# AI VIRTUAL PAINTING

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# ABSTRACT

Virtual painter is in where we can draw by just capturing the motion of a coloured marker with a camera. One coloured object at the tip of the finger is mainly used as the marker. We are here now, using the techniques of computer vision in open cv to build this project. The required language for this project is python due to its more exhaustive libraries and easy to make use of the syntax and but understanding the basics as well as it can be implemented in any open cv supported languages. The colour tracking and detection processes are used to achieve the goal of this project.

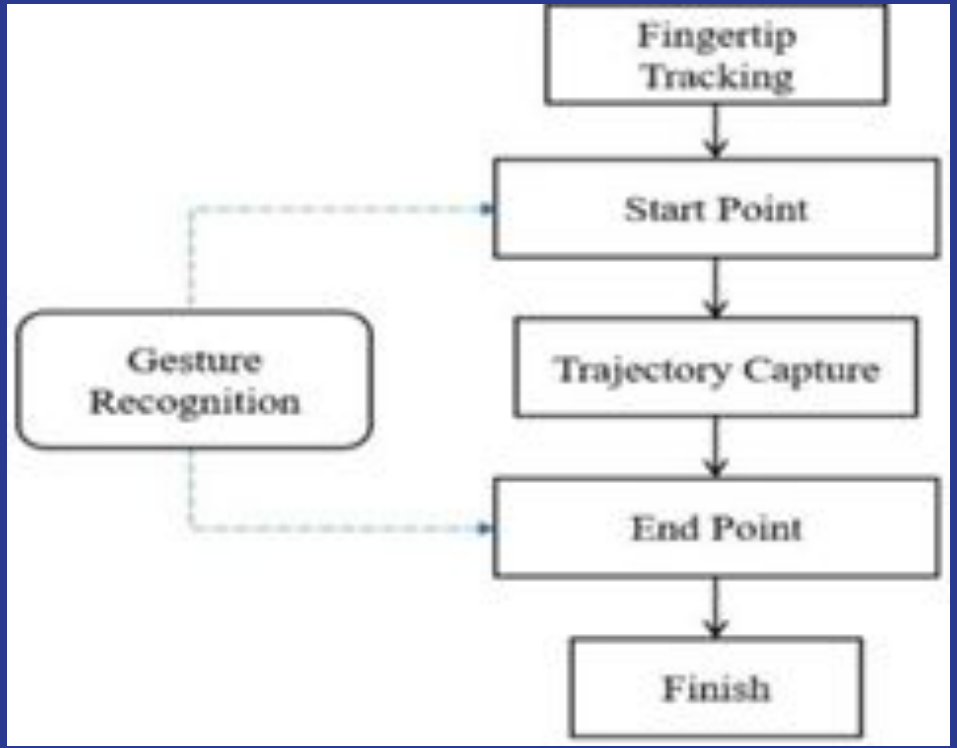
# EXISTING SYSTEM

- 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.

# PROPOSED SYSTEM

- The proposed system is developed to overcome the disadvantages of the Existing system. In this system, we are using hand gesture recognition with the use of machine learning algorithm by using python programming, which creates natural interaction between man and machine.
- With the advancement in technology, the need of development of natural ‘human – computer interaction (HCI)’ systems to replace traditional systems is increasing rapidly.
- We will be using the computer vision techniques of OpenCV to build this project. The preferred language is Python due to its exhaustive libraries and easy to use syntax but understanding the basics it can be implemented in any OpenCV supported language.

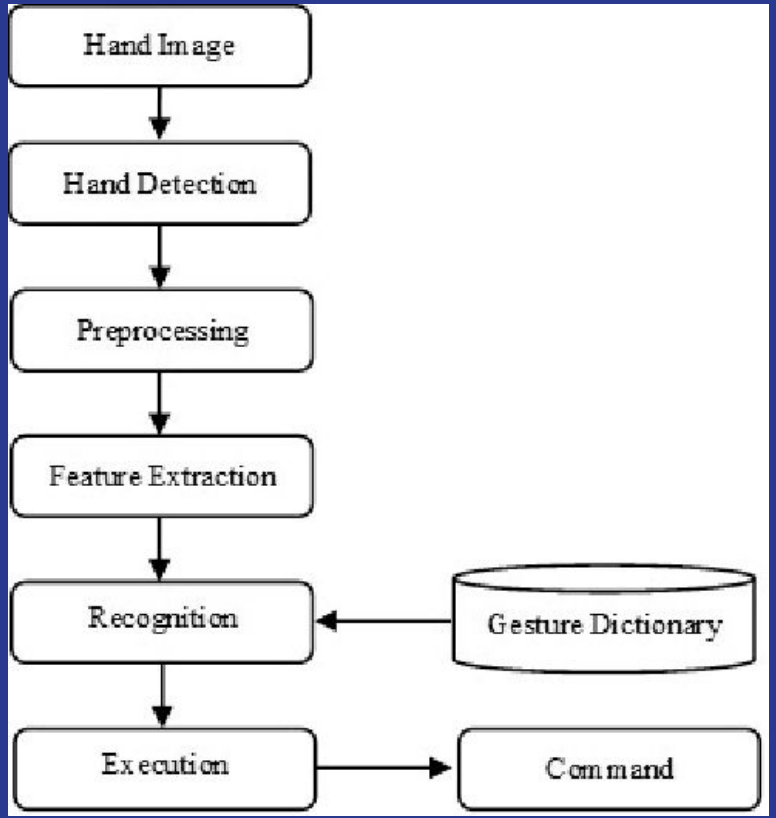
Fig: Proposed System



# HAND GESTURE DETECTION

- Recognizing the position of the composing hand and recognizing it through other signals is an fundamental step in initializing airborne composing.
- Not at all like conventional writing, when the write moves down, and the write moves up, composing within the discuss isn't laid out as a writing arrangement. Events.
- The framework recognizes the position of a piece hand and recognizes it from a non-writing hand by tallying the number of raised fingers.

# FLOWCHART OF HAND GESTURE



# LANGUAGE DESCRIPTION

## PYTHON

- Python is a powerful muti-purpose programming language created by Gudio van Rossum Python is a dynamic, byte code coupled language. There is no type declaration of variables, parameters, functions, or methods in source code.
- This makes the code short and flexible ,and you lose the compile time type checking of the source code. This makes the code short and flexible ,and you lose the compile time checking of the source code.
- Python tracks the type of all values at the runtime and flags code that does not make sense as its runs. Python is an interpreter, object-oriented, high- level built in data structures, combined with dynamic binding; make it very attractive for Rapid Application Development, as well as  for use as a scripting or glue language to connect existing components together .
- Python's simple, easy to learn syntax and easy-t0-use syntax, making it the perfect language for someone trying to learn computer programming for the first time. Emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourage program modularity and code reuse.

- The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.
- Often, programmers fall in love with python because of the increased productivity it provides. Since there is no compilation step, the edit-test debug cycle is incredibly fast.
- Debugging python programs is easy: bug or bad input will never cause a segmentation fault. Instead, when the interpreter discovers an error, it raises an exception. When the program doesn’t catch the exception, the interpreter prints a stack trace.
- A source level debugger allows inspection of local and global variables, evaluation of arbitrary expressions, setting breakpoints, stepping through the code a line at a time, and so on. The debugger is written in Python itself, testifying to python’s introspective power.
- On the other hand, often the quickest way to debug a program is to add a few print statements to the source: the fast edit-test-debug cycle makes this simple approach very effective.

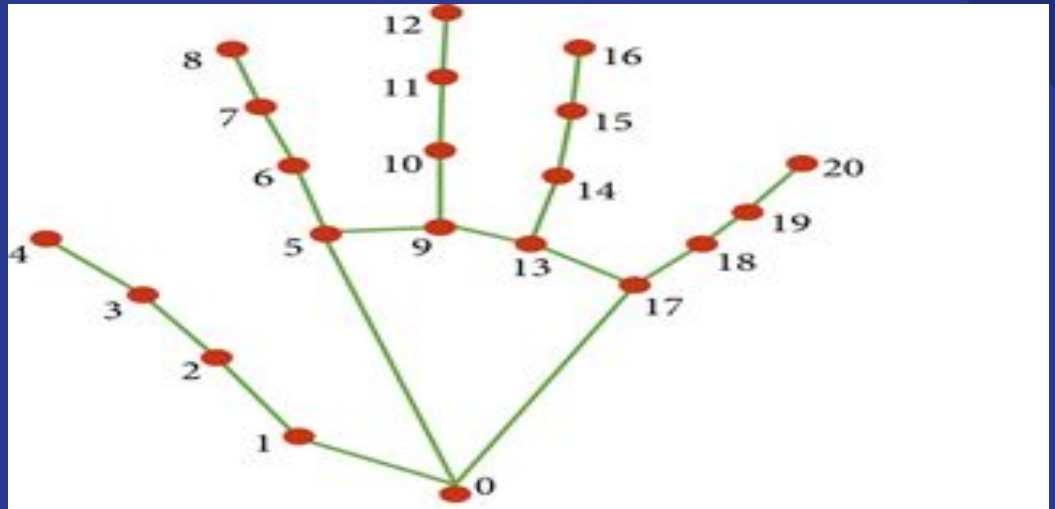
# ALGORITHM USED FOR HAND TRACKING

- Hand gesture recognition and tracking are handled by the MediaPipe framework, while computer vision is handled by the OpenCV library.
- To track and recognize hand movements and hand tips, the program makes use of machine learning ideas.

## MediaPipe

- MediaPipe is a Google open-source framework that was initially released in 2019. MediaPipe has some built-in computer vision and machine learning capabilities. A machine learning inference pipeline is implemented using MediaPipe. ML inference is the process of running real data points.
- The MediaPipe framework is used to solve AI challenges that mostly include video and audio streaming. MediaPipe is multimodal and platform independent.
- Face detection, multi-hand tracking, hair segmentation,object detection, and tracking are just a few of the applications that MediaPipe has to offer.
- MediaPipe is a framework with a high level of fidelity. Low latency performance is provided through the MediaPipe framework. It's in charge of synchronizing time-series data.

- The MediaPipe framework has been used to design and analyze systems using graphs, as well as to develop systems for application purposes. In the pipeline configuration, all of the system's steps are carried out.
- The pipeline that was designed can run on a variety of platforms and can scale across desktops and mobile devices. Performance evaluation, sensor data retrieval, and a collection of components are all part of the MediaPipe framework.
- The MediaPipe framework uses a single-shot detector model for real-time detection and recognition of a hand or palm. It is first trained for the palm detection model in the hand detection module since palms are easier to train.
- It designates a hand landmark in the hand region, consisting of 21 joint or knuckle coordinates as shown in the Figure .




0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

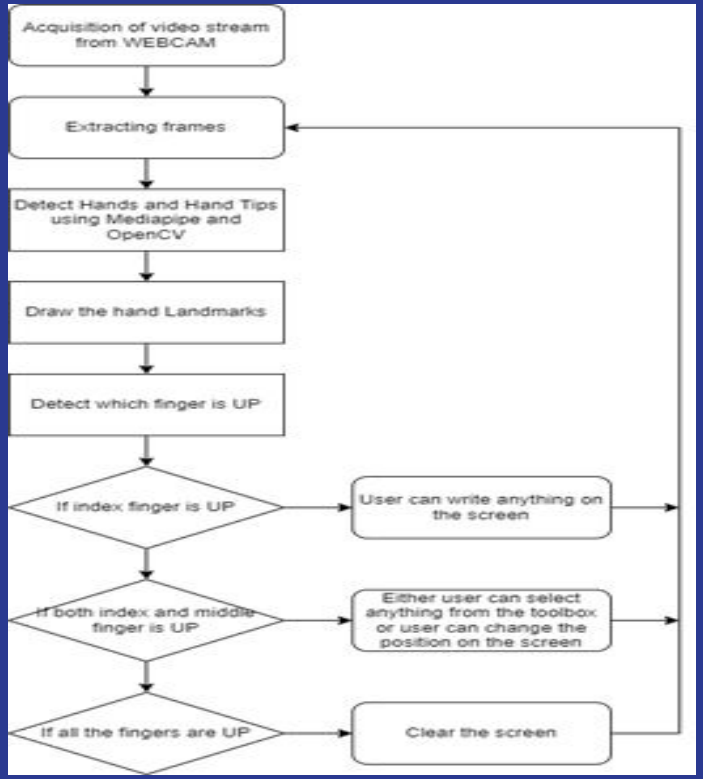
# OPEN CV

- The computer vision library OpenCV is a must-have for everyone who works with computers. It includes object detection image-processing methods.
- OpenCV is a python package for creating real-time computer vision applications. Image and video processing and analysis are handled by the OpenCV library.
- OpenCV is a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc.
- In OpenCV, the CV is an abbreviation form of a computer vision, which is defined as a field of study that helps computers to understand the content of the digital images such as photographs and videos.

# Flowchart of the Virtual Paint Application

- The virtual paint application presented is based on the frames recorded by the PC's web camera. The frames are captured by the web camera and sent to the system. The method makes use of a web camera to capture each frame till the application is finished.
- The video frames are transformed from BGR to RGB color to locate the hands in the video frame. The system then determines which finger is up by comparing the tip Id of the corresponding finger found via the MediaPipe to the respective coordinates of the up fingers, and then performs the appropriate function.
- The user can write anything on the screen if his or her index finger is raised. If both index finger and middle finger are up, the user can either change position on the screen or can select any tool provided in the toolbar of the application. If all the fingers are up except the thumb finger, the user can clear the screen. If all the fingers are up, then no action is performed on the screen.

The various constraints in the system are explained in the flowchart of the Virtual Paint Application in Figure.



# SYSTEM REQUIREMENTS

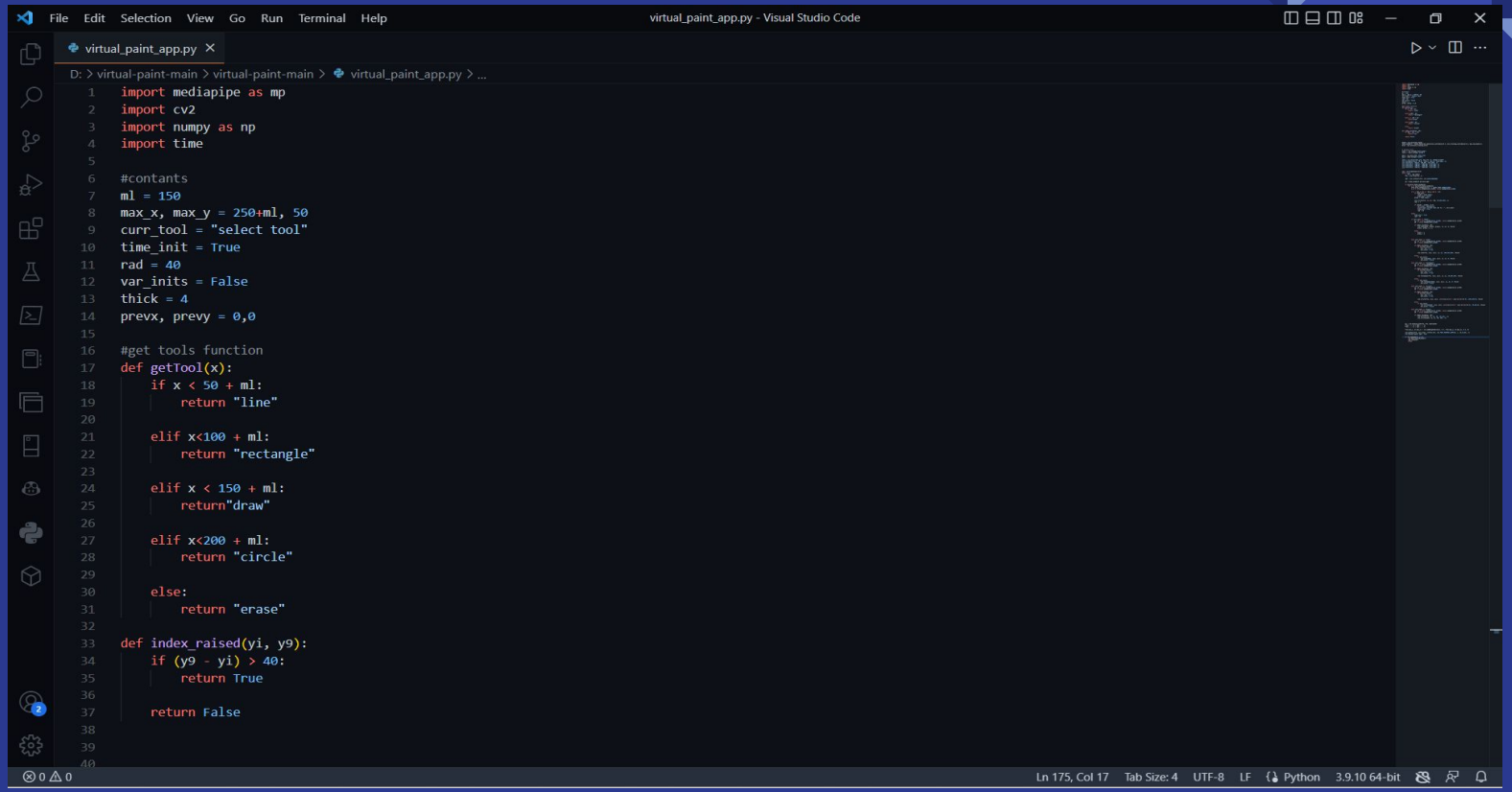
**HARDWARE REQUIREMENTS**

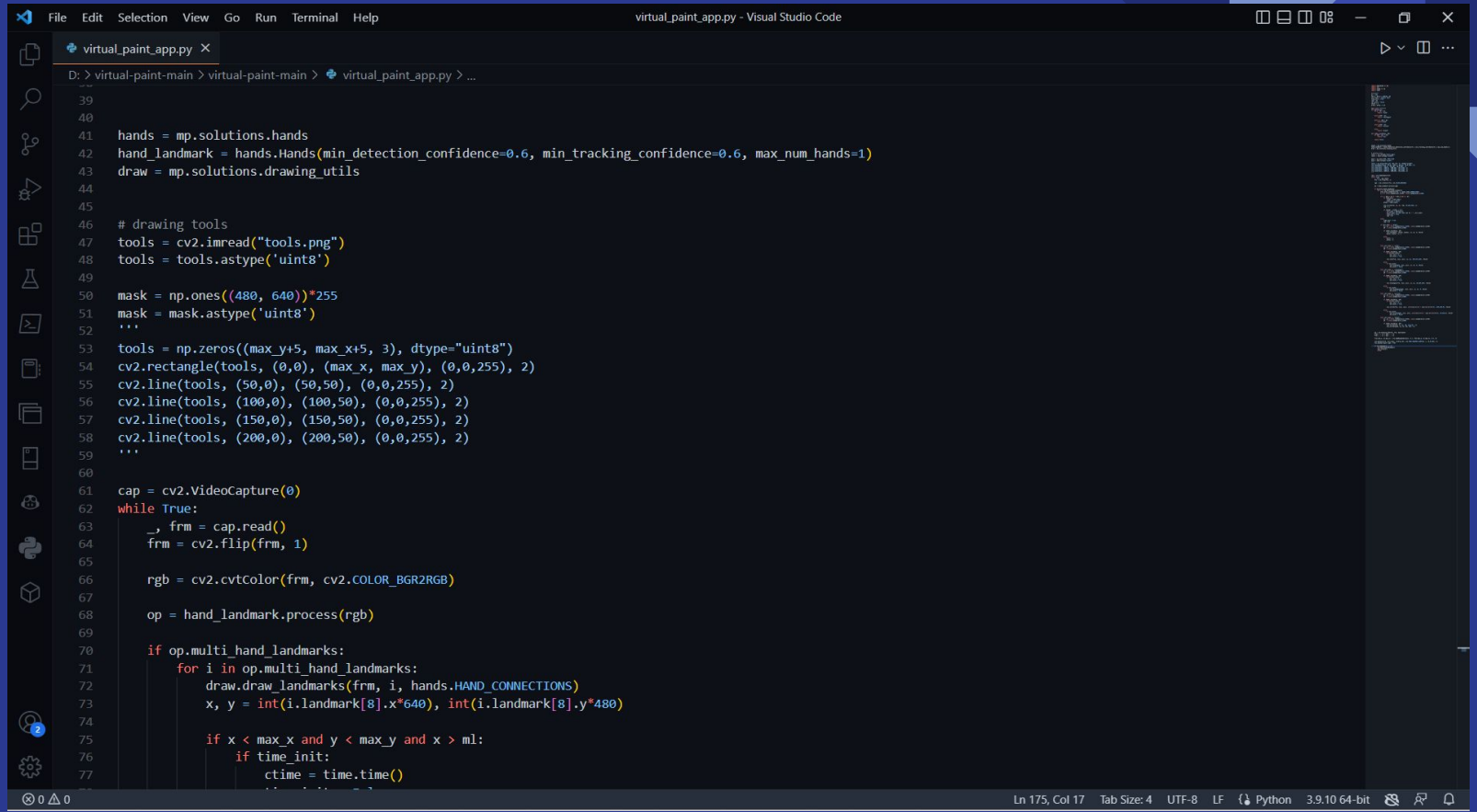
Processor : Intel Core i7 or above Main Memory : 8 GB RAM or above Hard Disk : 120 GB

**SOFTWARE REQUIREMENTS**

Operating System : Windows 10 or above
Front end : HTML
Backend : Python
IDE Used : IDLE

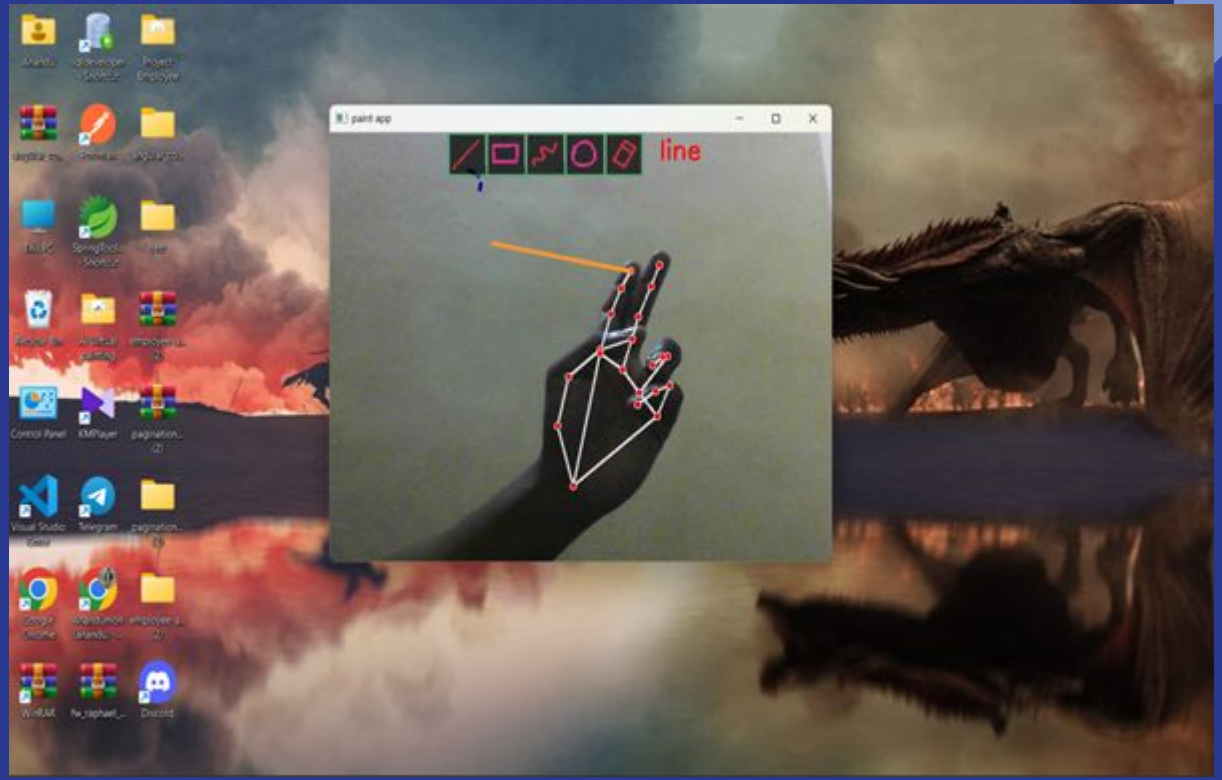
# SAMPLE CODE


File Edit Selection View Go Run Terminal Help
virtual_paint_app.py - Visual Studio Code
virtual_paint_app.py
D: > virtual-paint-main > virtual-paint-main > virtual_paint_app.py > ...
import mediapipe as mp
import cv2
import numpy as np
import time
#contants
ml = 150
max_x, max_y = 250+ml, 50
curr_tool = "select tool"
time_init = True
rad = 40
var_inits = False
thick = 4
prevx, prevy = 0,0
#get tools function
def getTool(x):
if x < 50 + ml:
return "line"
elif x<100 + ml:
return "rectangle"
elif x < 150 + ml:
return"draw"
elif x<200 + ml:
return "circle"
else:
return "erase"
def index_raised(yi, y9):
if (y9 - yi) > 40:
return True
return False
Ln 175, Col 17 Tab Size: 4 UTF-8 LF Python 3.9.10 64-bit


File Edit Selection View Go Run Terminal Help
virtual_paint_app.py - Visual Studio Code
virtual_paint_app.py
D: > virtual-paint-main > virtual-paint-main > virtual_paint_app.py > ...
39
40
41 hands = mp.solutions.hands
42 hand_landmark = hands.Hands(min_detection_confidence=0.6, min_tracking_confidence=0.6, max_num_hands=1)
43 draw = mp.solutions.drawing_utils
44
45
46 # drawing tools
47 tools = cv2.imread("tools.png")
48 tools = tools.astype('uint8')
49
50 mask = np.ones((480, 640))*255
51 mask = mask.astype('uint8')
52 '''
53 tools = np.zeros((max_y+5, max_x+5, 3), dtype="uint8")
54 cv2.rectangle(tools, (0,0), (max_x, max_y), (0,0,255), 2)
55 cv2.line(tools, (50,0), (50,50), (0,0,255), 2)
56 cv2.line(tools, (100,0), (100,50), (0,0,255), 2)
57 cv2.line(tools, (150,0), (150,50), (0,0,255), 2)
58 cv2.line(tools, (200,0), (200,50), (0,0,255), 2)
59 '''
60
61 cap = cv2.VideoCapture(0)
62 while True:
63 _, frm = cap.read()
64 frm = cv2.flip(frm, 1)
65
66 rgb = cv2.cvtColor(frm, cv2.COLOR_BGR2RGB)
67
68 op = hand_landmark.process(rgb)
69
70 if op.multi_hand_landmarks:
71 for i in op.multi_hand_landmarks:
72 draw.draw_landmarks(frm, i, hands.HAND_CONNECTIONS)
73 x, y = int(i.landmark[8].x*640), int(i.landmark[8].y*480)
74
75 if x < max_x and y < max_y and x > ml:
76 if time_init:
77 ctime = time.time()
0 0
Ln 175, Col 17 Tab Size: 4 UTF-8 LF Python 3.9.10 64-bit

# SCREENSHOTS


Interface of ai virtual paint application




Hand tracking image


Drawing images

# CONCLUSION

we have developed 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. Our application allows the user to save their final work or watch their drawing process as a playback animation could also be unique features that resemble real creativity software.

# FUTURE SCOPE

This work can be further improved by experimenting with different interpolation methods such as PyGame which includes a line drawing method that could help produce smoother and cleaner lines. In the same vein, a variety of brush shapes and textures can be implemented to make this application more robust.

# THANKYOU