Lokmanya Tilak Jankalyan Shikshan Sanstha's

Lokmanya Tilak College of Engineering

Sector-4, Vikas Nagar, Koparkhairane, Navi Mumbai

(Approved by AICTE, Affiliated to University of Mumbai, & Accredited by NAAC)

Mini Project-2A
Presentation I
T.E. (Computer Engg.) Sem - V

2023-24

(AI-Virtual Mouse)

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Presentation Outline

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- Algorithm and Process Design details
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Abstract

- Introducing the realm of human-computer interaction, AI Virtual Mouse technology offers seamless gesture-based control through web cameras

- By tracking hand movements, this comprehensive system eliminates the dependency on conventional input devices, simplifying the user experience and enhancing accessibility.

- Advanced features such as gesture recognition and intuitive cursor control empower users to navigate digital interfaces more efficiently and effectively

- This technology changes how people interact with computers

Introduction

- Virtual mouse technology redefines human-computer interaction, allowing users to input commands without physical mice
- manage computers and others devices with gestures rather than pointing and clicking a mouse or touching a display directly
- This technology utilizes webcams and sophisticated image processing to interpret hand movements as actionable commands
- By eliminating traditional input devices, virtual mouse technology streamlines user interaction and enhances accessibility
- From gaming to sign language recognition, virtual mouse technology's intuitive interface marks a significant advancement in HCI
- revolutionizing how users interact with computers

Literature Survey

Sr.No	Name of paper with author	Year of publication	Paper description
1.	**Virtual Mouse using Hand Gestures** Prof. Roshnee Matlani Prof.Shruti Mishra	14 January 2022	Explores alternative mouse control methods like head movement tracking and delay features, highlighting their potential for moving the mouse pointer and clicking actions without a physical mouse button
2.	**Hand Gesture-based Virtual Mouse using Opencv** **Dr.** Gayatri Jagnade **Prof.**Mitesh Ikar **Prof.** Maithili Chaware	01 March 2023	Introduces contactless laptop/computer control disabilities and addressing pandemic concerns. Features hand gestures, eye blinking, yellow object scrolling, mouth opening, and fingertip volume control Developed with MediaPipe

Objective & Scope

Objective:

Develop and evaluate an AI virtual mouse system using computer vision techniques to enable intuitive and efficient mouse control through hand gestures captured by a webcam.

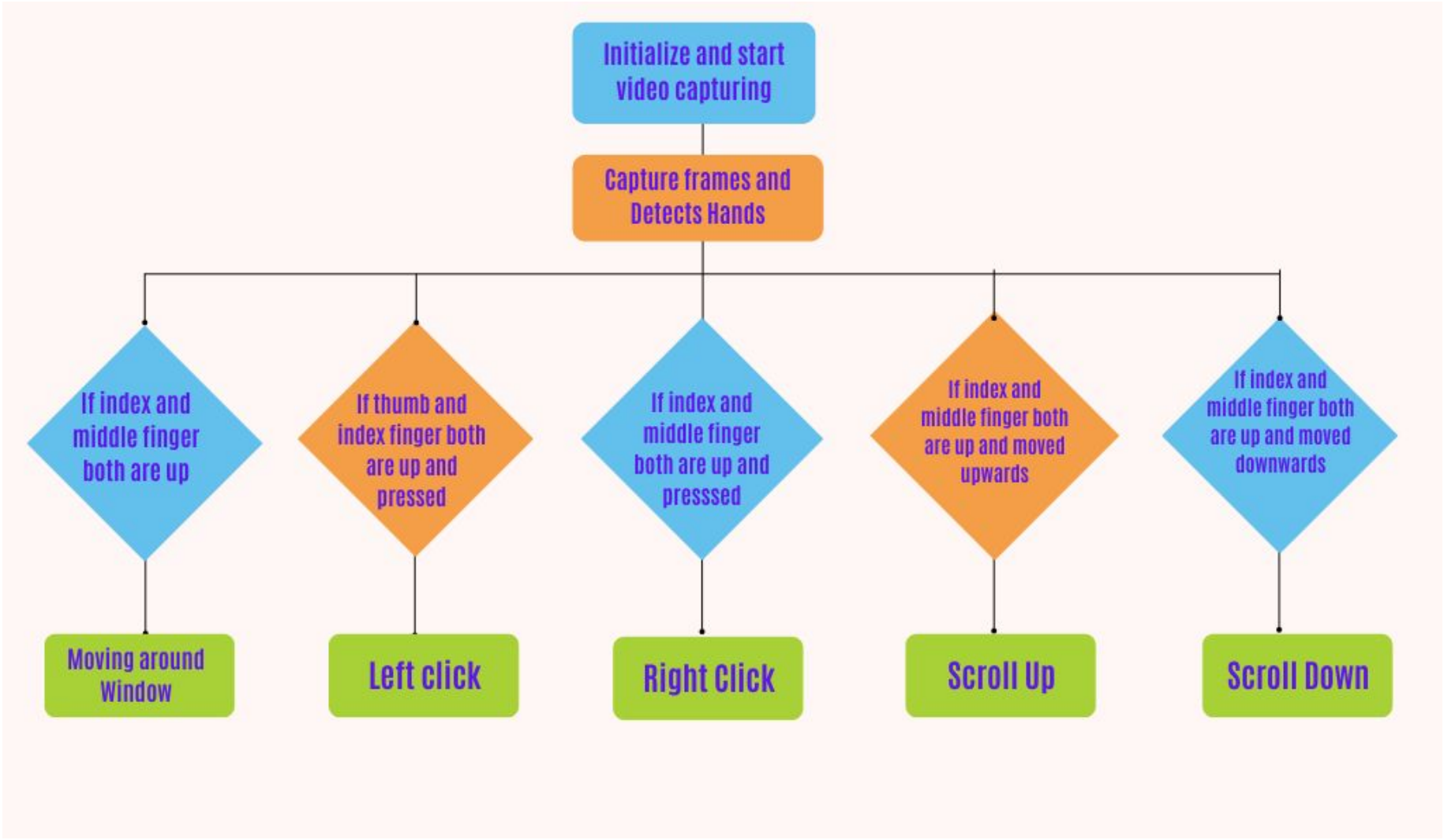
Scope:

- Develop an AI virtual mouse system using computer vision techniques.
- Implement hand gesture recognition for intuitive mouse control.
- Define hardware and software requirements for system operation.
- Conduct performance evaluations under various conditions.
- Evaluate user experience through usability testing.
- Compare with existing mouse solutions.
- Provide recommendations for implementation and future enhancements.

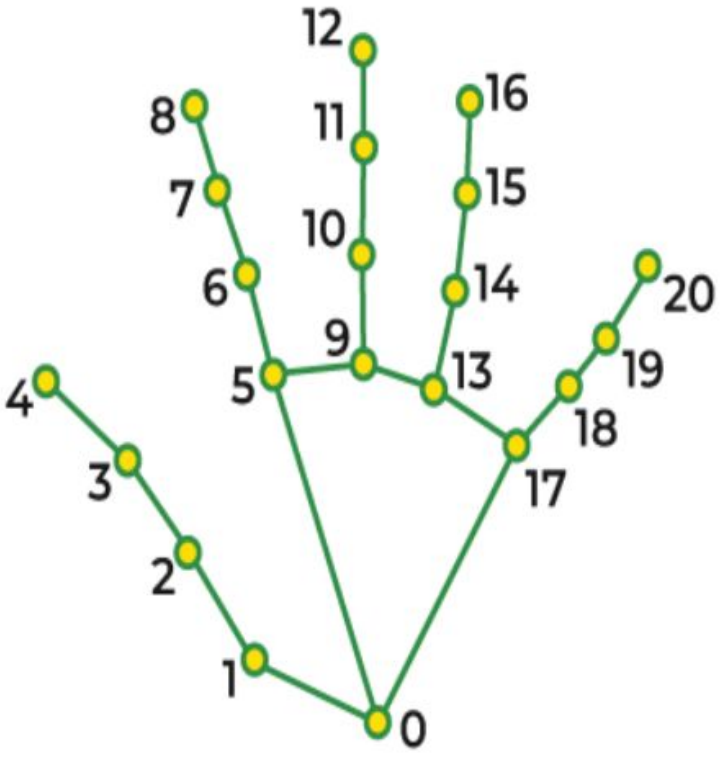
Problem Definition

- Traditional mouse input methods face limitations such as reliance on flat surfaces, cable lengths, and other physical constraints, constraining accessibility and flexibility.
- Existing virtual mouse solutions may lack accuracy or require specialized hardware, limiting widespread adoption.
- This project aims to develop an AI virtual mouse system that utilizes computer vision techniques to interpret hand gestures captured by a standard webcam.
- By offering users an intuitive and efficient alternative to traditional mouse input methods, the system seeks to enhance accessibility and enable new forms of interaction.
- The goal is to empower individuals across diverse computing environments, fostering innovation and inclusivity in human-computer interaction.

Proposed system Architecture/ Framework diagram with explaination .



- Algorithm and Process Design details Algorithm and Process Design details



0. WRIST
1. THUMB_CMC
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3. THUMB_IP
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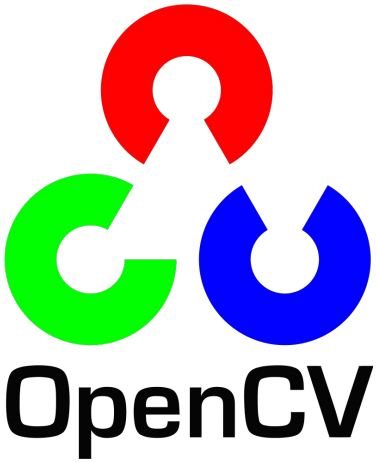
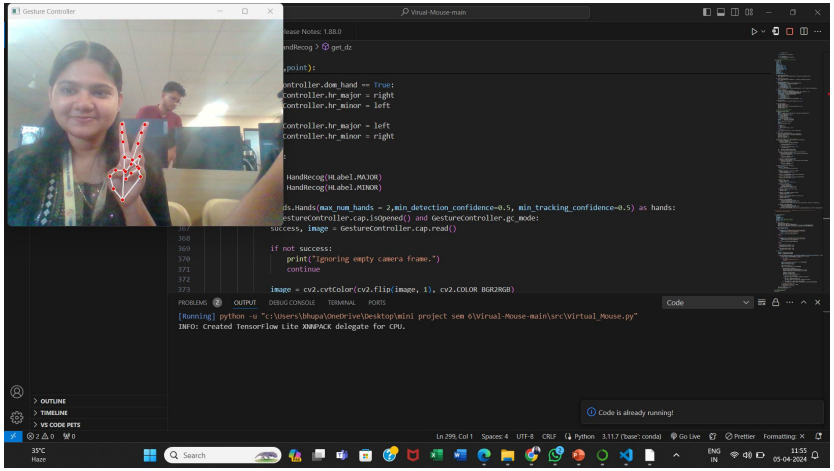
5. INDEX_FINGR_MCP
6. INDEX_FINGR_PIP
7. INDEX_FINGR_DIP
8. INDEX_FINGR_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

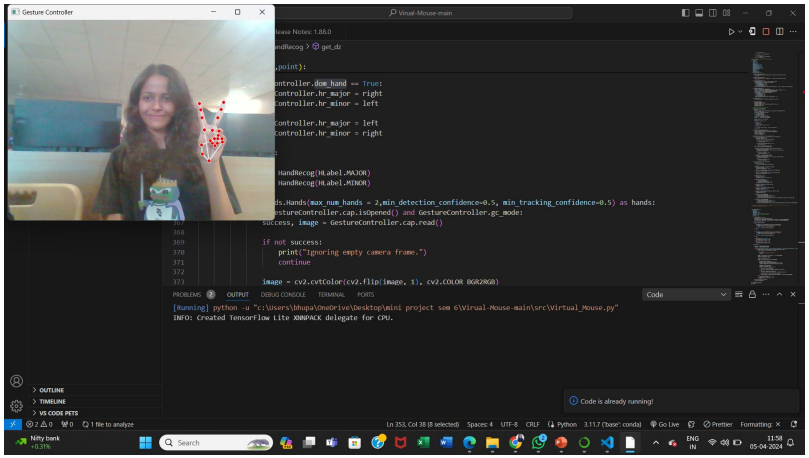
Techstack

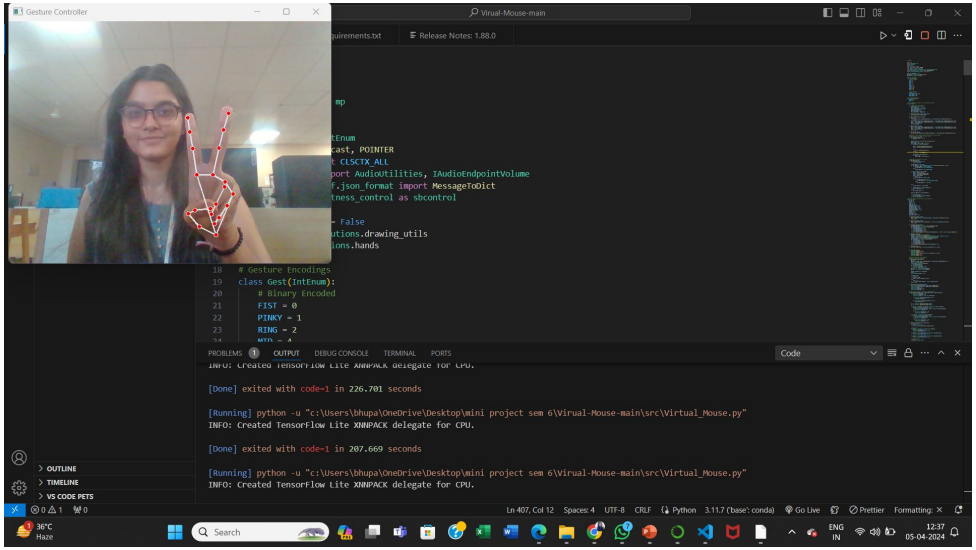
- **Python Libraries:** Various Python libraries like OpenCV, NumPy, PyAutoGUI, and TensorFlow can be used for building the Al virtual mouse system.
- **Open CV:** This library is used for image and video processing, which can be used for hand detection and tracking.
- **NumPy:** NumPy is used for numerical computations, and it is used to process the captured images.
- **PyAutoGUI:** PyAutoGUI is used to control the mouse movements and clicks.
- **Mediapipe:** A cross-platform framework for building multi-modal applied machine learning pipelines.



Result for Validation and Verification







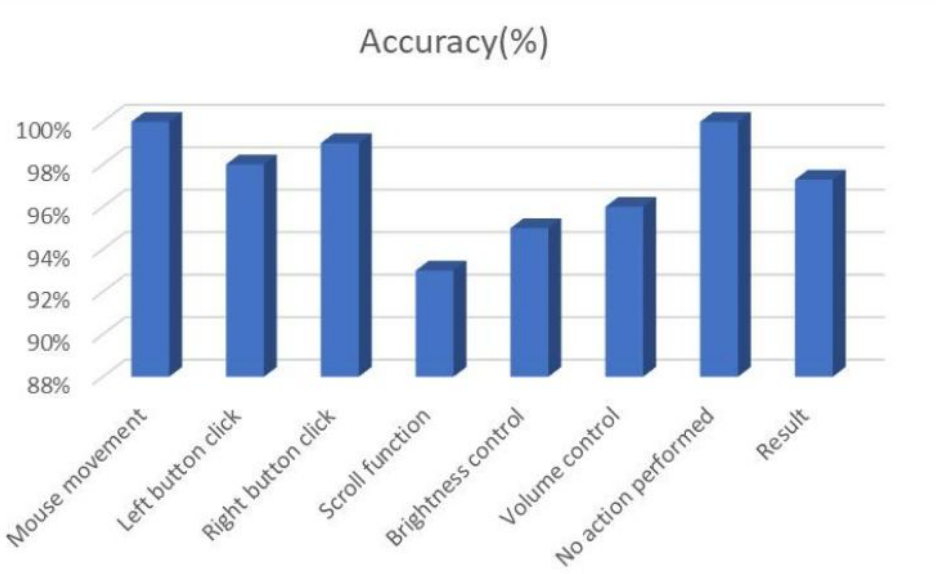
Analysis

Experimental results are tabulated in Table:

Mouse function performed	Success	Failure	Accuracy(%)
Mouse movement	100	0	100%
Left button click	98	2	98%
Right button click	99	1	99%
Scroll function	93	7	93%
Brightness control	95	5	95%
Volume control	96	4	96%
No action performed	100	0	100%
Result	681	19	97.28%

Analysis

From Table , it can be seen that the proposed AI virtual mouse system had achieved an accuracy of about 97%. From this 97% accuracy of the proposed AI virtual mouse system, we come to know that the system has performed well. As seen in Table, the accuracy is low for “Scroll function” as this is the hardest gesture for the computer to understand. The accuracy for scroll function is low because the gesture used for performing the particular mouse function is harder. Also, the accuracy is very good and high for all the other gestures. Compared to previous approaches for virtual mouse, our model worked very well with 97% accuracy. The graph of accuracy is shown in Figure



Conclusion

Due to accuracy and efficiency plays an important role in making the program as useful as an actual physical mouse, a few techniques had to be implemented. After implantation such type of application there is big replacement of physical mouse i.e., there is no need of any physical mouse. Each & every movement of physical mouse is done with this motion tracking mouse (virtual mouse).The proposed gesture controller system offers a hands-free interaction method for computer users. By leveraging hand gestures, users can seamlessly navigate GUIs, perform actions, and adjust system settings. The combination of computer vision techniques and command execution logic enables intuitive and efficient control over various computer functions. Further development and refinement of the system could enhance its usability and applicability across different

References

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2) MSDN Microsoft developers network – www.msdn.microsoft.com

3) www.codeproject.com/Articles/498193/Mouse-Control-via-Webcam

4) Aniket Tatipamula's Blog - http://anikettatipamula.blogspot.in/2012/02/hand-gesture-using-opencv.html

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6) https://ieeexplore.ieee.org/document/10053488