

AI Virtual Mouse

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Abstract - In the current situation where we are adjusting our living while being in the pandemic, a touchless mouse controller will be useful to eliminate the risk of spreading infection through touch on public service devices. In this project, we have created an AI-based Mouse Controller. It will first detect the hand landmarks, then track and then perform functions. We have also applied smoothing techniques to make it more usable. The virtual mouse will be operated without touching any device or screen. The domain of the project is AI/ML. The programming language used is mainly Python. This system is based on the concept of computer vision.

Key Words: AI Virtual Mouse, Hand Recognition, OpenCV, Mediapipe, Object Tracking

1. INTRODUCTION

In this high-tech world, it's almost impossible to imagine life without computers. The invention of computers is one of the greatest humankind inventions. Computers have become an essential part of almost everyday use for individuals of every age. In daily life, we interact many times with computers to make our work easier. Thus, Human-Computer Interaction (HCI) has become a hot topic for research.

In our daily life, vision and gestures are important approaches for communication among human beings, and the same role is played by the mouse in Graphical User Interface (GUI) based computers. So, a combined methodology can be used to make a better interactive system for Human-Computer Interaction. Computer vision techniques can be an alternative way for the touch screen and create a virtual human-computer interaction device using a webcam.

In this project, a finger tracking-based virtual mouse application will be designed and implemented using a regular webcam. To implement this, we will be using the object tracking concept of Artificial Intelligence and the OpenCV module of Python.

1.1 Objective

The main objective of this project is as follows:

- To develop a virtual mouse using python programming language which works using hand gestures.

- To create a system which won't require any hardware to operate mouse which will reduce the hardware cost.
- To find an alternative way to use at public places to reduce spread of virus through touch and will help people to return to normal routine after pandemic.

1.2 Limitations Of Existing System

- The existing systems are our traditional hardware mouse devices either wired or wireless to control the cursor. This means the actual hardware device is required. Also, the touchpad in laptops and touch screen devices requires a user to touch the surface.
- Other existing virtual mouse control system consists of a simple mouse operation which uses colored tips like red, green, and blue color. These colored fingers act as an object that the web-cam senses to perform actions and then image processing techniques are applied to them.
- Some existing systems use number of fingers to perform the specific operations (for eg. 1 finger for left click, 2 fingers for right-click, 3 for double click). Such systems are more complex and difficult for the user to use.

1.3 Scope

The scope of this project is to develop a virtual mouse that will be operated without touching any device or screen. In today's world where we are adjusting our living while being in a pandemic, a touch less mouse controller will be useful to eliminate the risk of spreading infection through touch on public service devices. Like a self-ticketing system at the railway station, many people touch the same screen which can increase the chances of virus infection. The virtual mouse can be used without touching the screen. This project can improve the scope of Human-Computer Interaction technology to be explored more.

2. PROPOSED SYSTEM

There is no specific algorithm which we have used for virtual mouse but there are some python's inbuilt modules which will help in processing of this system. So the

modules which we will be using are opencv, mediapipe, numpy, autopy, time, maths.

2.1 Design Details

The system will be taking the real-time video input from the webcam and converting it into array form to find the coordinates of the frame. These coordinates will help the program to locate the fingers in an accurate position and detect which fingers are raised. By identifying which finger is up system will perform certain functions assigned like moving or clicking.

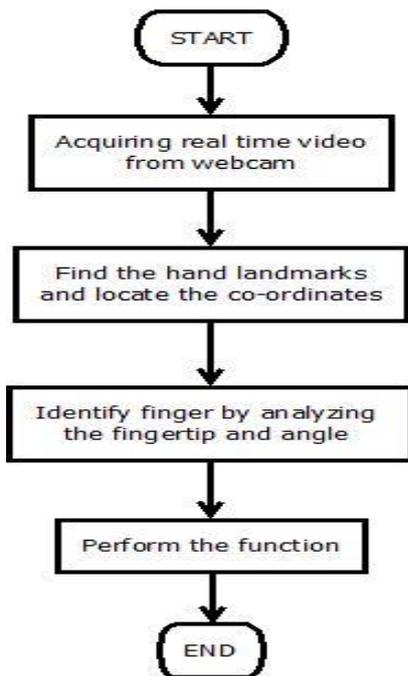


Fig -1: Working Of System

2.2 Methodology

i. Capturing video

The use of the OpenCV module is to capture the real-time video using a webcam which acts as an input for further processing.

ii. Find hand landmarks

Using Python libraries like CV2 and MediaPipe we coded the program to locate the hand landmarks. After recognizing hand it will locate 21 points as shown in the figure.

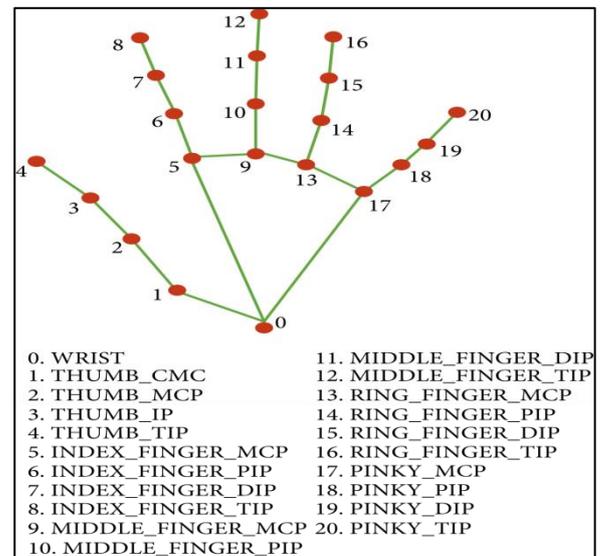


Fig -2: Hand Landmarks

iii. Get the tip of the index and middle finger

We also included different functions in a library named "HandTrackingModule" for simplicity. This module includes the functions for detecting hands, locating fingers, counting which fingers are up, finding the distance between fingers, etc.

iv. Check which fingers are up

Program checks which fingers are up.

- **Index fingers:** If only the index finger is up that means the mouse is in moving mode. Users can move their finger to move the cursor on the screen.
- **Index finger and Middle finger:** If both of these fingers are up then the mouse is in clicking mode. When the distance between these two fingers is short, the clicking function will be performed.

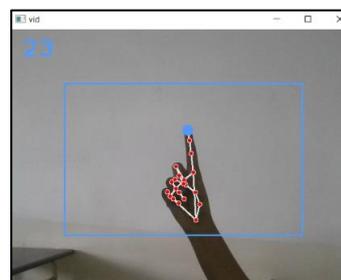


Fig -3: Moving Mode

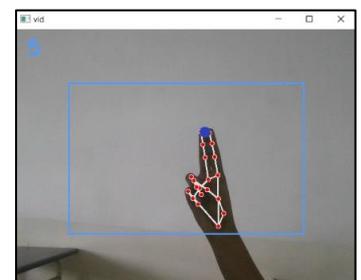


Fig -4: Performing Click Function

v. Convert the coordinates to get the correct positioning

Accurate location tracking of the cursor on the screen is important for the exact working of the mouse.

vi. Implement the functions

By locating the coordinates and tracking the fingers we perform the mouse functions virtually i.e. without any physical contact with the device.

vii. Frame rate

Frame rate helps us to check if the movements of the cursor are smooth or not.

viii. Smoothen the values so the mouse is not jittery

By observing the change in frame rate and movement of cursor we applied some smoothing technique to mouse so that it is easy to use for user.

ix. Display

We also displayed the tracking by webcam to show implementation properly.

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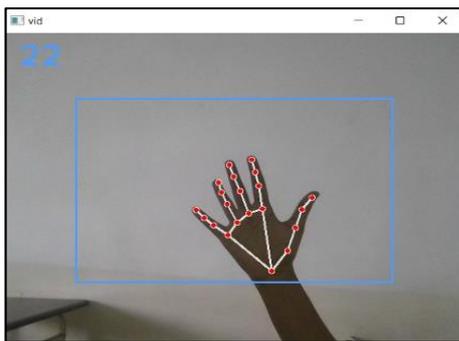


Fig -5: Display

3. CONCLUSIONS

We have developed an AI virtual mouse system using python which can control the mouse functions by using hand gestures instead of using a physical mouse. Our system uses a webcam or a built-in camera which detects the hand gestures and fingertips and processes these frames to perform the particular mouse functions.

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