Virtual Notepad

A DISSERTATION
Submitted in partial fulfillment of the requirement
For the award of the Degree of

BACHELOR OF TECHNOLOGY
In
ELECTRONICS & TELECOMMUNICATION ENGINEERING by

Aryaman Gokarn, Khushi Patni and **Yuvraj Purohit**

Under the guidance of
Dr. Amol Deshpande

Department of Electronics & Telecommunication Engineering
Sardar Patel Institute of Technology
Munshi Nagar, Andheri(W), Mumbai-400058
UNIVERSITY OF MUMBAI
2020-2021

CERTIFICATE

This is to certify that the dissertation entitled **"Virtual Notepad"** has been completed successfully by **Aryaman Gokarn, Khushi Patni** and **Yuvraj Purohit** under the guidance of **Dr. Amol Deshpande, Prof. Milind Paraye** and **Prof. Sneha Weakey**.

Certified by

Dr. Amol Deshpande
Project Guide

Dr. Y. S. Rao
Head of Department

Dr. B. N. Chaudhari
Principal

Department of Electronics & Telecommunication Engineering
Sardar Patel Institute of Technology
Munshi Nagar, Andheri(W), Mumbai-400058
UNIVERSITY OF MUMBAI
2011-2012

DISSERTATION APPROVAL CERTIFICATE

This is to certify that the dissertation entitled **"Virtual Notepad"** by **Aryaman Gokarn, Khushi Patni** and **Yuvraj Purohit** is approved for the award of Degree of Bachelor of Technology in Electronics & Telecommunication Engineering from University of Mumbai.

External Examiner

(signature)

Name:

Date:

Internal Examiner

(signature)

Name:

Date:

Seal of the Institute

Abstract

Digital painting is an emerging art form in which traditional painting techniques such as watercolor, oils, impasto etc are applied using digital tools by means of a computer ,a graphics tablet , stylus and software. With the advent of new sensing technologies, touch free-air interaction is becoming viable as a contender for the next generation of expressive, embodied interaction modes. Virtual Notepad is a hands-free digital drawing canvas for creating, recognizing and visualizing documents in air. This project is based on the concept of image processing and computer vision. It works on the principle that converts the hand movements in air, which are captured by a webcam, into a sequence of x, y coordinates on a 2D Cartesian plane, and visualizes them on a white canvas. Virtual Notepad can be used in highly sophisticated environments like a smart classroom, a smart factory or a smart laboratory, where it would enable people to annotate pieces of texts wherever they want without any reference surface.

Acknowledgement

We have great pleasure in presenting the report on Virtual Notepad. We take this opportunity to express my sincere thanks towards my guide Dr. Amol Deshpande and Milind Paraye, Professors of Department of Electronics & Telecommunication Engineering, S.P.I.T., Mumbai, for providing the technical guidelines and the suggestions regarding this line of work. We would like to express my gratitude towards their constant encouragement, support and guidance throughout the development of the project.

We also want to thank Prof. Sneha Weakey for her invaluable help rendered during the course of this work. We wish to express my deep gratitude towards all my colleagues at S.P.I.T., Mumbai for their encouragement.

Mr. Aryaman Gokarn Ms. Khushi Patni Mr. Yuvraj Purohit

Contents

Chapter 1

Introduction

During the Information Age, the media where documents are created has undergone a fast transition from traditional paper-based methods to any digital device. However, despite the progress, all modern methods are limited in that they restrict the region where the input is received to a given surface of reference.
Here is where Virtual Notepad comes into place. Virtual Notepad gives freedom of movement to the user and provides a real-time visual feedback of the written characters, making the interaction natural. It can be used in highly sophisticated environments like a smart classroom, a smart factory or a smart laboratory, where it would enable people to annotate pieces of texts wherever they want without any reference surface. Virtual Notepad can be a handy tool where the person sitting on the other side of the computer will draw anything in thin air and that will be captured by the webcam and will be displayed on the canvas.

Image processing is the core of our project. It is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. Image Segmentation is an important stage of the image recognition system, because it extracts the objects of our interest, for further processing such as description or recognition. Object detection in image processing is done using Contours. Contours can be explained simply as a curve joining all the continuous points (along the boundary), having the same color or intensity. The contours are a useful tool for shape analysis and object detection and recognition.
Virtual notepad is designed in such a way that it works at the convenience of the tip of the finger or a pen and does not need any special/expensive hardware or software to work.Color Segmentation plays a major role in detecting the tip of the finger/pen. It is based on the color feature of image pixels, it assumes that homogeneous colors in the image correspond to separate clusters and hence it helps to detect meaningful objects in the image.

Chapter 2

Project Objectives & Applications

The primary objective of Virtual Notepad was to draw on air and to innovate the idea of writing along with smooth drawing and fast responsive output. It is designed in such a way to make it more appealing by adding features like vibrant choices of colors to let the user be more creative and screenshot features to save and share the notes quickly and easily.

Virtual Notepad can have applications in many areas such as, smart factories, smart offices, smart class rooms, virtual reality games and even augmented reality environments.

● Cheap Solution for education purposes: As the world is advancing towards a more technologically dependent era and the way of learning is also becoming more digital, but due to financial restraints every school or college can't afford tablets for each student so this could be a great alternative to that .

● Fun and interactive way of learning : Due to the corona pandemic we are forced to stay indoors and all the colleges and schools have been working online and due to which sometimes students find it hard to concentrate on the screen and also feel bored. So the idea of a virtual notepad will be a more interactive way of learning.

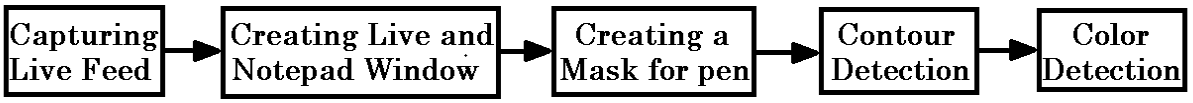
● Also used in various fields like 3 - D Modelling and Virtual reality

Chapter 3

System Design

For this project we are using opencv in python.OpenCV is the huge open-source library for computer vision, machine learning, and image processing, as it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human.We have used various commands from this library in different parts of the code. For our project we have divided the algorithm into different parts which are :

- The first is Capturing Live Feed from the webcam
- The second part is Creating Windows : Live Window and Notepad Window
- The third is to create a Window for mask so that our pen is detected
- The fourth is Object/Contour Detection
- The fifth part is Color Detection using Trackbars



Our main aim is to be able to write on the screen virtually, so for that we need to capture the live feed from a webcam. Firstly we will be loading the default webcam of the PC using “cv2.Videocapture” which will open the webcam. Then the program will read the frame from the camera and it will flip the frame so that the user sees a straight image rather than a flipped image on the screen.

The Live Frame window has the same functions added to it i.e. the clear function and the colors. Whatever we draw on the Live e created the window by adding Colors and Clear function at the top part of the window. It is used to capture the hand movements or the movements of the tip of the pen and then corresponding to the actions it draws on the screen. To create the window we have used the “cv2.rectangle” function which is used to draw a rectangle on any image and to add the text box on the window for the features like colours and clear we have used “cv2.putText” function which is used to draw a text string on any image.

Notepad Window is very useful for users as it acts as a notepad where we can store the text ,which we have written on the live screen.

Mask window helps us to capture the hand movements or gestures accurately without any noise or disturbance in the image.

Trackbars are helpful to tweak a variable value instantly without closing and relaunching the program.In our project we have used trackbars to adjust the values of hue, saturation and value of the image to create the desired mask. In the previous slide, to get the accurate mask we take help of the trackbars to adjust the values so that we detect only the tip of the object.

Chapter 4

Simulation & Experimental Results

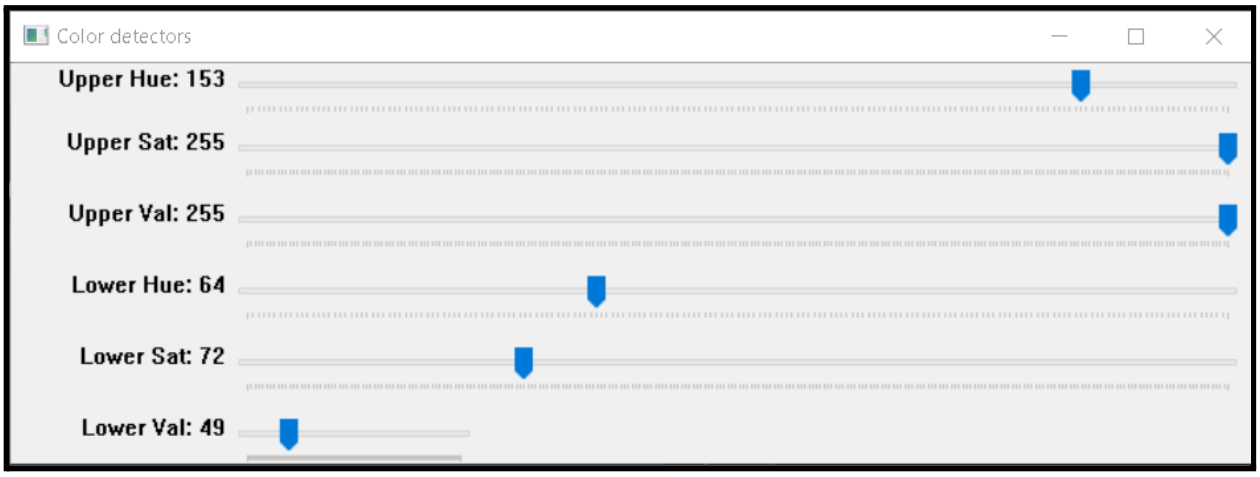


Fig 1: Trackbar

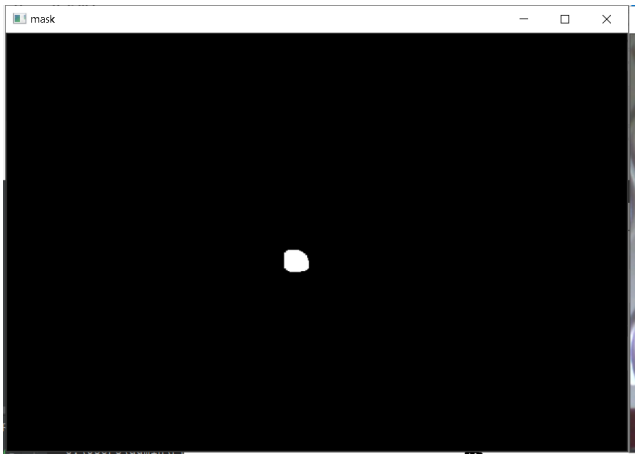


Fig 2.1: Mask of detected object

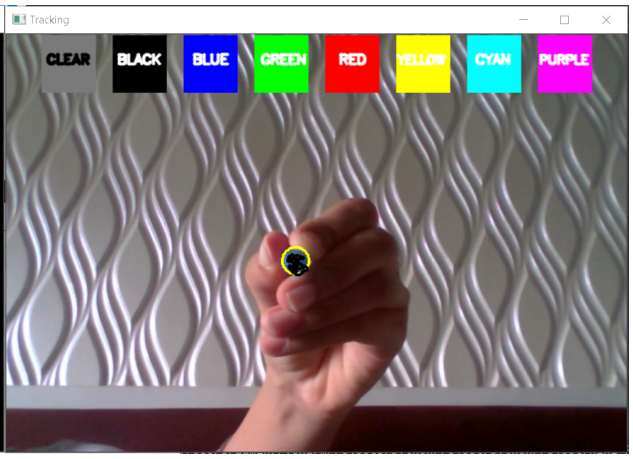


Fig 2.2: Object detection in Live Window

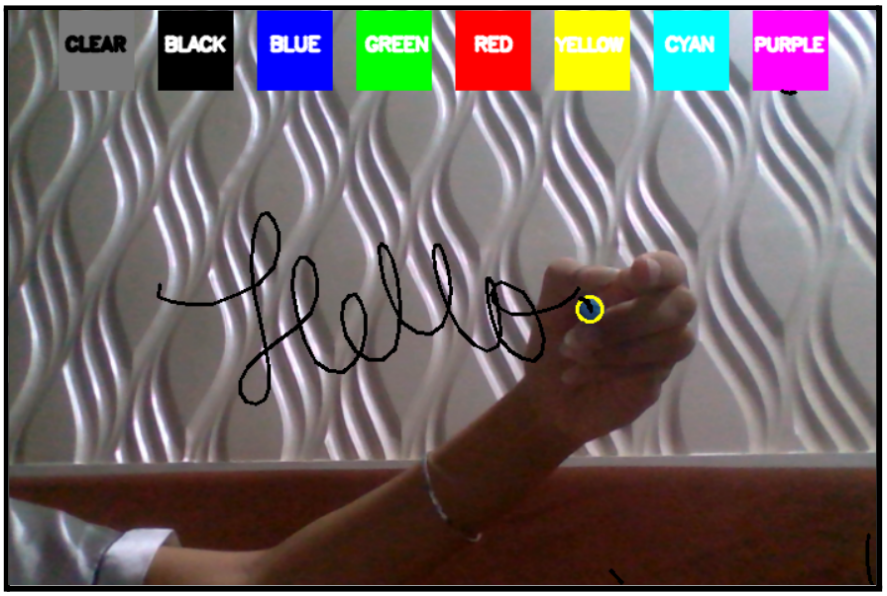


Fig 3: Live Window

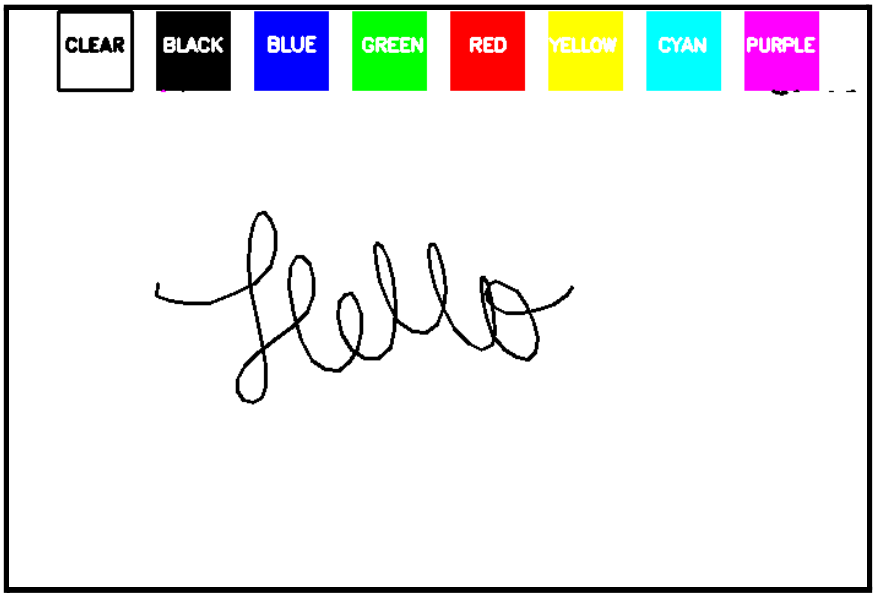


Fig 4 : Notepad Window

Chapter 5

Conclusions

We envision Virtual Notepad to be used in a smart classroom environment using augmented reality, where people can scribble anything as air notes and visualize these notes in the form of handwriting, thus giving the process of creating a new definition.

With Virtual Notepad, we have achieved a hands-free drawing program that uses OpenCV to detect the user's pointer finger. Colorful lines can be drawn wherever the user desires and the brush can even be modified. It is truly like drawing in the air! Virtual Notepad can be modified by adding a handwriting recognition feature to it using Natural Language Processing to detect characters.

References

1) Air Canvas By Justin Joco and Stephanie Lin (2019)
2) OpenCV - real-time optimized Computer Vision library
3) Python documentation
4) W. C. Westerman, H. Lamiraux, and M. E. Dreisbach, “Swipe gestures for touch screen keyboards”.
5) VirtualPen Using OpenCV
6) Webcam Paint Application Using OpenCV.
7) Virtual Pen and Eraser
8) AirScript - Creating Documents in Air