the client. The client should be prepared to attract what he wants to draw with no interference. In the future, this can be useful for making youngsters find out attracting resources in partner intuitive means. the most goal is to claim a truly clear show strategy that is sufficiently flexible to use with contrasting sorts of machines. Likewise, the show should be direct to use with youngsters and other UN organizations are ignorant. the most evenhanded of this undertaking is to shape a partner interface that empowers a client to draw one thing that they need. The client needs to draw an image as precisely and as speedy as feasible. we tend to moreover get to program in calculations that convert the bringing into a document design in this way it is much of the time keep on the pc. The PC program should have a drawing space in any place the client will draw.

2. LITERATURE REVIEW

A. Guennouni.S, Ahaitouf.A and Mansouriss.A , "Multiple object detection using Open CV on an embedded platform", 2014 Third IEEE International Colloquium in Information Science and Technology (CIST), 2014, pp. 374-377.
In this paper they have presented multiple object detection using Opencv. OpenCV is an open source PC vision library that is utilized progressively PC vision. OpenCV was created by Intel and presently upheld by Willow Garage and Itseez. OpenCV is planned and upgraded for constant applications, despite the fact that it's created in C and C++ dialects, a cross stage library runs on Linux, Windows and Mac OS . The fountain classifier, took on here for object discovery depends on Haar-like element and is comprises of joining numerous complicated classifiers in overflow structure, which speeds up object identification. Object Detection should be possible by utilizing Haar-like., Integral Image, AdaBoost Learning Technique, Cascade Clasifier

B. Chandan.G, Mohana Jain A.H "The Real Time Object Detection and Tracking Using Deep Learning and OpenCV", 2018 International Conference on Inventive Research in Computing Applications (ICIRCA), 2018, pp. 1305-1308.
Here they had projected the concept of The Real Time Object Detection and Tracking Using Deep Learning and OpenCV in the year of 2018 at International Conference on Inventive Research in Computing Applications Recognition and following calculations are depicted by separating the elements of picture and video for security applications. Highlights are extricated utilizing CNN and profound learning . Classifiers are utilized for picture order and then some. Just go for it based calculation with GMM model by utilizing the ideas of profound learning will give great exactness for highlight extraction and grouping Single Shot Detector, MobileNets are the alogrithms utilized for ongoing article discovery utilizing Deep Learning and OpenCV

C. Siam, Sayem Sakel, Jahidul Kabir, Md. . Human Computer Interaction Using Marker Based Hand Gesture Recognition., 2016.
A new method of HCI(HumanComputer Interaction), has proposed that uses marker detection and tracking technique. Instead of having a mouse or touchpad, two colored markers are worn on the tips of the fingers to generate eight hand movements to provide instructions to a desktop or laptop computer with a consumer-grade camera. They have also used the "Template match- 4 ing" algorithm for the detection of markers and Kalman Filter for tracking. In [2] the developed system uses a data glove-based approach to recognize real-time dynamic hand gestures. The data glove has ten soft sensors integrated in it that measure the joint angles of five fingers and are used to collect gesture data. Real-time gestures are recognized using techniques such as gesture spotting, gesture sequence simplification, and gesture recognition.

D. S. Khan, M. E. Ali, S. Das and M. M. Rahman, "Real Time Hand Gesture Recognition by Skin Color Detection for American Sign Language," 2019 4th International Conference on Electrical Information and Communication Technology (EICT), 2019, pp. 1-6, doi: 10.1109/EICT48899.2019.9068809.
Here they had developed a system that uses a skin color detection algorithm to convert ASL (American Sign Language) into text from real-time video. Because skin color and hand shape differ from person to person, detecting the hand might be challenging. The technology uses two neural networks to overcome this. The SCD (Scalable color descriptor) neural network is the first. The picture pixels are fed into the SCD neural network, which determines whether or not they are skin pixels. The second one is HGR (Hand gesture recognition) neural network to which the extracted features will be provided. The features will be extracted by two distinct algorithms namely Finding the fingertip and Pixel segmentation.

E. P. Ramasamy, G. Prabhu and R. Srinivasan, "An economical air writing system converting finger movements to text using web camera," 2016 International Conference on Recent Trends in Information Technology (ICRTIT), 2016, pp. 1-6, doi: 10.1109/ICRTIT.2016.7569563.
They have proposed a revolutionary technology in which the user can write the alphabet or type whatever he or she wants by merely waving his or her finger over a colorful LED light source. Only the color of the LED is tracked to extract the movement of the finger sketching the alphabet. The color of the tracked object is changed to white, while the background is changed to black. The black and white frames are stitched together to create a

single black and white image of the alphabet that the user wanted to draw.

2.1 EXISTING SYSTEM

Apple Pencil Macintosh in 2015 undraped the Apple Pencil, starting pointer was intended to figure with the main iPad proficiency. The Apple Pencil has attempted to be a valuable thingamabob for note-taking, portraying, and a ton of the pill type issue. The Apple Pencil has kept close beginning around 2015, and as of nowadays, all of Apple's iPads work with either the essential or second-age Apple Pencil. The Apple Pencil is a partner Apple-planned pointer that works with Apple's iPads.There's a little plastic tip that interfaces with the iPad's show, a pencil-like body to convey onto, and a charging instrument. inside the first Apple Pencil, there is a Lightning association, but the second-age model charges inductively through the iPad Pro. The Apple Pencil is utilized in the office of a finger for exactitude undertakings like composition and portraying, and it might be utilized for exploring through the bundle. It's sublime for drawings, craftsmanship creation, note-taking, and comparable undertakings because of its exact, has palm dismissal, and offers strain and slant sensitivity. It is intended to figure kind of an old pencil, but instead of composing on paper, you make the iPad show.

Writing Pads Works cushions can be associated with pcs or PCs with the devoted association link joined to the cushions. These cushions are joined with a pencil which permits us to compose on the cushions the substance of the cushion is naturally
refreshed in the presentation o PC or PC's.

Windows Ink Windows ink pen is utilized for the touch screen PCs like the Mac pencils for the iPad's.

2.2 PROPOSED SYSTEM The structure we are using is prepared for drawing or creating and ought to be conceivable without using any expensive hardware instruments like making a pad. The System is done by using image mining techniques. Using the AI procedure the structure can be passed from commitment on to yield. This system can draw figures with the uncovered hands. We simply need a working PC or a PC with a webcam. We use the python programming language to set up the virtual material for drawing reasons. Opencv is a library in the python language which is used to distinguish the development as a general rule using a webcam related to the pc or laptop. So we use the webcam to perceive the development and a while later use the python programming to draw the shapes on the virtual material. You truly need to first present the python programming language and Opencv library in your system. After that, you can run the going with code in your python terminal or IDLE to start the program

3. RESEARCH METHODOLOGY

3.1 Hand Gesture Detection

After viable game plan of program at first the paint window is instated. The gadgets picture is instated and stacked on to the drawing screen on which the client picks the mechanical assemblies and used for drawing. she wants to use. After the assurance of the gadget, the client is actuated to enter the vital worth. The client is then allowed 17 to draw on the image. After the presentation of the program, the client is affected to pick the gadget the individual necessities to use.The client has picked the Pencil instrument and started drawing on the screen. After the client is done drawing, the drawing is displayed on the screen

3.2 Executing Functions of Tools

The window will be 300 pixels wide by 200 pixels high. We will in like manner set the window to be full screen and have no limits. Then, we truly need to cause a circle that will to reliably run while our program is running. In this circle, we will truly take a gander at each pixel in our window to check whether it is in the extent of our article. If it is, we will execute the relating object work. Finally, we will close our window when the program is done.

3.3 DISPLAY OF OUTPUT

Here the housings that are recognized on the drawing screen are put with the specific assortment that is described for that particular gadget in the limit. Here it shows all of the drawings that we have drawn on the drawing screen and this is the outcome window for the client. We can see the aftereffect of the program.

1. Draw Tool The Draw instrument is used to characterize limits and curves on the screen. The pen instrument has a specific assortment that is portrayed for it.

2. Square shape Tool The Rectangle instrument is used to characterize limits and curves on the screen.

The pencil instrument has a specific assortment that is portrayed for it.

3. Eraser Tool The eraser instrument is used to destroy drawings on the screen. The eraser gadget has a specific assortment that is described for it.

3.3.1 GATHERING FRAMES OF HAND

Gathering frames from an accounts is like changing over from video to a couple of pictures.By isolating the video to jpg's using the gadgets like video to jpg's converter 18 significantly more instruments available in the web.This is a very straightforward cycle that ought to be conceivable with most video documents.The starting advance is to conclude the packaging speed of the video. This ought to be conceivable with different online gadgets, or by remembering the amount of housings for a given proportion of time. When you understand the packaging rate, you can use this gadget to remove frames from a video

3.3.2 MATCHING HAND POSITION WITH TOOLS

Screen is isolated into the pixels and there will be express article put in the pixels structure a compass when we run the program then the development of the fingers will be taken and facilitates with screen frames and if the thing and fingers development pixels matches, it executes the specific tool function. The hand position will be continuously monitored and when the hand position pixels with the function pixel then the specific tool function will be executed. Here the function of the tool gets executed when the hand gesture matches with the specified details mentioned in the programming.

3.3.3 DISPLAYING THE OUTPUT

Making the screen with the specific pictures and the pictures for the client's purpose. The beginning advance is to pick your ideal pictures to use on your screen. You can either find pictures on the web or make your own.At the point when you have your photos, you need to make a picture for each one. This ought to be conceivable in different ways, but a clear way is to use a substance director to make a text report with the image record name followed by the picture you want to use. pseudocode for virtual drawing:

1. Pick the image record you want to use as your image.
2. Make a text report and name it after the image record you want to use as your image.
3. In the text archive, type the picture you want to use as your image.
4. Save the text record.
5. Open the text record in a substance device or word processor.
6. Copy the picture and paste it into your report or show.

4. RESULTS AND DISCUSSION

1. Efficiency of the Proposed System

The proposed framework is exceptionally proficient in the manner we enjoy the benefit of distinguishing the movement of any size of the hand, since here comes the effectiveness of PC vision that can recognize any movement and recognize the movement in the webcam feed. The highlights for drawing can be refreshed with time, to help general society. The proposed framework is exceptionally savvy, it needn't bother with any outside equipment parts, and is not much destructive to the climate as the principles are all around kept up with. Instructors don't have a lot of errands to do with the interface it is very to deal with.

2. Comparison of Existing and Proposed System Existing system:(Smooth Writing)

In the Existing framework, we executed a Smooth Writing calculation that draws with the assistance of a pencil or any intelligent item., the iPad can perceive pointer penmanship as a discrete arrangement of focuses. The product should interconnect these focuses to create a liquid blend. One methodology is to associate the focuses utilizing cubic Be´zier bends. The cubic Be´zier bend was picked since it strikes a great harmony among feel and algorithmic speed. Higher degree Be´zier bends produce more liquid-looking bends, yet have more control focuses. Working out a Be´zier bend with many control focuses will diminish application responsiveness , On the other hand, a Be´zier bend with not many control focuses will have a more sudden appearance.

Proposed system:(Convolution Neural Network algorithm)

The convolutional brain network is not quite the same as the k-implies bunching calculation this calculation considers various variables like the size

of the leaf, pixel force, and gathering into a network this grid has specific worth based upon that worth picture is divided into various classes. And this convolutional brain network has high efficiency. As contrasted to and existing framework the proposed will give more precision and precisely

This work 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. So, we conclude that Virtual Sketch is developed using the library NumPy and in Open CV where we have many libraries and algorithm in built which makes the interfaces more active while using . We used python as, it have many inbuilt libraries and many modules which represent the imagination virtually when used along with OpenCV as well as its morphological processes.

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