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REAL TIME FINGER WRITING RECOGNITION USING WEBCAMERA

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Abstract. This paper proposes a real time finger writing recognition system using a web camera to enable user to interact with computer systems by their own bare hands. The hand region is firstly extracted by background subtraction and blob labelling . Then, convex hull and convexity defect are used to count the fingers and detect the fingertip coordinates. The trajectory of the fingertip is smoothed and drawn to become a finger writing character. This paper describes a system which uses multiple visual process to detect like Hand Tracking, Volume Gesture, Finger counter which ultimately tracks Finger Recognition based on computer vision.

In modern technologies video tracking and processing the feed has been very essential. This processed data can be used for many research purposes or to express a particular output on a particular system. There are various methods for processing and manipulation of data to get the required output. This application is created using OpenCV module and Mediapipe.

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. In this application frequent image feed results in video tracking of our particular finger. Video tracking is the process of locating a moving object (or multiple objects) over time using a camera.

The ability to perceive the shape and motion of hands can be a vital component in improving the user experience across a variety of technological domains and platforms .One such technology is using MediaPipe .MediaPipe is a framework mainly used for building audio, video, or any time series data. With the help of the MediaPipe framework, we can build very impressive pipelines for different media processing functions.

Keywords:

Hand tracking, Computer Vision, OpenCV, Air Writing, Media Pipe, Color Tracking, Color Detection, Mask, Eraser, Volume Gesture, Finger Counting.

1. Introduction

1.1 About Project

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 opencv and mediapipe framework by using python programming, which creates natural interaction between man and machine.

1.2 Purpose

- First, people with hearing problems have many problems in daily life. Although listening and listening are taken for granted, people with this disability communicate using sign language.
- Waste of paper is not uncommon. A lot of paper is wasted scribbling, writing, drawing, etc. The production of A4 paper requires an average of about 5 liters of water. 93% of sources are from trees, 50% of commercial waste is paper, 25% of landfills are paper, and the list goes on. Wasted paper damages the environment through the use of water and trees and generates tons of waste.
- During this pandemic , students are studying in online class when the faculty tried to explain the concept using board its hard to fix a camera try to understand for student in a single window.
- Air writing can solve these problems quickly. It will serve as a communication tool for the deaf. Your text written in the air can be presented in AR or converted to speech. One can write on-air quickly and keep working without too many distractions.

1.3 Objectives of the Project

To create a virtual canvas to sketch.

• To detect the human finger as a color marker.

• To create an interface between user and the system were they can interact in an effective way using this application.

1.4 Scope of the Project

The scope of this system is mainly used as a powerful means of communication for the deaf,which means implementing this project can help in:

1.An effective communication method that reduces mobile and laptop usage by

eliminating the need to write.

2.It helps people with hearing impairments to communicate well.

3.Various purposes, such as sending messages, e-mails, etc., as the generated text can also be used for that.

4.To ensure that, the interface is very simple and easily understandable by the user.

5.The user should be able to draw what he wishes to draw without any interruptions.

6.In future, this is useful for making kids to learn drawing in schools in an interactive way.

2. Literature Survey

2.1 Existing System

- The existing system works with your fingers only, and there are no highlighters, paints, or relatives.
- Identifying and characterizing an object such as a finger from an RGB image without a depth sensor is a great challenge.
- The system uses a single RGB camera to write from above. Since depth detection is not possible, the up and down activities of the finger cannot be tracked. Therefore, the entire path of the fingertip is drawn, and the resulting image would be absurd and not recognized by the model.
- Using real-time hand gestures to change the system from one state to another requires much code care.

- In addition, the user must know many movements to control his plan adequately.
- The project focuses on solving some critical social problems.

2.2 Proposed System

- This tool allows the user to track the movement of any colored object of his choice.
- The user can even choose the colors of his choice to be displayed. By running the application, the camera is activated thus enabling the user to draw in the air just by waving the tracker object.
- The drawing is also simultaneously visible on the white window .
- He/She can choose any color of his/her choice displayed to draw and also can clear the screen when needed.
- We will be using the computer vision techniques of OpenCV to build this application

3. Proposed Architecture

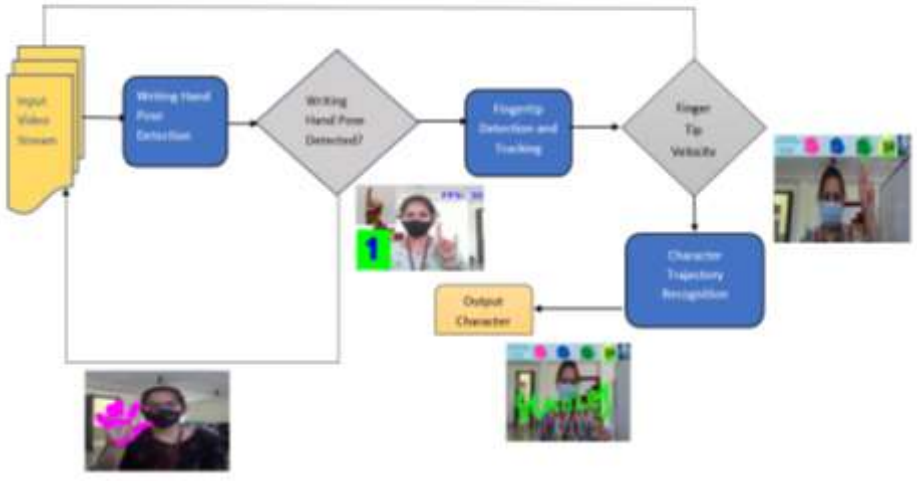

Fig: 1 Architecture

System Methodology

- The frames are read and convert the captured frames

- Make the canvas frame and put the respective link buttons on it.
- Now, Set the track bar values for finding the mask of the colored marker.
- Used to make the features get elevated.
- The next step goes on like this by, Detecting the contours, finding the center coordinates of large contour and keep storing them in the array for next frames (Arrays for drawing points on the canvass).
- Finally, draw the points stored in an array on the frames and canvas.
- While writing we use one finger ,for selecting and stopping we use two fingers.

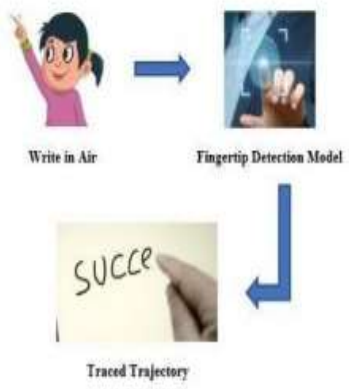

Fig :2 System Methodology

4. Implementation

4.1 Algorithm

Step 1:initialize necessary libraries like opencv and mediapipe.

Step 2:set up the paint interface now we manually set the coordinates of each of the color boxes on the frame. We use the opencv function cv2.rectangle() to draw the boxes

Step 3:start reading the video (frame by frame) now we use the opencv function cv2. Video capture() method to read a video, frame by frame (using a while loop), either from a video file or from a webcam in real-time.

Step 4:in this case, we pass 0 to the method to read from a webcam. We can just add the exact same paint interface for ease of usage

Step 5:find the contour-of-interest once we start reading the webcam ,our finger gets detected and we can start writing the content using 1 finger and eraser & choose another color using 2 fingers.

4.2 Code Implementation

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. In this application frequent image feed results in video tracking of our particular finger. Video tracking is the process of locating a moving object (or multiple objects) over time using a camera.

The ability to perceive the shape and motion of hands can be a vital component in improving the user experience across a variety of technological domains and platforms .One such technology is using Media Pipe .Media Pipe is a framework mainly used for building audio, video, or any time series data. With the help of the Media Pipe framework, we can build very impressive pipelines for different media processing functions.

Python 3.7. Python is broadly utilized universally and is a high-level programming language. It was primarily introduced for prominence on code, and its language structure enables software engineers to express ideas in fewer lines of code. Python is a programming language that gives you a chance to work rapidly and coordinate frameworks more effectively.

PyCharm is a dedicated Python Integrated Development Environment (IDE) providing a wide range of essential tools for Python developers, tightly integrated to **create a convenient environment for productive Python, web, and data science development**.

5. Result

After implementing the algorithm we have determined how to the track a hand,Counting of Fingers, Stretch of fingers using Volume Gesture Application, Real time finger writing using webcamera

#Hand Tracking

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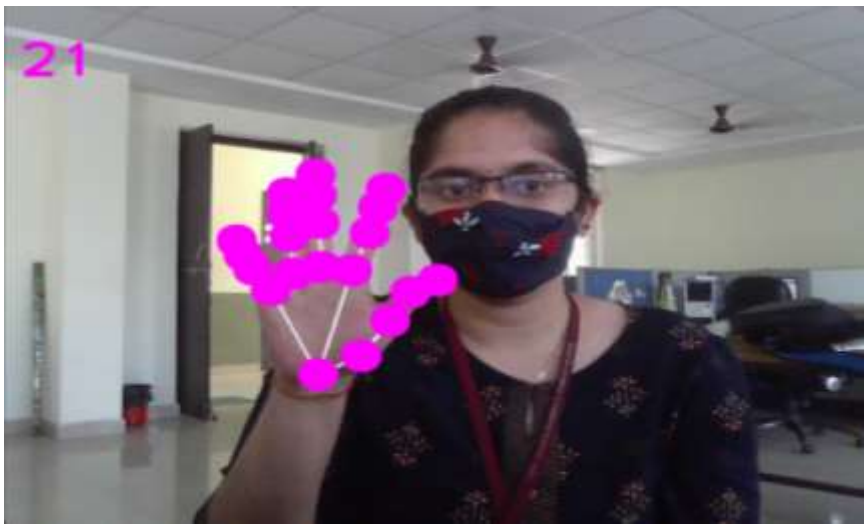

Fig 3.Hand Tracking -It is an application where it try to track the points/tip of finger

#Finger Counting

Fig 4 Finger Counting- It is used to detect number of finger that is showed on screen In this image it demonstrate the count of zero

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Fig 5 Finger Counting- It is used to detect number of finger that is showed on screen In this image it demonstrate the count of one

#Finger Counting

Fig 6 Finger Counting- It is used to detect number of finger that is showed on screen In this image it demonstrate the count of Two

#Finger Counting

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Fig 7 Finger Counting- It is used to detect number of finger that is showed on screen In this image it demonstrate the count of three

#Finger Counting

Fig 8 Finger Counting- It is used to detect number of finger that is showed on screen In this image it demonstrate the count of four

#Finger Counting

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Fig 9 Finger Counting- It is used to detect number of finger that is showed on screen In this image it demonstrate the count of five

#Volume Gesture

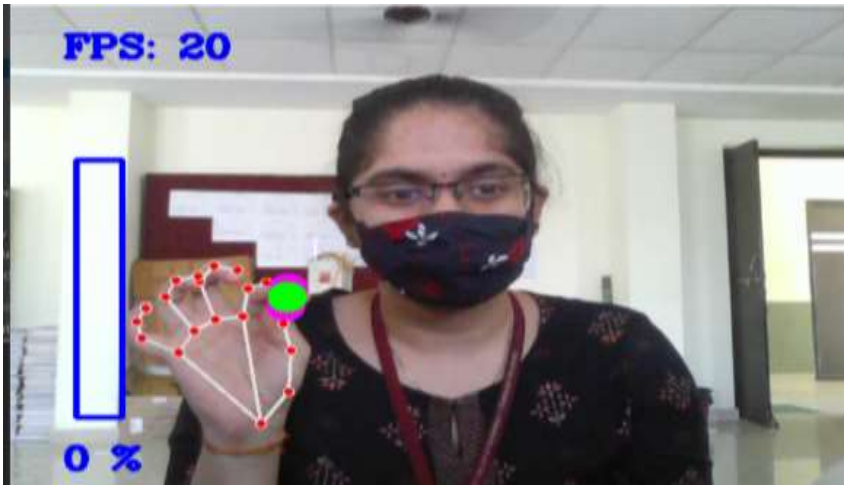

Fig 10 Volume Gesture-This application works when your trying stretch with 2 fingers. This image demonstrate the lowest stretch percentage i.e 0%.

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Fig 11 Volume Gesture-This application works when your trying stretch with 2 fingers. This image demonstrate the medium stretch percentage i.e 45%.

#Realtime Finger Writing Recognition Using Web camera

Fig 12 Realtime Finger Writing Recognition Using Web camera-It is a effective interface where a user can directly write and earse the content on the screen.This image demonstrate how do we select the color-we use 2 fingers(Index and Middle Finger) for selecting.

#Realtime Finger Writing Recognition Using Web camera

Fig 13 Realtime Finger Writing Recognition Using Web camera-It is a effective interface where a user can directly write and earse the content on the screen. This image demonstrate how do we write the content on the screen for doing that we use one finger that is the index finger.

#Realtime Finger Writing Recognition Using Web camera

Fig 14 Realtime Finger Writing Recognition Using Web camera-It is a effective interface where a user can directly write and earse the content on the screen. This image demonstrate how do we stop writing on the screen for doing that we use 2 fingers i.e Index and Middle finger respectively.

#Realtime Finger Writing Recognition Using Web camera

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Fig 15 Realtime Finger Writing Recognition Using Web camera-It is a effective interface where a user can directly write and earse the content on the screen. This image demonstrate how do we earse the content on the screen for doing that we need first select the earse button (as symbol is clearly mention on the screen) with 2 fingers(Index and Middle fingers respectively).With one finger we need earse content that is Index Finger.

6. Conclusion

The system has the potential to challenge traditional writing methods. It eradicates the need to carry a mobile phone in hand to jot down notes, providing a simple on the-go way to do the same. It will also serve a great purpose in helping especially abled people communicate easily. Even senior citizens or people who find it difficult to use keyboards will able to use system effortlessly. Extending the functionality, system can also be used to control IoT devices shortly. Drawing in the air can also be made possible. The system will be an excellent software for smart wearables using which people could better interact with the digital world. Augmented Reality can make text come alive. There are some limitations of the system which can be improved in the future. Firstly, using a handwriting recognizer in place of a character recognizer will allow the user to write word by word, making writing faster. Secondly, hand-gestures with a pause can be used to control the real-time system as done by instead of using the number of fingertips. Thirdly, our system sometimes recognizes fingertips in the background and changes their state. Air-writing systems should only obey their master's control gestures and should not be misled by people around. Finally the real time finger writing recognition is done where the user and write his content on the screen using the bare hands. In the future, advances in Artificial Intelligence will enhance the efficiency of air-writing.

7. Future Scope

Some examples that are being implemented in the near future are as follows: Video Processing using Android Phone: Mobile devices such as smart phones, iPads and tablet pcs are equipped with cameras, the demand of the

image processing applications increased. These applications need to be faster and consumes lower power because the mobile device is only powered by a battery. The hardware technology depends on the semiconductor technology instead we can use an efficient programming language to write an image processing application for the mobile devices. Robot Control: Controlling the robot using gestures considered as one of the interesting applications in this field proposed a system that uses the numbering to count the five fingers for controlling a robot using hand pose signs. The orders are given to the robot to perform a particular task, where each sign has a specific meaning and represents different function.

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