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## **VIRTUAL MOUSE WITH TOUCHLESS INPUT INTERFACE**

### **PYTHON PROJECT REPORT**

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## ABSTRACT

The mouse is one of the wonderful inventions of Human-Computer Interaction (HCI) technology. Currently, wireless mouse or a Bluetooth mouse still uses devices and is not free of devices completely since it uses a battery for power and a dongle to connect it to the PC. In the proposed AI virtual mouse system, this limitation can be overcome by employing webcam or a built-in camera for capturing of hand gestures and hand tip detection using computer vision. The algorithm used in the system makes use of the machine learning algorithm. Based on the hand gestures, the computer can be controlled virtually and can perform left click, right click, scrolling functions, and computer cursor function without the use of the physical mouse. The algorithm is based on deep learning for detecting the hands. Hence, the proposed system will avoid COVID-19 spread by eliminating the human intervention and dependency of devices to control the computer.

## INTRODUCTION

With the development technologies in the areas of augmented reality and devices that we use in our daily life, these devices are becoming compact in the form of Bluetooth or wireless technologies. This paper proposes an AI virtual mouse system that makes use of the hand gestures and hand tip detection for performing mouse functions in the computer using computer vision. The main objective of the proposed system is to perform computer mouse cursor functions and scroll function using a web camera or a built-in camera in the computer instead of using a traditional mouse device. Hand gesture and hand tip detection by using computer vision is used as a HCI [1] with the computer. With the use of the AI virtual mouse system, we can track the fingertip of the hand gesture by using a built-in camera or web camera and perform the mouse cursor operations and scrolling function and also move the cursor with it.

While using a wireless or a Bluetooth mouse, some devices such as the mouse, the dongle to connect to the PC, and also, a battery to power the mouse to operate are used, but in this paper, the user uses his/her built-in camera or a webcam and uses his/her hand gestures to control the computer mouse operations. In the proposed system, the web camera captures and then processes the frames that have been captured and then recognizes the various hand gestures and hand tip gestures and then performs the particular mouse function.

Python programming language is used for developing the AI virtual mouse system, and also, OpenCV which is the library for computer vision is used in the AI virtual mouse system. In the proposed AI virtual mouse system, the model makes use of the MediaPipe package for the tracking of the hands and for tracking of the tip of the hands, and also, Pynput, Autopy, and PyAutoGUI packages were used for moving around the window screen of the computer for performing functions such as left click, right click, and scrolling functions. The results of the proposed model showed very high accuracy level, and the proposed model can work very well in real-world application with the use of a CPU without the use of a GPU.

## **PROBLEM DESCRIPTION & OVERVIEW**

The proposed AI virtual mouse system can be used to overcome problems in the real world such as situations where there is no space to use a physical mouse and also for the persons who have problems in their hands and are not able to control a physical mouse. Also, amidst of the COVID-19 situation, it is not safe to use the devices by touching them because it may result in a possible situation of spread of the virus by touching the devices, so the proposed AI virtual mouse can be used to overcome these problems since hand gesture and hand Tip detection is used to control the PC mouse functions by using a webcam or a built-in camera.

## **OBJECTIVE**

The main objective of the proposed AI virtual mouse system is to develop an alternative to the regular and traditional mouse system to perform and control the mouse functions, and this can be achieved with the help of a web camera that captures the hand gestures and hand tip and then processes these frames to perform the particular mouse function such as left click, right click, and scrolling function.

## ALGORITHM USED FOR HAND TRACKING

For the purpose of detection of hand gestures and hand tracking, the MediaPipe framework is used, and OpenCV library is used for computer vision [7–10]. The algorithm makes use of the machine learning concepts to track and recognize the hand gestures and hand tip.

### MEDIAPIPE

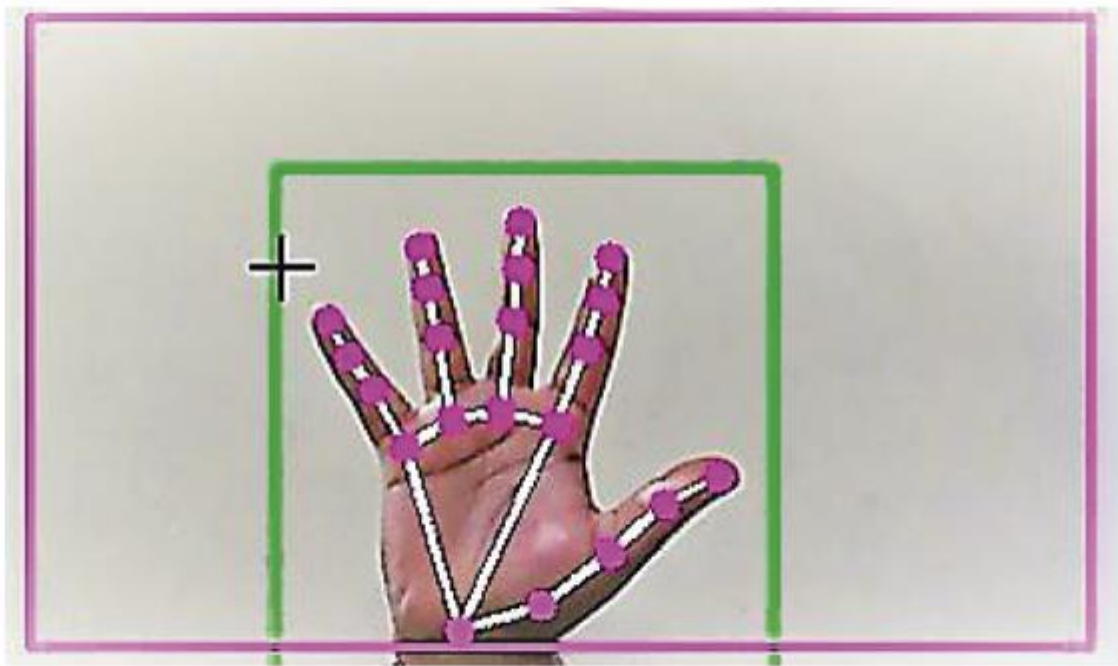
MediaPipe is a framework which is used for applying in a machine learning pipeline, and it is an opensource framework of Google. The MediaPipe framework is useful for cross platform development since the framework is built using the time series data. The MediaPipe framework is multimodal, where this framework can be applied to various audios and videos [11]. The MediaPipe framework is used by the developer for building and analyzing the systems through graphs, and it also been used for developing the systems for the application purpose. The steps involved in the system that uses MediaPipe are carried out in the pipeline configuration. The pipeline created can run in various platforms allowing scalability in mobile and desktops. The MediaPipe framework is based on three fundamental parts; they are performance evaluation, framework for retrieving sensor data, and a collection of components which are called calculators [11], and they are reusable. A pipeline is a graph which consists of components called calculators, where each calculator is connected by streams in which the packets of data flow through. Developers are able to replace or define custom calculators anywhere in the graph creating their own application.

### OPEN CV

OpenCV is a computer vision library which contains image-processing algorithms for object detection. OpenCV is a library of python programming language, and real-time computer vision applications can be developed by using the computer vision library. The OpenCV library is used in image and video processing and also analysis such as face detection and object detection.

## THE CAMERA USED IN THE AI VIRTUAL MOUSE SYSTEM

The proposed AI virtual mouse system is based on the frames that have been captured by the webcam in a laptop or PC. By using the Python computer vision library OpenCV, the video capture object is created and the web camera will start capturing video. The web camera captures and passes the frames to the AI virtual system.

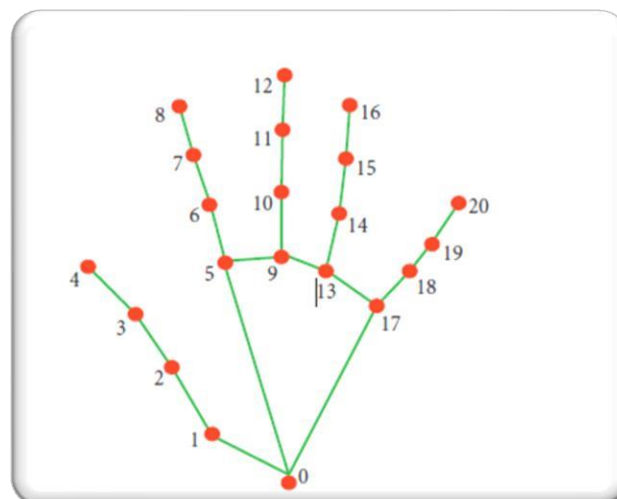


## PROBLEM DEFINITION

Traditional computer mouse or trackpad interactions can be cumbersome and limiting, especially for physically impaired individuals. The objective of the AI Virtual Mouse (Wave Sync) project is to create a gesture-based interface that allows users to control a computer monitor and laptop without the need for an external mouse [2]. This project aims to achieve accurate and reliable gesture recognition using AI algorithms, develop an intuitive user interface, ensure compatibility with various platforms, and assess user experience and potential applications. The ultimate goal is to provide a seamless and efficient alternative to traditional mouse control.

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## METHODOLOGY:

1. **Software Setup:** Set up the software environment for data collection and analysis [1].
2. **Data Collection:** Record a diverse dataset of gestures performed by multiple users to train the gesture recognition system [1].
3. **Gesture Recognition Algorithm:** Develop an AI-based gesture recognition algorithm that accurately interprets the collected gestures [2].
4. **Integration with Devices:** Integrate the AI virtual mouse system with both computer monitors and laptops for seamless control [2].
5. **User Interface Design:** Design a user-friendly interface that allows users to interact with the system easily [2].

## ALGORITHM AND TECHNIQUES USED:

The AI Virtual Mouse system uses the MediaPipe framework for hand gesture detection and hand tracking. MediaPipe is a cross-platform and open- source framework developed by Google for machine learning pipelines, enabling the analysis of audio and video data. The system also employs the Single-shot detector model for real-time hand detection and recognition. OpenCV, a computer vision library, application



## RESULTS

**Accuracy and Precision:** Evaluate the accuracy and precision of the gesture recognition system through various tests.

**User Experience:** Gather user feedback through surveys and usability tests to assess the overall user experience.

**Comparison with Traditional Mouse Control:** Compare the performance and user satisfaction of the AI virtual mouse with a traditional mouse.

## CONCLUSION AND FUTURE SCOPE

The AI Virtual Mouse (Wave Sync) project has shown promising results in providing an intuitive and hands-free computer interaction solution. The system's accuracy and efficiency have the potential to replace traditional physical mice, especially in scenarios where users may face challenges using conventional input devices.

The future scope of the project includes the implementation of smart movement for better coverage, enhancing accuracy and performance through hardware optimization, and expanding the application to mobile devices.

## REFERENCES

- 1) OpenCV Website – [www.opencv.org](http://www.opencv.org)
- 2) MSDN Microsoft developers network – [www.msdn.microsoft.com](http://www.msdn.microsoft.com)
- 3) Code project – [www.codeproject.com/Articles/498193/Mouse-Control-via-Webcam](http://www.codeproject.com/Articles/498193/Mouse-Control-via-Webcam)
- 4) iee







