

VIRTUAL MOUSE USING HAND GESTURES

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Abstract —Hand Gesture Recognition plays a key role in human-computer interactions. As we can see that there are so many new Technological advancements happening such as biometric authentication which we can see frequently in our smart phones, similarly hand gesture recognition is a modern way of human-computer interaction i.e., we can control our system by showing our hands in front of webcam and hand gesture recognition can be useful for all kinds of people. Based upon this idea this paper is presented. With new changes seen in computer technology day by day, it has become quite essential for us to find specific new ways of interaction with computer systems as its need is increasing in society every day. Today, every device is making the use of touch screen technology on its systems, which isn't affordable to be used in all applications. A specific interactive module like a virtual mouse that makes use of Object Tracking and Gestures that will help us to interact can be an alternative way for the traditional touch screen and the physical mouse. The objective is to create an Object Tracking application that interacts with the system.

Index Terms -Object Tracking, Hand Gestures, Image capture, Computer Vision, Open CV, Deep Learning, Image Processing.

I. INTRODUCTION

A Computer Mouse is an input device that helps to point and to interact with whatever that is being pointed. There are so many types of mouse in the current trend, there's the mechanical mouse that consists of a single rubber ball which can rotate in any direction and the movement of the pointer is determined by the motion of that rubber ball. Later the mechanical mouse is replaced by the Optical Mouse. Gestures can be in any form like hand image or pixel image or any human given pose that require less computational difficulty or power for making the devices required for the recognition to make work. Different techniques are being proposed by the companies for gaining necessary information/data for recognition handmade gestures recognition models. Some models work with special devices such as data glove devices and color caps to develop a complex information about gesture provided by the user/human. In a Similar way the virtual mouse that we will discuss in this paper is made up of OpenCV, pyautogui. OpenCV is a python library for computer vision which is used for capturing images from webcam. Pyautogui is a python library that is used for specifying keyboard and mouse operations. Previously when we want to operate and work with system's it's been a really different thing. So once the technology is being developed the things like separate applications and soft wares are created and developed for easy use of system. When the technology had introduced technologies like artificial Intelligence and machine learning they have become booming technologies that help us easily to operate and give commands to systems without any human interactions. So here the model is also a part of these technologies which can help us work with our systems with ease. The techniques are developed in such a way even machine / System have the intelligence that can identify and vary different thing which are easy for human now became easy for systems to understand the same things with a new way of learning. Virtual Mouse using Hand gesture recognition allows users to control mouse with the help of hand gestures and system's webcam is used for tracking hand gestures. Computer vision techniques are used for gesture recognition. OpenCV consists of a package called video capture which is used to capture data from a live video.

II. Problem Description & Overview

The proposed 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. To design a virtual mouse that detects hand gestures and performs mouse operations only using the fingers. we used different combinations of fingers to perform various operations of the mouse according to which particular combination of fingers is recognized. In the proposed system, users don't have to colour their fingers with a specific colour and are not required to use any device or sensors.

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.

III. 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. The algorithm makes use of the machine learning concepts to track and recognize the hand gestures and hand tip.

3.1. Media Pipe.

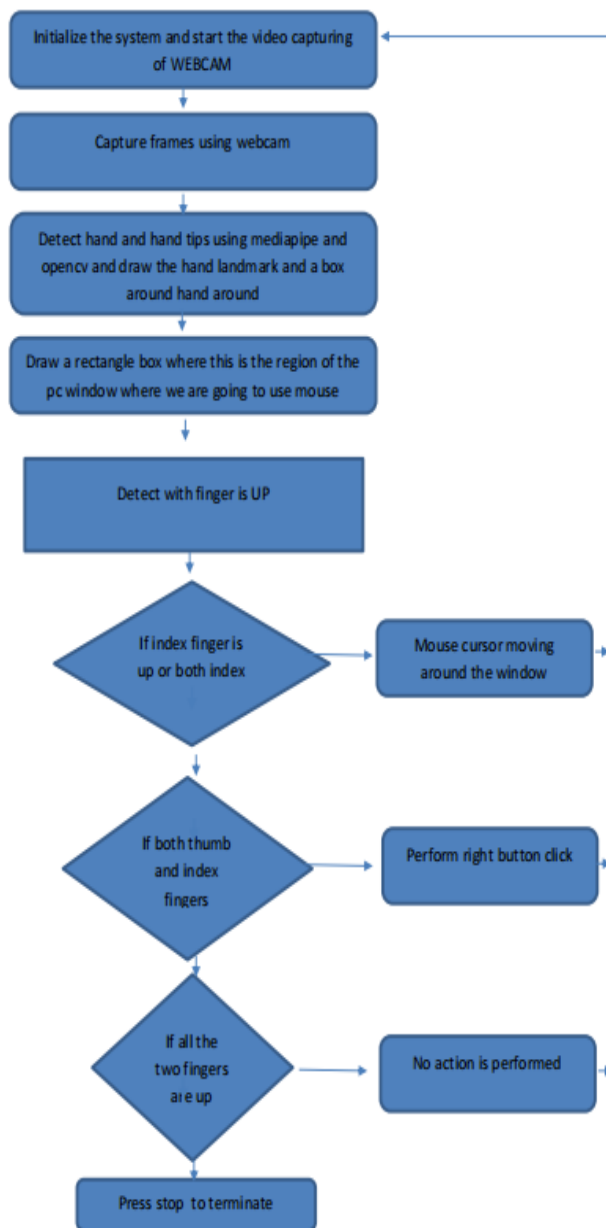
Media Pipe is a framework which is used for applying in a machine learning pipeline, and it is an opensource framework of Google. The Media Pipe framework is useful for cross platform development since the framework is built using the time series data. The pipeline created can run in various platforms 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, 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.

3.2. OpenCV.

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.

IV. Methodology

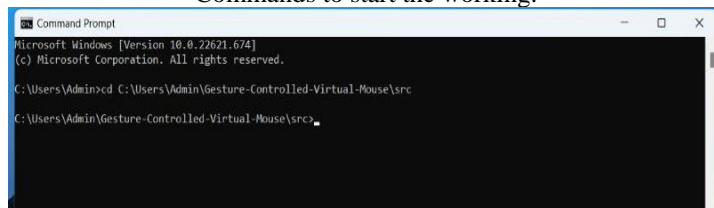
The various functions and conditions used in the system are explained in the flow Diagram of the real-time AI virtual mouse System



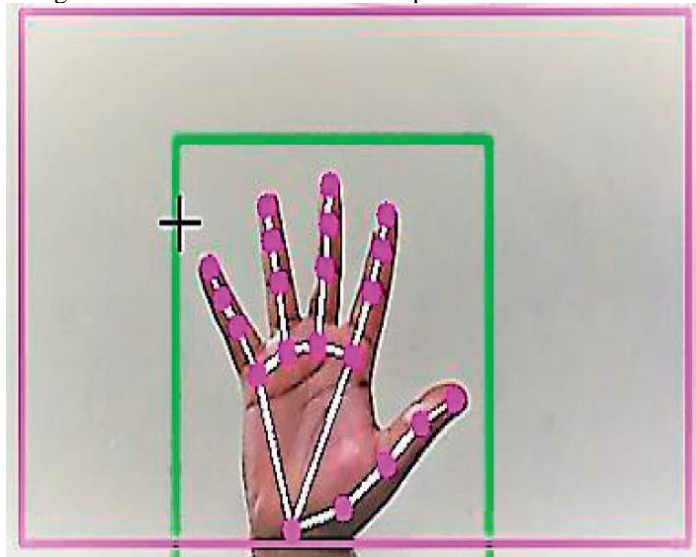
V. Experimental Results and Evaluation

In the proposed AI virtual mouse system, the concept of advancing the human-computer interaction using computervision is given.

Commands to start the working:



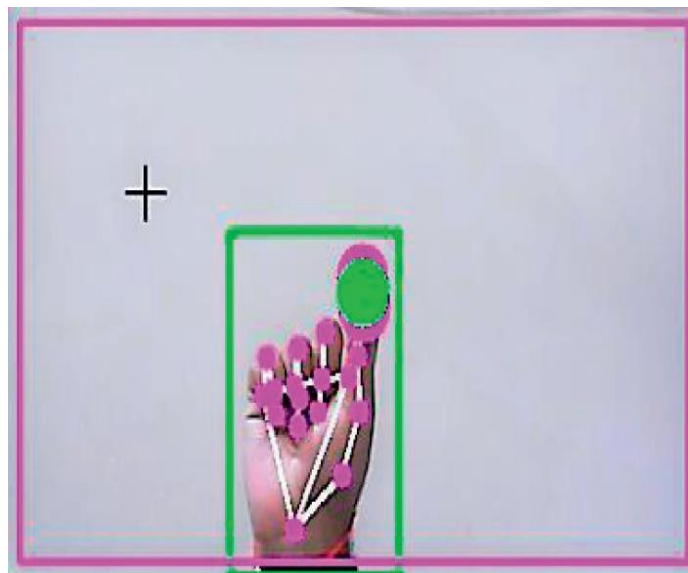
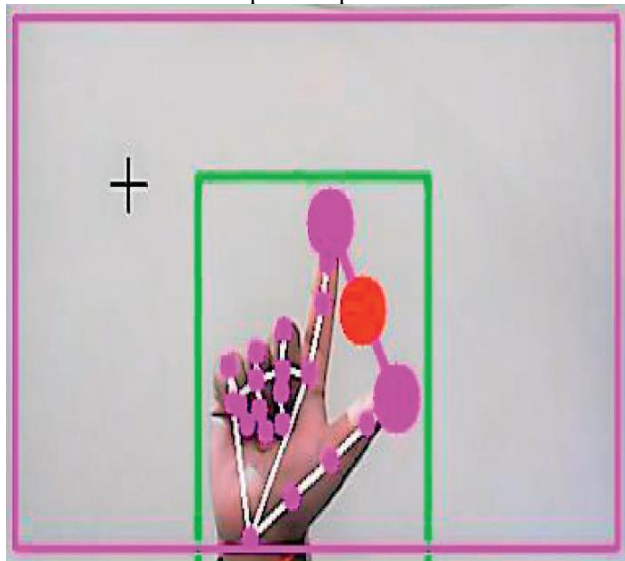
Capturing video using the webcam the area of the computer screen where we can move the cursor.



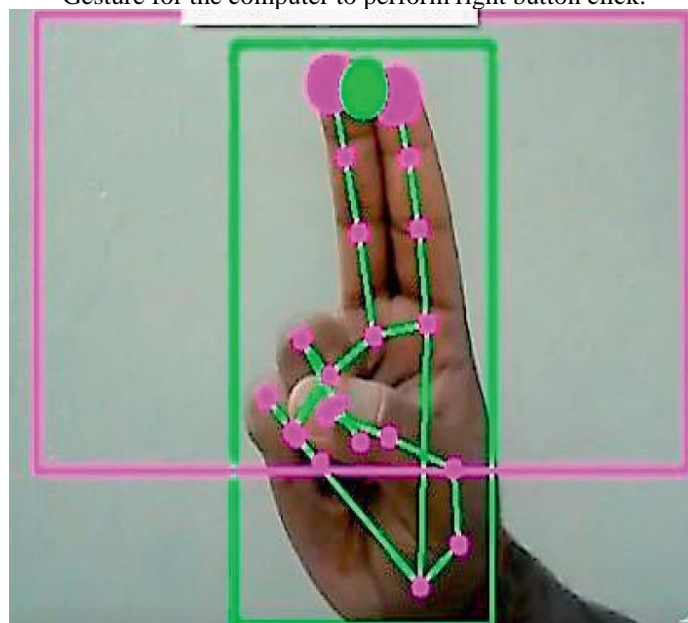
Mouse cursor moving around the computer window.



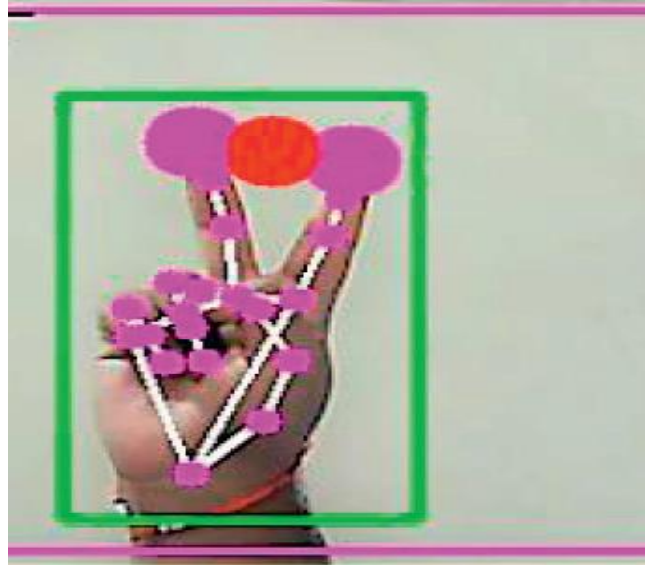
Gesture for the computer to perform left button click.



Gesture for the computer to perform right button click.



Gesture for the computer to perform right button click and scroll down function.

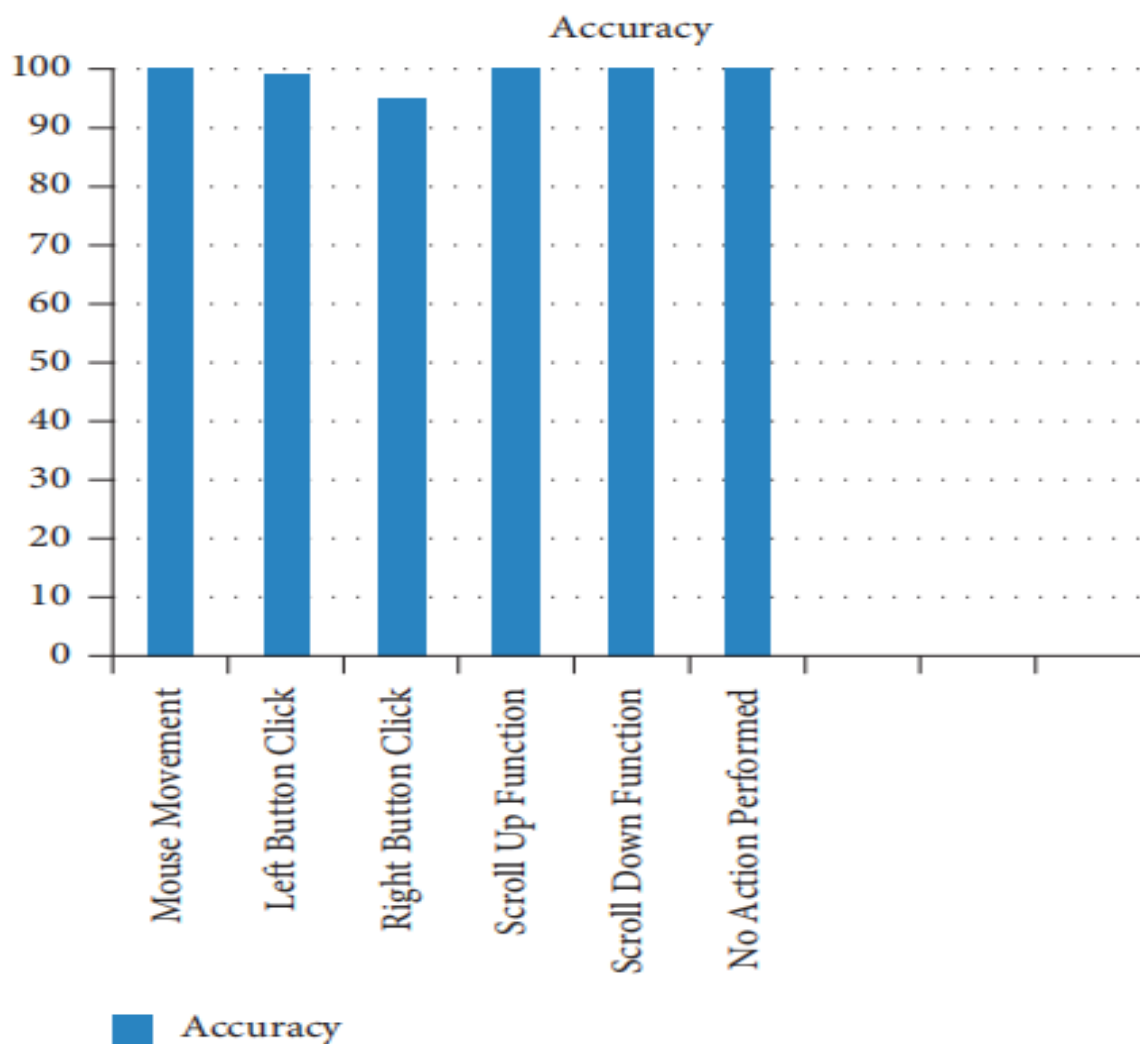


5.1 Comparison between Existing and Proposed

TABLE 1: Experimental results.

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

*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.



VI. FUTURE SCOPE

- We can give more advanced virtual mouse including more facilities.
- Implement some extra features from time to time for enhancing the software quality

The above-mentioned points are the enhancements that can be done to increase the applicability and usage of this project. We have left all the options open so that if there is any other future requirement in the system by the user or students for the enhancement of the application then it is possible to implement them. In the last, we would like to thank all the persons involved in the development of the application directly or indirectly. We hope that the project will serve the purpose for which it is developed thereby underlining the success of the Process.

VII. CONCLUSION

The proposed system can be achieved by using a webcam or a built-in camera which detects the hand gestures and hand tip and processes these frames to perform the particular mouse functions. From the results of the model, we can come to a conclusion that the proposed AI virtual mouse system has performed very well and has a greater accuracy compared to the existing models and also the model overcomes most of the limitations of the existing systems. Since the proposed model has greater accuracy, the AI virtual mouse can be used for real-world applications, and also, it can be used to reduce the spread of COVID-19, since the proposed mouse system can be used virtually using hand gestures without using the traditional physical mouse.

VIII. REFERENCES:

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