GESTURE MATE

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Introduction:

The paper proposes an AI virtual mouse system that utilizes hand gestures and hand tip detection for performing mouse functions on a computer using computer vision. The system aims to replace traditional mouse devices by using a built-in camera or webcam to track fingertip movement and perform mouse cursor operations and scrolling functions. Python programming language and OpenCV library are used in the system, along with MediaPipe, Pynput, Autopy, and PyAutoGUI packages. The proposed model achieves high accuracy levels and can work well in real-world applications without the use of a GPU.

Literature Survey:

- This paper presents a study of gesture-based interaction techniques for virtual reality, including virtual mouse control. The authors evaluated different hand gesture recognition techniques and compared their performance in terms of accuracy and usability. They also discuss the design considerations for developing gesture-based interaction systems in virtual reality.
- Title: A Vision-Based Approach for Hand Gesture Recognition in Virtual Mouse Control Author: C. Wang and W. Li Year: 2020 Paper: Journal of Computer Applications, vol. 40, no. 5, pp. 1276-1282.
- This paper presents a vision-based approach for hand gesture recognition in virtual mouse control. The system uses a webcam to capture hand movements and translate them into mouse movements. The authors evaluated the system with a group of users and found that it was accurate and easy to use, demonstrating the potential of this approach for practical applications.

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Problem Statement:

1. Traditional methods of controlling slides, such as using a physical mouse or keyboard, can be cumbersome and distracting for the presenter.
2. Gesture control technology can provide a more intuitive and seamless way to navigate through slides during presentations.
3. Current gesture control technology can be expensive and not accessible to everyone.
4. The development of an affordable and user-friendly gesture-controlled virtual mouse for slide presentations would improve the overall user experience.
5. The final product should be easy to set up and use, with clear instructions and minimal technical requirements.

Technology Stack:

HardWare:

1. Webcam
2. laptop or Pc

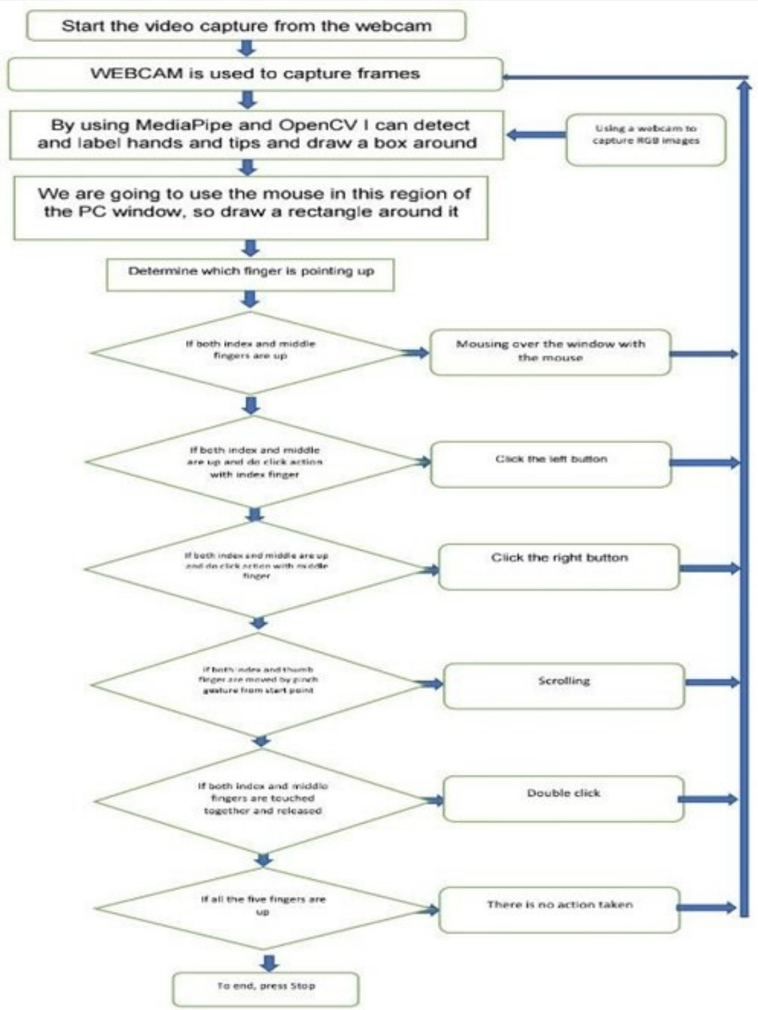
SoftWare:

1. Python
2. Anaconda
3. VS code
4. Javascript

System Architecture:

1. Input Sensors: The system will use sensors, such as a camera or a depth sensor, to capture user hand movements and gestures.
2. Gesture Recognition: The captured hand movements and gestures will be analyzed and recognized by a gesture recognition module. This module will classify the gestures into different categories such as scroll, click, drag, etc.
3. Virtual Mouse Control: Based on the recognized gesture, the system will move the virtual mouse on the screen accordingly. The virtual mouse control module will generate the corresponding mouse events such as left-click, right-click, scroll, drag, etc.
4. Feedback Mechanism: The system will provide feedback to the user, indicating the success or failure of the recognition of the gesture. The feedback can be in the form of a sound, vibration, or a visual indicator.

System Design:



Module Description:

1. **Hand Detection:**

- Encouraging the discovery and following of hands and separating them from the environment is important.
- Managing fabric objects can interfere with the ability to see and distinguish hands.
- Differences in appearance and non-biological factors can cause issues.

2. **Hand Tracking:**

- Tracking the hands is reliable at close range, but visibility may become difficult in virtual reality.
- As virtual reality expands, hand tracking will become more reliable.

3. Involvement and Inclusivity:

- Hand tracking and demonstrations pose challenges related to irregular embodiment and inclusion.
- Separating the skin from the surrounding area is crucial for hand tracking and visualization.
- Skin color is a potential issue that is not explicitly addressed in hand tracking technology.

4.Gesture Recognition Based on Computer Vision:

- Touch Image Collection: The touch-based touch perception method involves collecting touch image information from one or more cameras.
- Pre-processing: The collected data is pre-processed, including sound removal and information enhancement.

- Separation Algorithm: A separation algorithm is used to detect the target touch in the image.
- Touch Recognition: Touch-based touch recognition consists of three main parts: touch recognition, touch analysis, and touch detection.
- Input Image Segmentation: The first step in touch recognition is to tap the input image to create a segment.
- Touch Separation: The touch separation process consists of two main parts: touch area processing and touch separation.
- Touch Area Processing: The touch area process removes the touch circuit from the background complex with self-tracking of the image containing the touch.
- Touch Separation: The touch separation phase segment uses a post-touch algorithm to separate the current touch from the background.
- Touch Modelling: Touch modelling technologies mainly include visual-based touch modelling and 3D model-based touch models.

Performance Evaluation:

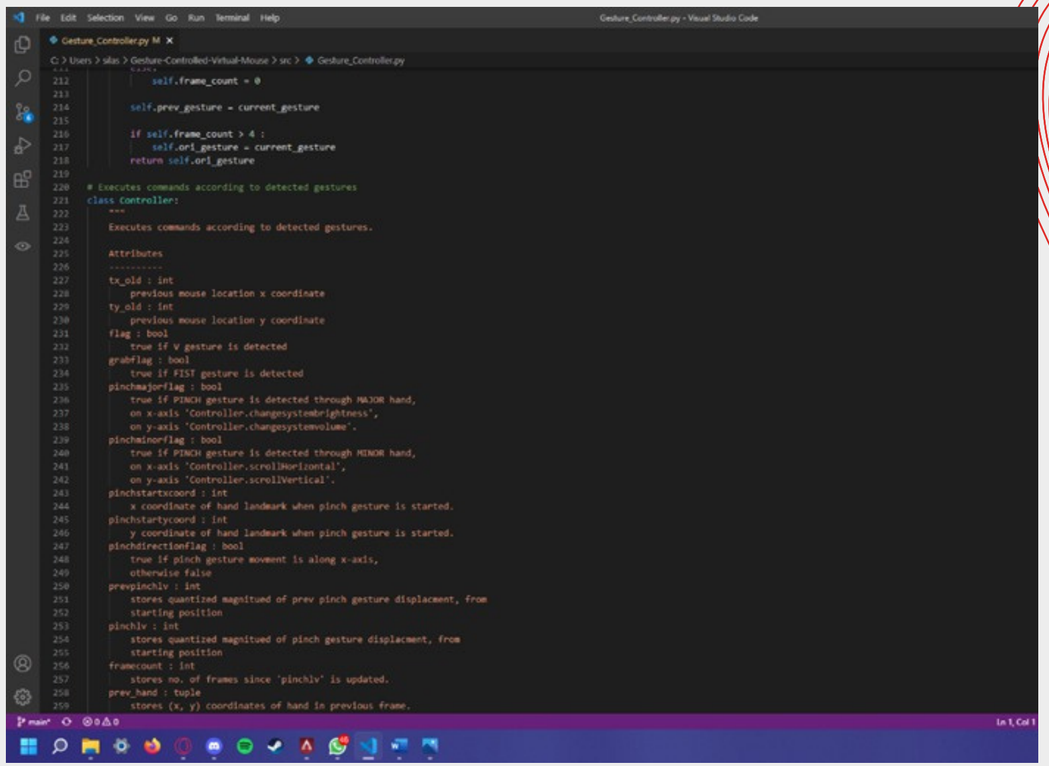
An AI system utilizing computer vision to improve human-computer interaction is proposed in the proposed visual mouse AI system. Because of the limited number of data sets available, it is difficult to compare contradictory outcomes of testing of visual AI mouse systems. A total of 600 hand-labeled touches were obtained through this test, which was performed 25 times by four people in different lighting conditions and at different distances from the screen, and each person tested the visual mouse system individually. In Table 1, the results of 10 AI tests performed in normal light conditions, 5 AI tests performed in dim light, 5 AI tests performed near the webcam, and 5 AI tests performed at a distance from the webcam are tabulated.

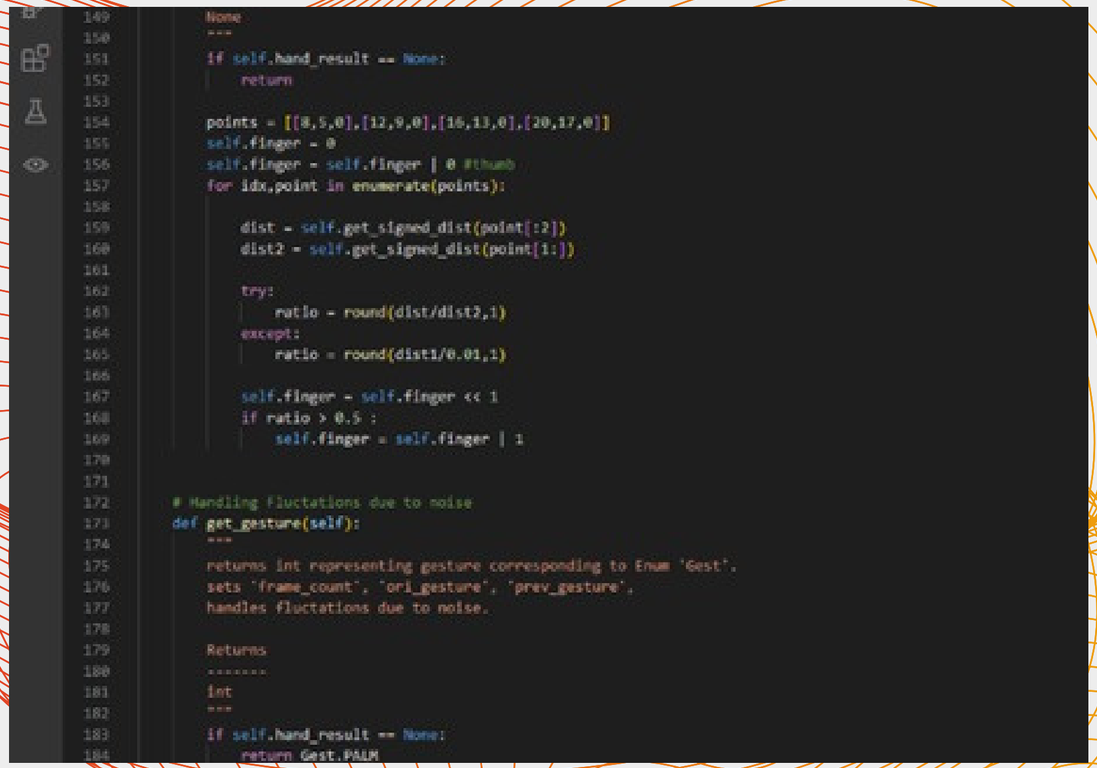
Table:

Hand tip gesture * performed		Success (%)	Failure	
Tip ID 1 or both tip IDs 1 and 2 are up	Mouse movement	100	0	1(
Tip IDs 0 and 1 are up and the distance between the fingers is <30	**Left button click**	99	1	9
Tip IDs 1 and 2 are up and the distance between the fingers is <40	**Right button click**	95	5	9
Tip IDs 1 and 2 are up and the distance between the fingers is >40 and both fingers are moved up the page	Scroll up function	100	0	1(
Tip IDs 1 and 2 are up and the distancebetween the fingers is >40 and both fingers 100 are moved down the page	Scroll down function	100	0	
All five tip IDs 0, 1, 2, 3, and 4 are up	No action performed	100	0	1
Result		594	6	9

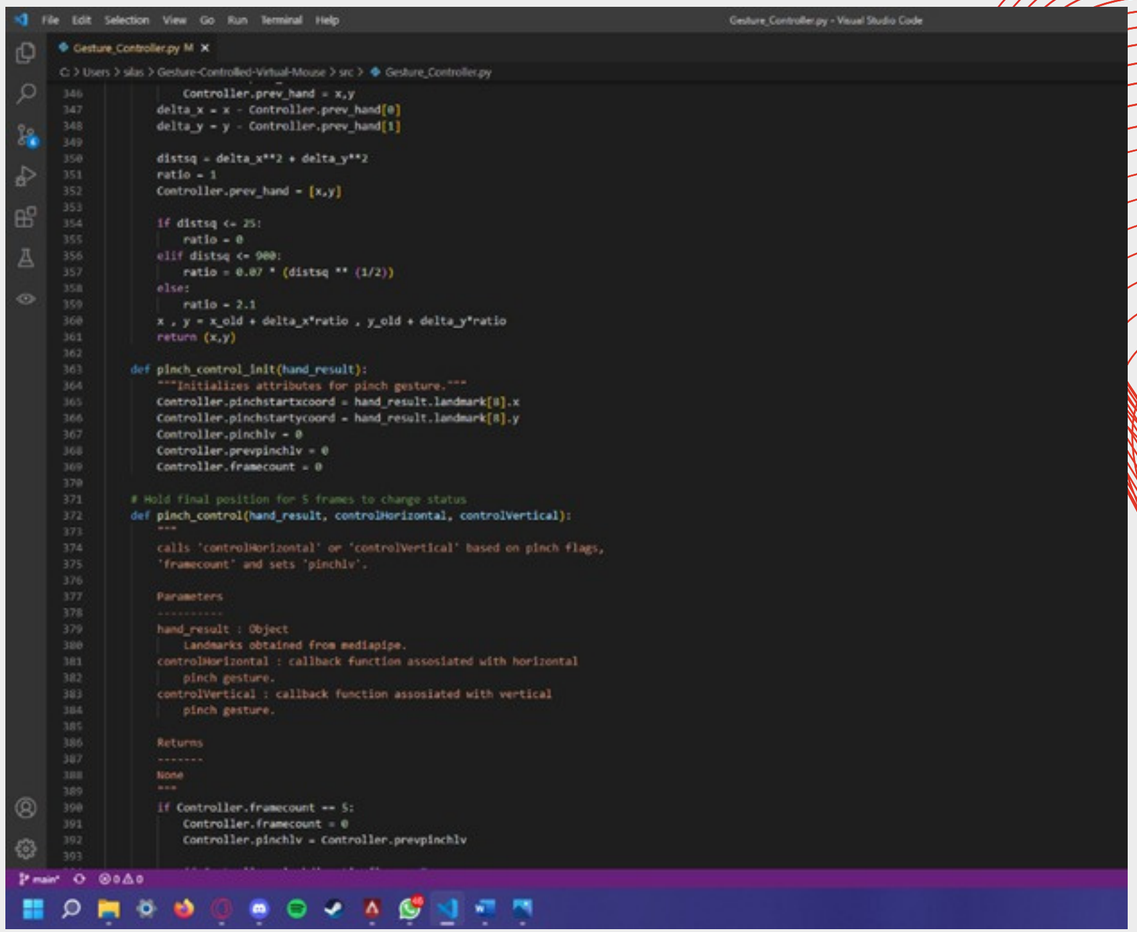
* Finger tip ID for respective fingers: tip Id 0: thumb finger; tip Id 1: index finger; tip Id 2: middle finger; tip Id 3: ring finger; tip Id 4: little finger.

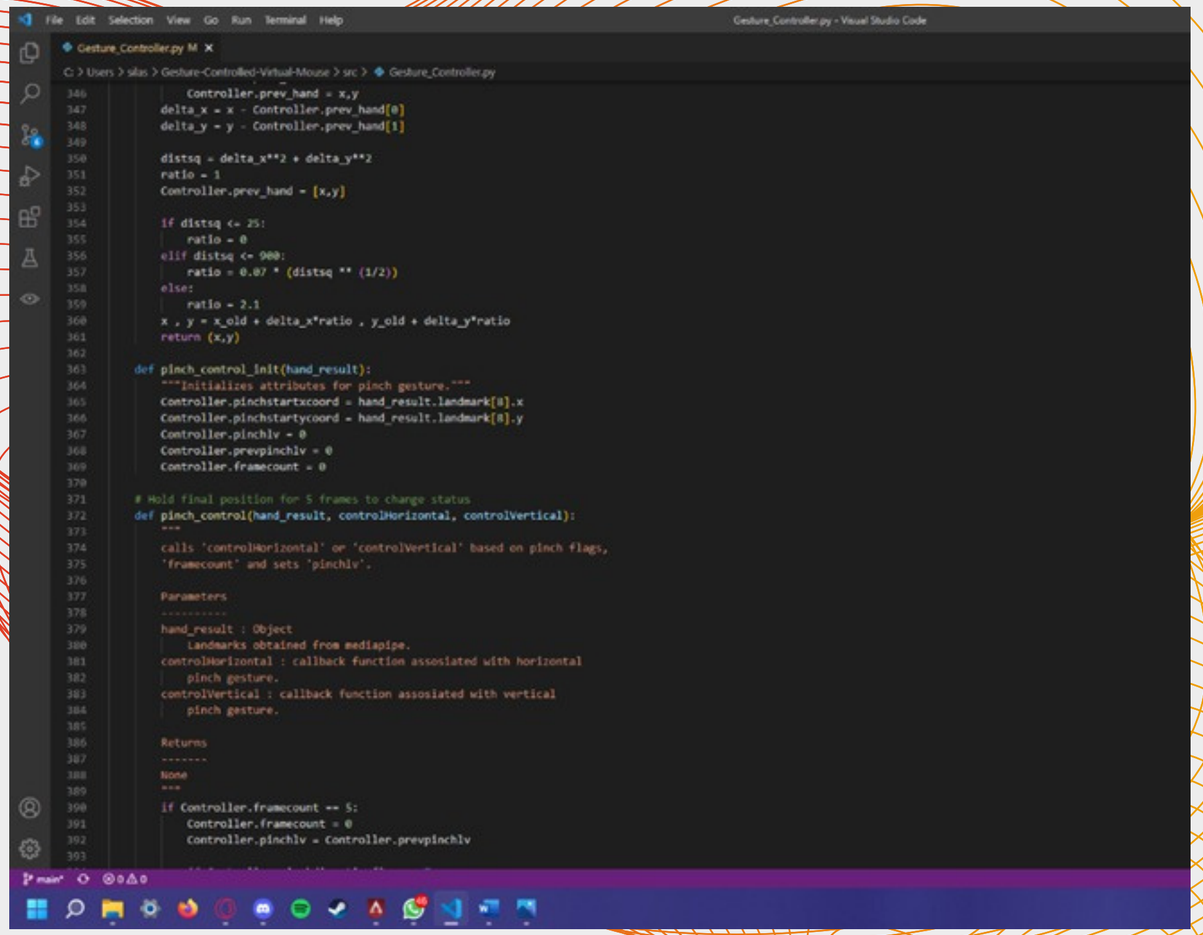
Coding Screen Shots:





Coding Screen Shots:





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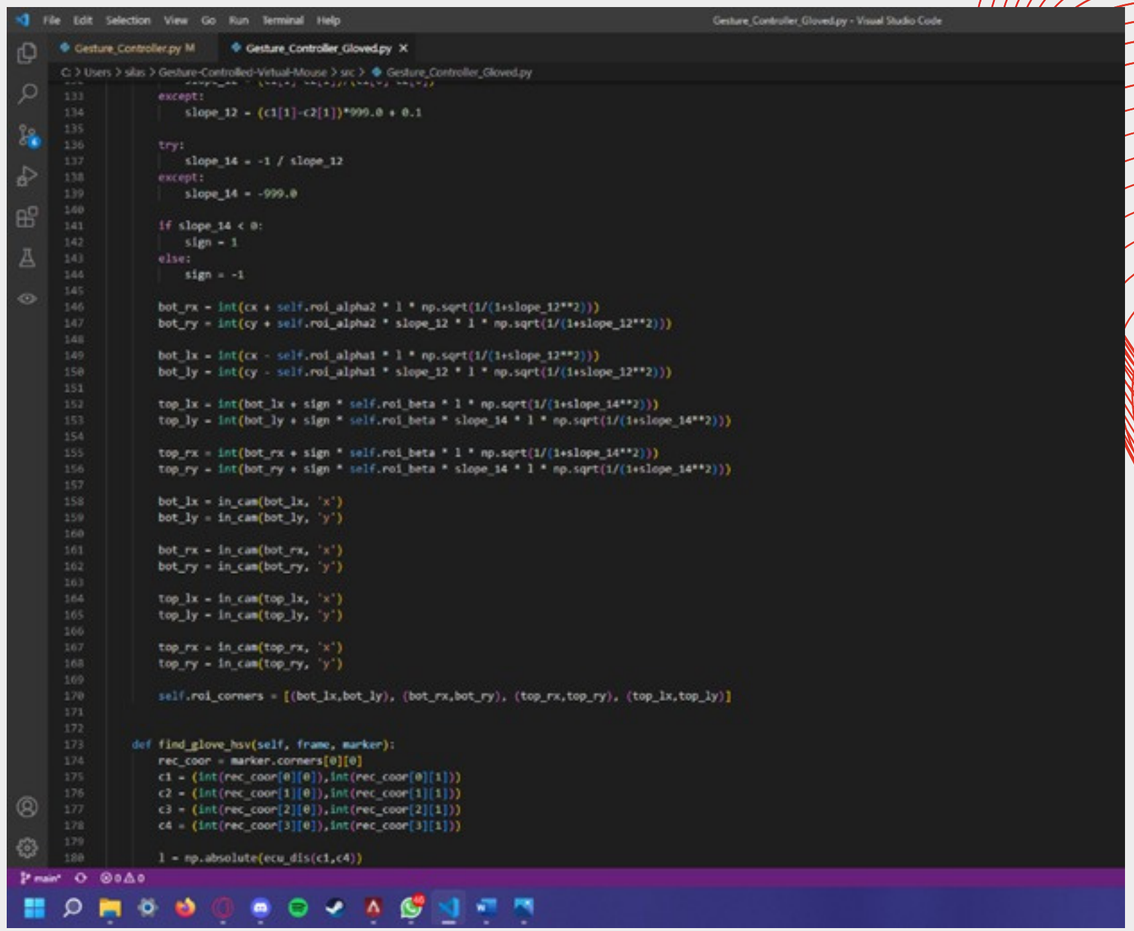
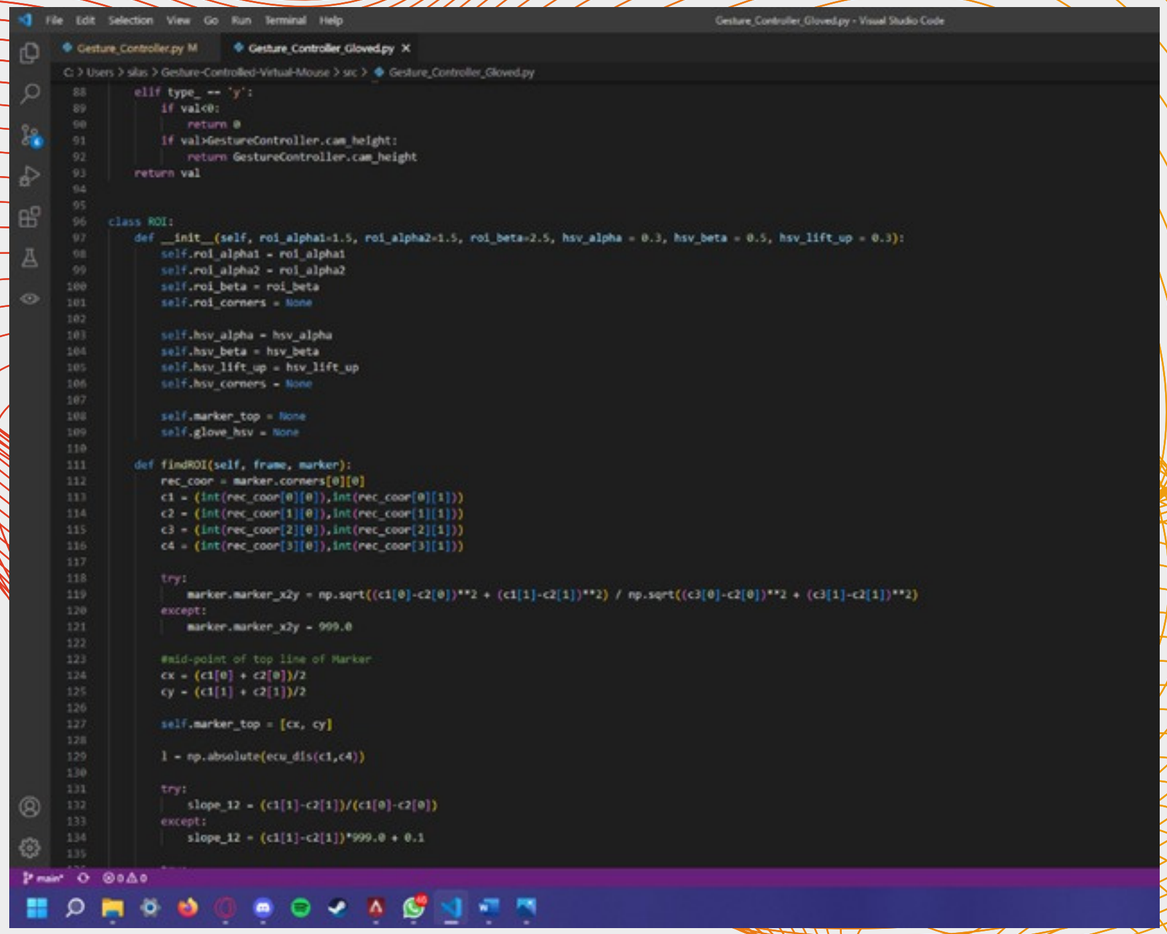
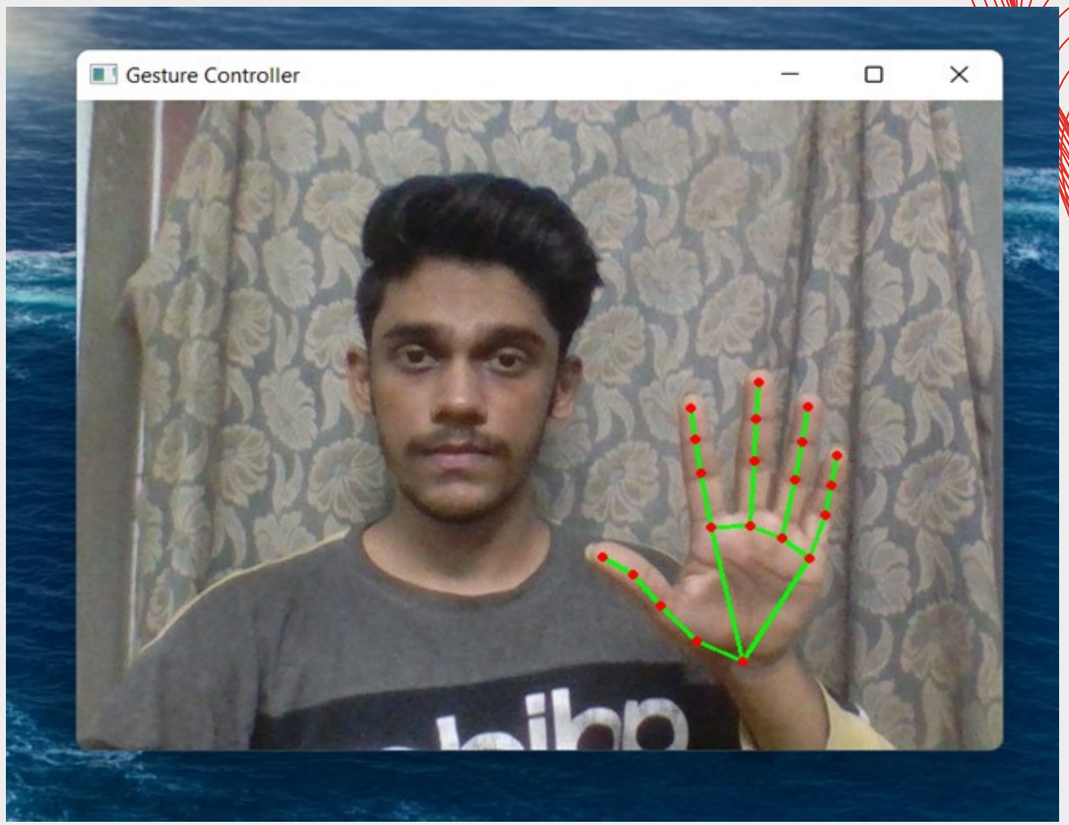


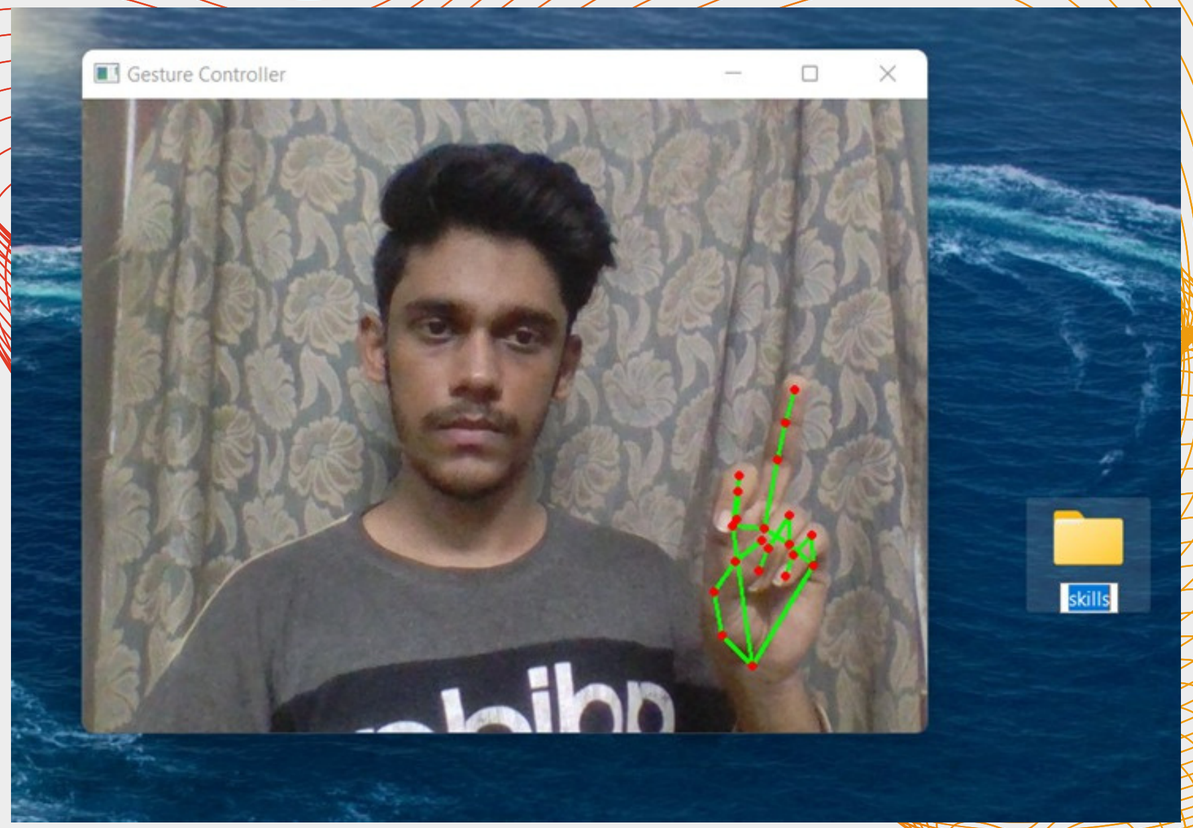


Output Screen Shots:

Neutral Gesture

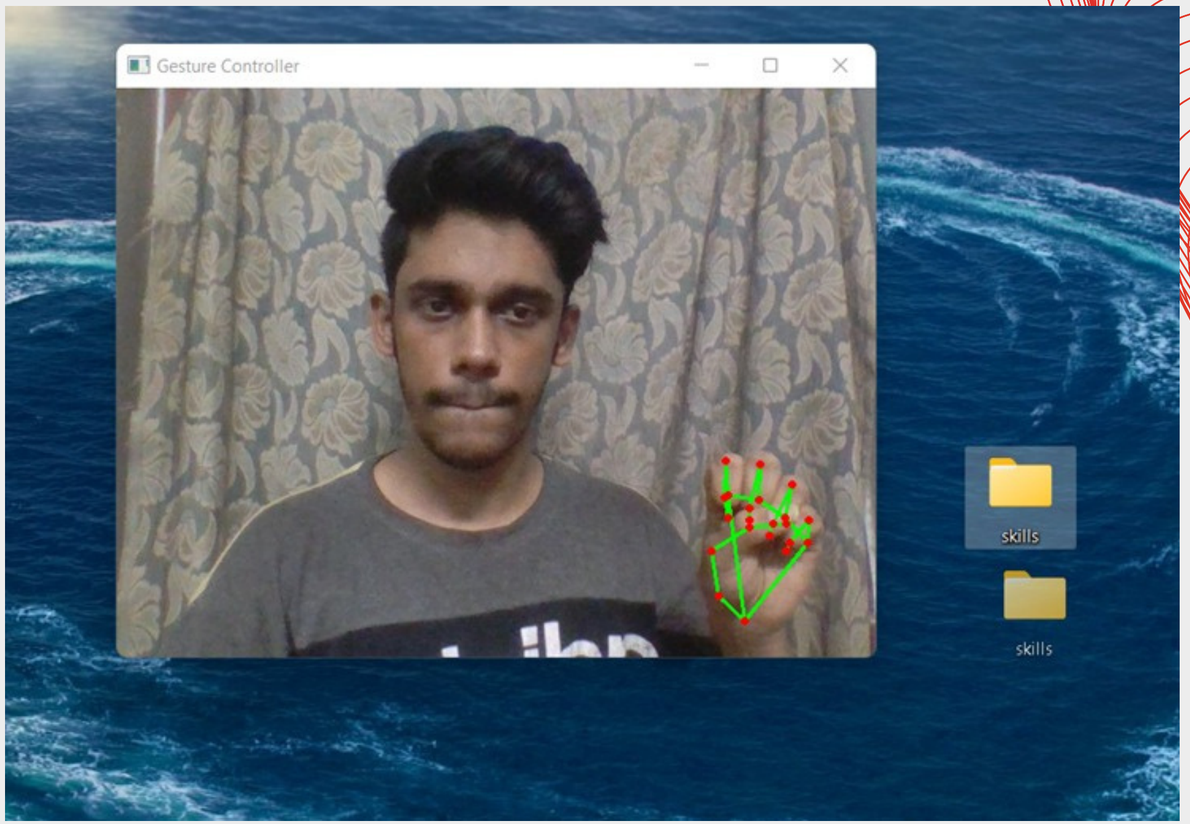


Left Click:

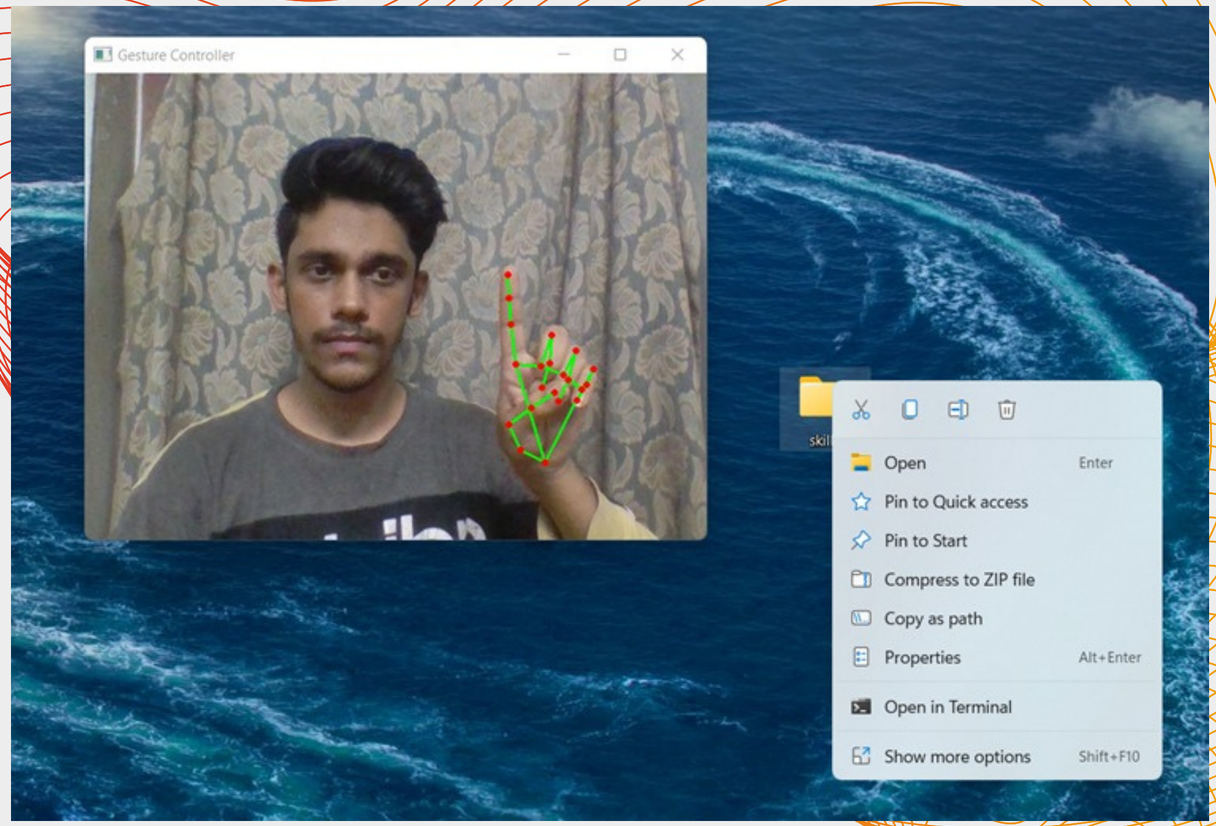


Screen Shots:

Drag and drop:



Right Click:



Conclusion :

- AI virtual mouse system allows controlling mouse cursor functions using hand gestures
- Uses webcam or built-in camera to detect hand gestures and process frames
- Proposed model has higher accuracy compared to existing models
- Can be used for real-world applications and to reduce the spread of COVID-19
- Limitations include decreased accuracy in right-click function and difficulty in clicking and dragging to select text
- Next steps include improving finger tip detection algorithm to address limitations.

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Thank You