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Intelligent Image Processing System Based on Virtual Painting

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Abstract

Image processing and artificial intelligence have come so far in the age of technology that they are now used in every field. AI is meant to help people do their jobs better and with less help. Virtual painting is a clever tool that lets us paint by just moving our hands. This app uses hand tracing and finger movement recording to show marks. With this program, we can open the camera on our computer or laptop and draw with our hands, colored pens, or pens we made ourselves. Image processing is used to figure out how the hand is moving. This turns the person in front of the camera into a great illustrator who can pick out colors and draw in similar directions on the screen. OpenCV, which is the brain of the system, and Media Pipe have been added to this application.

Introduction

Digital image processing is new compared to how people are drawn to each other by what they see. In the short time it has been around, it has been used successfully in almost every imaging field. In recent years, digital image processing has grown a lot. Psychologists, physiologists, computer scientists, and others use digital images to study how people see things. Image processing is important for the military, remote sensing, meteorology, and other large-scale applications. With the rise of multimedia, digital image processing and video technology have become the norm (Tian, 2022).

When you draw virtually, you use a camera to record how your hands move as you draw. Most of the time, the one-color thing on your fingertip is used as a marker. OpenCV can be used on robots. Pick up letters, figure out what's on the conveyor belt, and let cars drive themselves. This project needs Python because it has a larger library, an easy-to-understand syntax, and a basic understanding. It can be done in any open-source language with CV support (Ismail et al., 2021).

After this introductory part, the rest of the inquiry is split into five parts: In the second part, we'll talk about work like this. In the third part, the recommended method is shown. In contrast, the third part talks about the proposed method, and the fourth part talks about the results and the debate. The last part, the fifth section, talks about the conclusion and any extra work that needs to be done.

Related Works

This system is linked to the following works:

Gaikwad, Ganesh, and their colleagues made Virtual Painting, a canvas-based platform where we can draw by moving our hands. It basically watches the hand and keeps track of how the fingers move.

Most of the time, the tips of the fingers are used as markers during this process. It uses OpenCV technology, which is the basis of augmented reality, most of the time. Virtual Painting is written entirely in the Python programming language, and it works for both beginners and experts. The output is the result of color tracking and detection.Using the color marker, a mask is made on the original color canvas.

Thoravi Kumaravel, Balasaravanan, and others make apps for painting in virtual reality. Most users learn by watching online videos of an instructor painting in 2D. A test showed that people liked the device and could use it to paint in virtual reality (Gaikwad et al., 2022).

VR users can use Multi-A-Painter to create 3D art in real time.Painters can join a session by clicking on a URL in any browser that supports WebGL and WebVR. Simple painting tools and the novelty of VR make people want to explore. This setting helps get rid of geographical isolation, culture and language, gender, age, and social status. (Kumaravel et al., 2019)

Konieczny and others showed a simulator for spray painting. Users can use a spray gun to paint a simulated area by putting on glasses and using a tracking system. Spray guns can make random shapes and patterns by using ray tracing to make a copy of droplets hitting an object. In combination with past studies on spray gun properties, this method creates a realistic simulation of spray paint, including the effects of viscosity, air pressure, and paint pressure (Knispel & Bullock, 2017).

Bill Baxter and his colleagues offer a system for interactive painting with a haptic interface. We talk about a 3D brush model that can change shape and makes it easy to control complex strokes. The force feedback gives the user tactile feedback that helps them control the paintbrush.

Methods

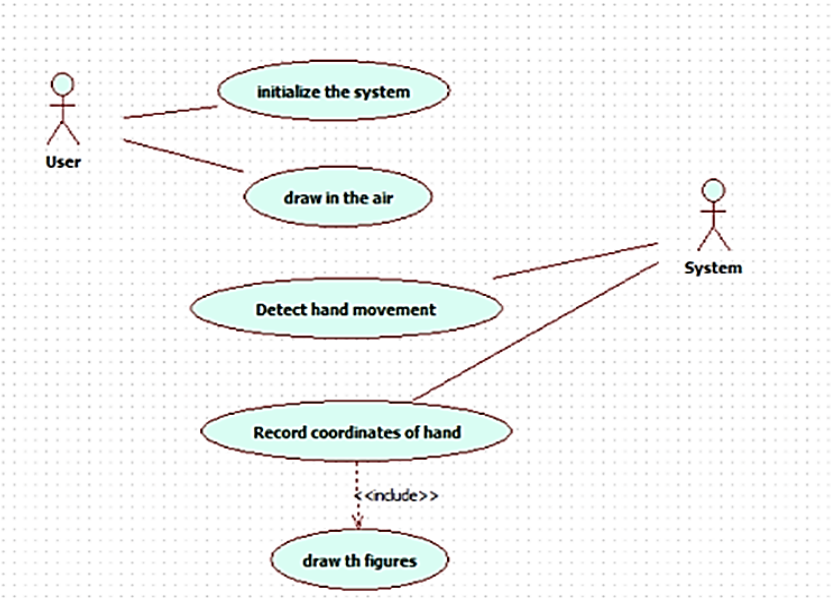

Figure 1. Use Case of the System

Due to the recent epidemic, both teachers and students are using the Internet to learn. Learning activities are done with the help of tools for virtual meetings, the idea of meetings, and digital

discussion methods. Students were less active when they were learning theory than when they were learning practice. This made it harder for teachers to find online learning materials that would get students more involved. The goal of this work is to come up with a way to get important information to teachers and students so that they can work together better. Figure 1: A flowchart for a use case Use case diagrams to help developers, end users, and domain experts understand each other's systems. There are use cases and actors in the use case diagram. Each actor puts a use case into place (Baxter et al., 2001). This system is made up of parts like Python, OpenCV, MediaPipe, and others. Hand gesture recognition can see how your hands move in real time. First, the technology looks for hand movements, and then it records them.

Computer vision is used by this system to find, recognize, and understand hand gestures. Posture, orientation, position, and scale pose obstacles. By default, it can tell when you're using a colored pen or marker and will draw as you move it.

In the proposed system, the following are the main packages:

OpenCV is a huge open-source library for computer vision, machine learning, and image processing. It is now an important part of real-time operations. It can find things, faces, and handwriting in pictures and videos. With NumPy and Python, you can look at the structure of OpenCV's arrays. We use vector space to find the parts of an image pattern (Ibrahim et al., 2021).

MediaPipe Hands uses a multi-model ML pipeline: MediaPipe has a framework for drawing conclusions from sensory data, tools for evaluating performance, and inference and processing components that can be used over and over again. MediaPipe makes it easy for developers to quickly combine new and old perception components into prototypes and apps that work on multiple platforms. A developer can set up a MediaPipe program to manage CPU and GPU resources efficiently for low latency performance, synchronize audio and video frames, and look at performance and resource usage (Zhang et al., 2020).

Results and Discussion

After we start keeping track of the coordinates of each location, we may draw the center of the contour on the screen. This application was built with Python, OpenCV, and other Python components. We learn how to select elements and trigger actions by using this unique selection.

The general steps to drawing are first, import the necessary libraries. Set up the Paint interface by using the OpenCV function. And draw using the coordinates of each color box on the frame. Step 3: Start reading the video frame by frame from a webcam using the OpenCV function. Step 4: Find the contour-of-interest (the bottle cap) by starting to read the webcam feed, finding the contour, doing a series of image operations, and smoothing it out. Step 5: Start drawing and save the drawings by keeping track of the coordinates and colors of every point the center of the contour touches on the screen. Step 6: Put the drawings on the screen by saving all the points in their respective color descriptors.

Figure 2 depicts how to draw a circle virtually, as seen below:

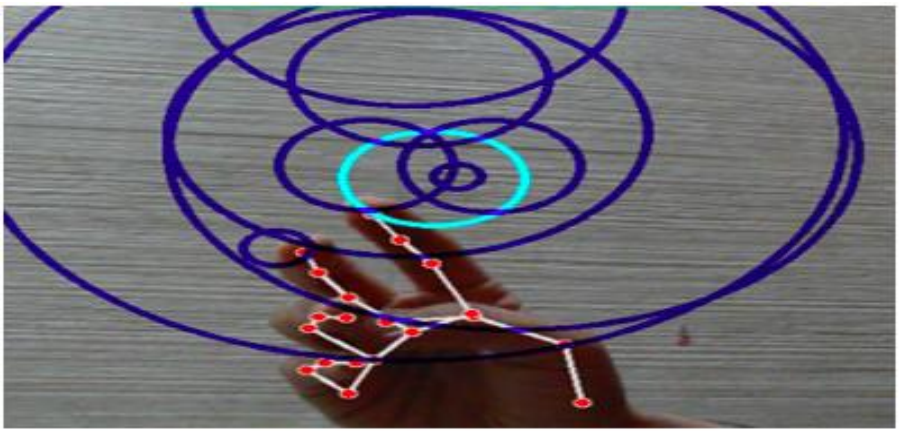

Figure 2. Draw a virtual circle

Figure 3 shows how to use the system and ML pipeline to draw virtual rectangular

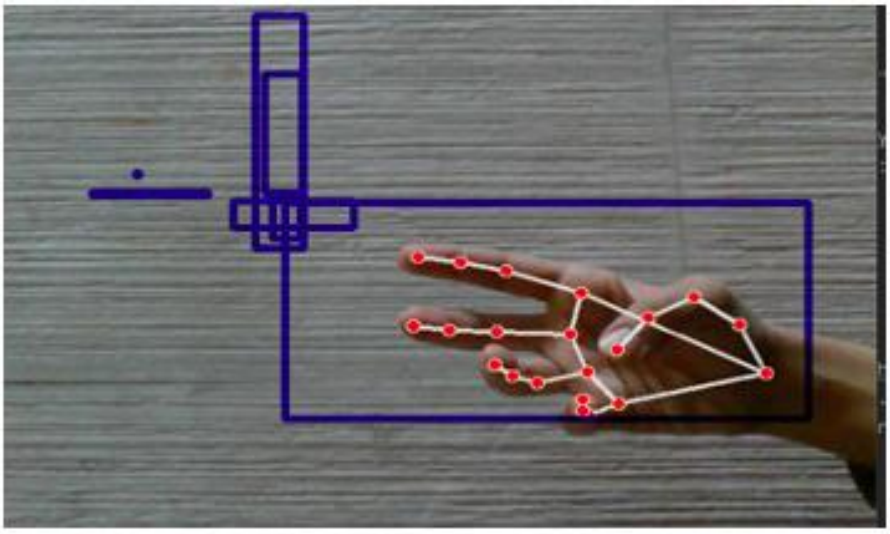

Figure 3. Draw a virtual rectangular

In Figure 4, we can almost make out the colors and lines.

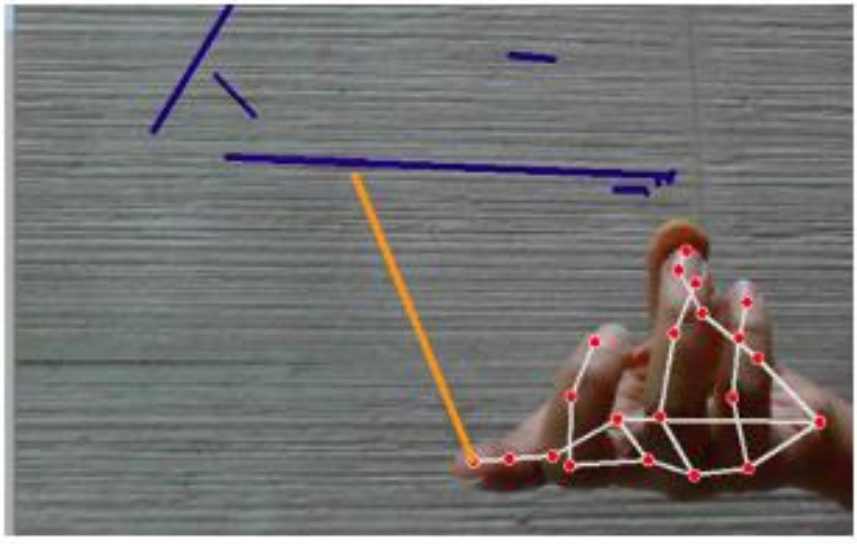

Figure 4. Draw the lines and pick the color.

In Figure 5, the system was used to virtually erase the drawing objects.

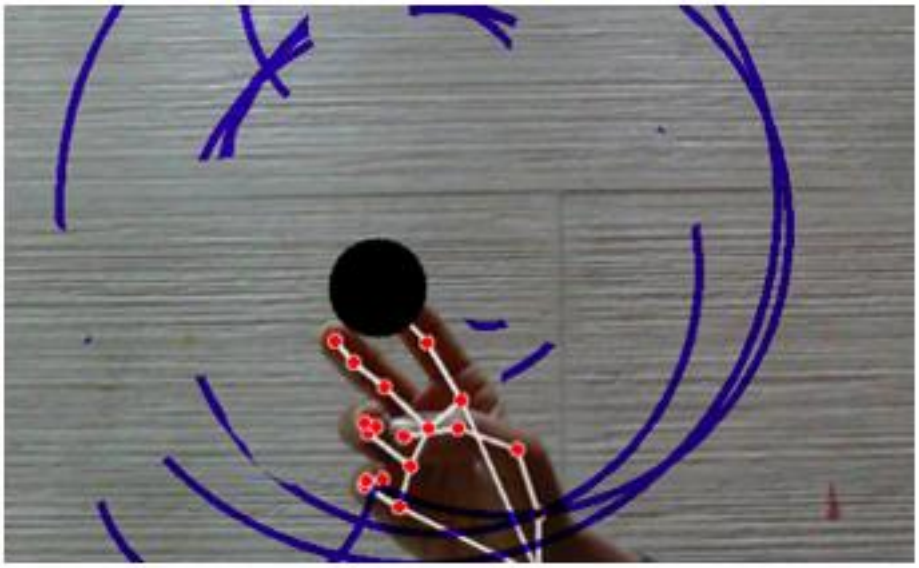

Figure 5. Erase the shapes.

Compared to the previous works, the US system has a friendlier interface and is more appealing because it can be used with a webcam and virtual sketches can be made with fingers.

Conclusion

A virtual painter is one of the tools used to support online interactive learning. It lets teachers finish the information they are given to make a clearer picture that they can then show to their students. Virtual painters can track how the user moves his fingers, mostly by sketching and letting go, which teachers can use to give their students more interactive information for both theoretical and practical learning. Here are a few examples of things that will be done in the near future: Making videos with an Android phone: All smartphones, iPads, and tablet computers come with built-in cameras.

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