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Virtual Mouse with hand gestures using AI

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Abstract This research presents a novel system to control a mouse using hand gestures. Traditional mouse controls require the user to use a physical device, such as a trackpad or a mouse. By using hand gestures, the user can interact with the virtual mouse in a more natural manner. The proposed system uses hand tracking techniques to capture and track hand gestures, and uses a set of customizable rules to interpret them into actions. Without using a hardware mouse, the computer can be operated remotely based on hand gestures and can perform left-click and right-click operations. It is based on artificial intelligence for detecting the hands. So, the usage of this virtual mouse will reduce the rapid spread of corona virus by reducing the human-computer interaction.

Keywords— Finger tracking module, Artificial intelligence hand gesture recognition, Virtual mouse.

I. INTRODUCTION

Virtual mouse refers to a computer program that enables users to control their computer cursor or other devices without physically touching them. It is particularly beneficial for people with motor disabilities, physical injuries or disabilities, or anyone who finds it hard to use a traditional physical mouse. The virtual mouse AI uses Media pipe, OpenCV and autopy to track the movements of fingers and move the computer cursor accordingly. The creation of virtual mouse technology has brought numerous benefits to users, including:

1. Accessibility: Virtual mouse AI technology makes computer devices more accessible to people with disabilities or who have difficulty using a traditional mouse.

2. Improving working conditions: Virtual mouse AI technology can reduce the amount of repetitive motion injury in computer-intensive work environments.

3. Efficiency: Using a virtual mouse decreases the amount of time needed to complete tasks by eliminating the need for physical movement across the desktop.

The development of virtual mouse AI technology has had a significant impact on fields such as health care, engineering, productivity, and education, among others. With continued advancements in AI technology, virtual mouse applications are expected to become more prevalent and widely used in our daily lives. The hand gestures are simple form of communication. The moto is to perform various operations that can be performed by a physical mouse. Without using expensive sensors, web cam is used to identify the gesture and perform the required operation. This enables the client to operate the system without involving the usage of any physical device to perform mouse operations. The first step is to identify the fingertip of hand a camera and perform the mouse cursor operations. The structure of this research paper is as below. 2nd section describes the Methodology in detail. 3rd section describes purpose of the project. 4th section describes Related work on this theory. 5th Section describes the proposed system. 6th shows the testing and evaluation of the project. 7th sections show the result. 8th, 9th, 10th describes the conclusion, future scope and some of the References of the project.

II. METHODOLOGY

This study has proposed a novel system to recognize motions, identify fingers tips, and examine the mouse functions. For algorithm implementation, Python programming is used. To process images, operate the mouse, and create multimodal

applications, OpenCV, AutoPy and media pipe library are used.

A. System Design

The proposed Hand Tracking and Gesture structure relies upon the housings gotten using the cam in the PC or computer. Utilizing Python PC visibility module OpenCV, the clips get thing is made and the cam will start recording getting clip. The cam gets and goes through the housings to Hand Tracking and Gesture.

1.Taking the Video and Fining

Hand Tracking and Gesture framework utilizes the cam in every bundling is gotten up to the completion of process. The clip outlines are taken care of converting BGR into RGB covering gaps to see the fingers in the clips outline with outline by displayed in the going with program.

2. Region for functioning through the Window

The Hand Tracking and Gesture structure uses the astounding evaluation, and it changes over the. Unequivocally up to fingers are seen and till we see what tip is ready for playing out the device work, a box in rectangle is shown in regards with PC screen in the cam locale how the moment all through the screen.

3. Detecting finger tips

This process is identifying what tip is up utilizing the finger data of the individual tip which is observed utilizing Media Pipe and separate points of the tips that raised, and as per that, the specific mouse work is performed.

4. For the Movement on Computer Screen

Assuming that the pointer is raised with Id = 1 or two fore tip having Id = 1 and centre tip having Id = 2 are raised, the gesture is designed to move around the PC screen utilizing the Autopy.

5. To detect some gestures

Accepting both the pointer having tip Id = 1 and centre tip having Id = 2 raised and length is below 40 px, the PC response with play out Using the pynput Python library, click the right mouse button. Assuming both the pointer having tip Id = 1 and the centre tip is raised with Id = 2 raised and length is below 40 px and both tips are climbed the screen, the PC used for play out the look into mouse work with Autopy. If none of the fingers are raised, the PC does not do anything.

B. System Description in General

This flowchart shown in the picture of virtual mouse using hand gestures explains the many circumstances and functions employed in the system. The video interface will start after the camera has been detected. From a video interface, the camera can extract and identify human hand motions. Media Pipe is utilized for hand tracking functionality. Once the cursor has been identified, travel in the appropriate direction to carry out tasks like click twice, zoom in and out, and zoom in. A well-functioning web camera is the first crucial piece of hardware. to take control of the mouse's training tool and replace the mouse's operation with the tool. In order to make functioning easier, the item can be employed as our mouse once it has been captured in our frames utilizing OpenCV. The Webcam's function is to record human hand gestures and motions so that its image can be stored in memory. The system's overall diagram is as follow

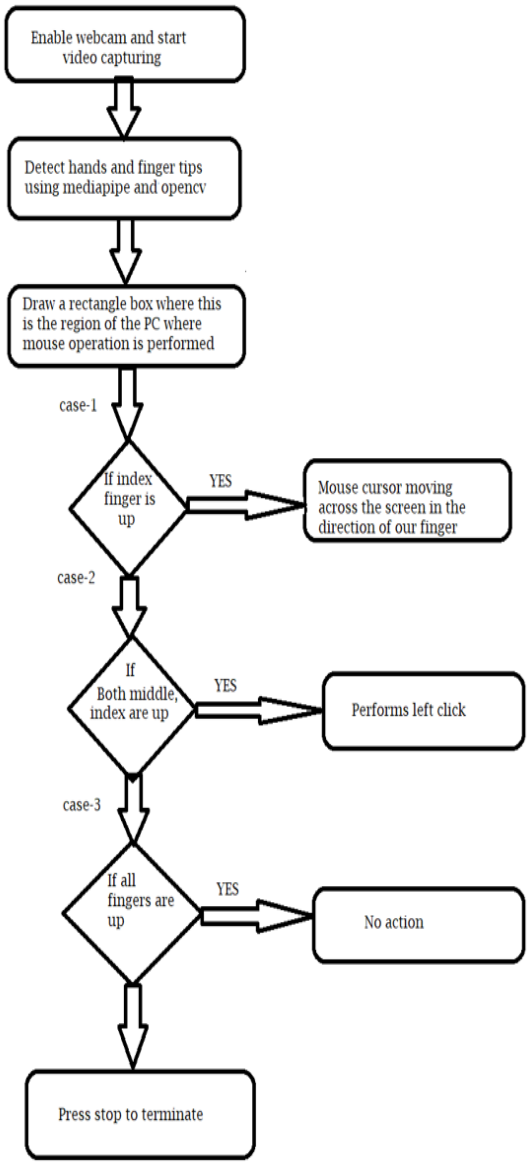

Fig 1: Flow chart

III.PURPOSE OF THE PROJECT

Movement affirmation and following plan is to control the mouse cursor limits by using the hand signals instead of using a certifiable mouse. The proposed plan can be made by using a computer cam or a key cam which sees the hand signals and hand tip and cycles these edges to play out the particular mouse capacities. From the unavoidable consequences of the model, we can show up at an objective that the proposed Gesture affirmation and worldwide situating system has performed well overall and has a more basic accuracy stood separated from the current models and likewise the model setbacks an enormous piece of the obstructions of the current structures. Since the proposed model has more key exactness, the Gesture affirmation and following can be used for authentic applications, and correspondingly, it will by and large be used to decrease the spread of human contact disorders, since the proposed mouse system can be made basically using hand movements without using the standard real mouse.

IV.RELATED ON THIS THEORY

There are numerous applications that use hand gestures to control the cursor. Instead of relying on crude communication, it will provide more advanced human-computer connection.

In 2020 Gubbala Durga Prasanth and P. Srinivas Reddy proposed a paper on “Virtual mouse implementation using OpenCV”. They used OpenCV, Deep learning, NumPy and anaconda technology. Its major drawback is that it is very complex to use. [1]

In 2019 Kabid Hassan Shibly, Samrat Kumar Dey, Md. Aminul Islam, Shahriar Iftekhar Showrav proposed a paper on “Design and Development of Hand gesture based virtual mouse”. They used HCI technology and its major drawback is that it needs good lightning conditions. [2]

In 2020 Vantukala VishnuTeja Reddy, Thumma Dhyanchand, Galla Vamsi Krishna, Satish Maheshwaram proposed a paper on “Virtual mouse using Coloured fingertips and hand gesture recognition” They used Hand gesture recognition, neural networks and PyAutoGUI technologies for development.One of its major drawback is it uses colored fingertips. [3]

In 2020 Monali Christina, A. Daniel Computer, Manthan K. Bhatkar, Ofrin P. Lopes proposed a paper on “Virtual mouse using object tracing”. It uses HCV technique and OpenCV. Its main drawback is that its accuracy varies according to the background it gives 95% accuracy in plain background and 40% in non-plain background. [4]

In 2022 Nishi Jain, Sanjay Jadhav proposed a research paper “AI Virtual mouse using OpenCV python” in JETIR conference 2022. Its main drawback is decrease in accuracy in right click and there are difficulties in clicking. [5]

In 2022 Hritik Joshi, Nithin waybhase, Ratnesh L, Dharmendra proposed a paper on “Design of virtual mouse using gesture recognition and machine learning” in Research square 2022. It main drawback is colour detection algorithm. It can only perform basic operations such as scrolling, selecting and changing slides. [6]

V. PROPOSED SYSTEM

The proposed Hand Tracking and Gesture framework can be utilized to conquer issues when in doubt, for example, conditions where there is no space to utilize a veritable mouse and likewise for people who have issues in their grasp and can't deal with a few purposes. Also, in the midst of the human contact sicknesses circumstance, it isn't defended to utilize the contraptions by contacting them since it could accomplish what is going on of spread of the illness by arriving at the gadgets, so the proposed Hand Tracking and Gesture construction will be utilized for conquer issues because arm motion and finger ID is utilized for a couple of touchless applications. Python code is utilized for empowering the Hand Tracking and Gesture framework, and in addition, OpenCV for PC visibility is utilized for construction. In the proposed Hand Tracking and Gesture system, the model uses the Media Pipe pack for hand tracking and monitoring of the tips of the fingers. The following are the libraries used in implementation of this system.

OPENCV:

OpenCV is a open source computer vision library. It can be installed using "pip install OpenCV-python".

MEDIAPIPE:

An open-source system called Media Pipe can be used to create computer vision inference over any type of sensory data, including audio and video. Three prebuilt libraries for vision, text, and audio are provided by Media Pipe Tasks. Import the audio, text, or visual library into your development project, depending on the Media Pipe Task the app used. It can be installed using “pip install media pipe”.

AUTOPY:

A straightforward, cross-platform GUI automation library for Python is called AutoPy. It has tools for managing the mouse and keyboard, detecting colors and bitmaps on the screen, and showing alerts. It can be installed using "pip install autopy".

VI.TESTING AND EVALUATION

Table1

Hand tip detection	**Function**	**Success**	**Failure**	**Accuracy**
Index Finger up	Move cursor	100	0	100
Index and middle finger up (single tap)	click	98	2	98
Index and middle finger up (double tap)	Double click	98	2	98
Result		296	4	98.6

EVALUATION GRAPH

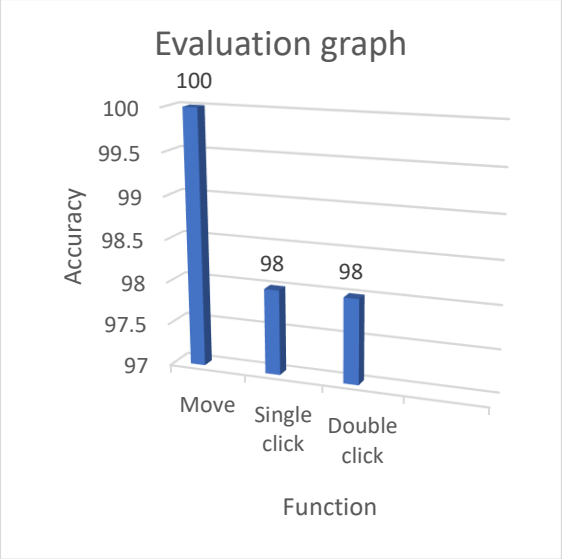

Fig 2: Graph

VII. RESULT

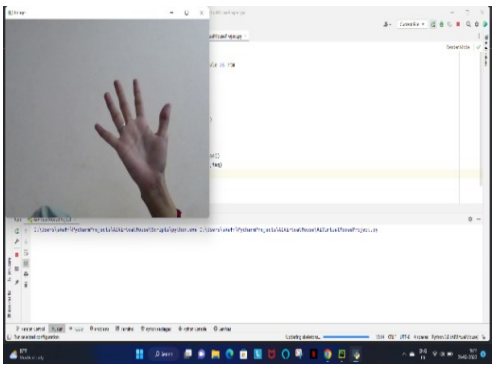

Fig 3: Starting video interface using webcam

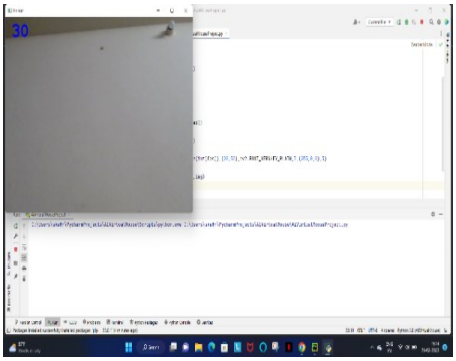

Fig 4: Frame rate and display

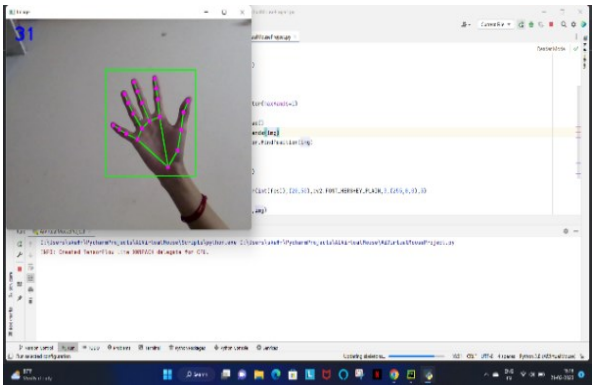

Fig 5: Identifying landmarks

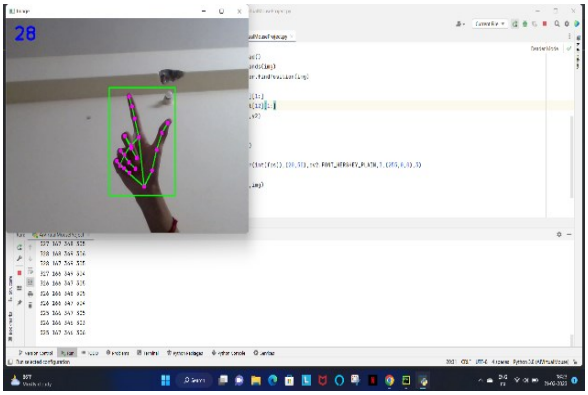

Fig 6: Identification of coordinates

Identifying the positions of the finger:

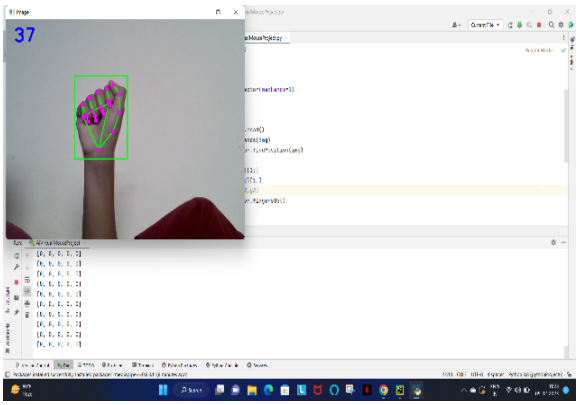

Fig 7: All fingers down

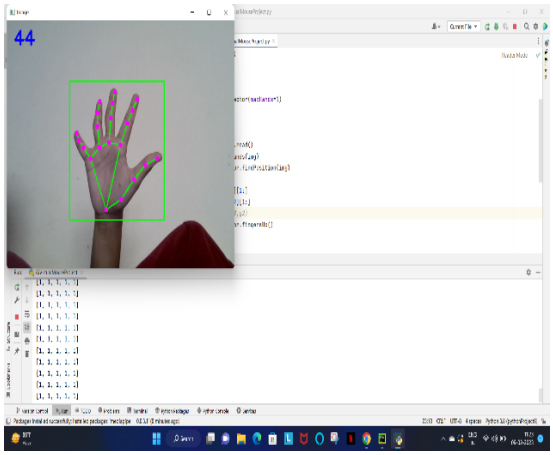

Fig 8: All fingers up

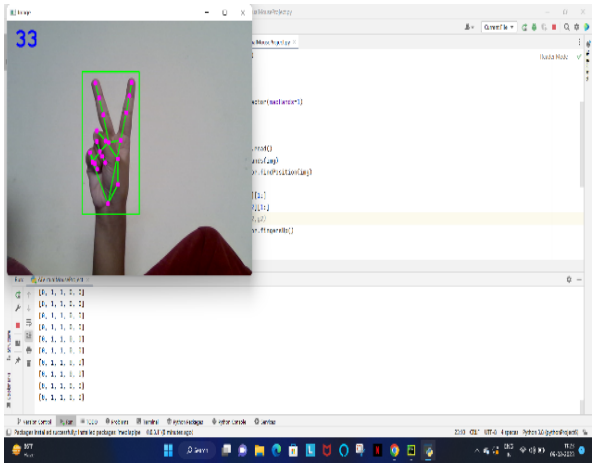

Fig 9: Index and Middle finger up

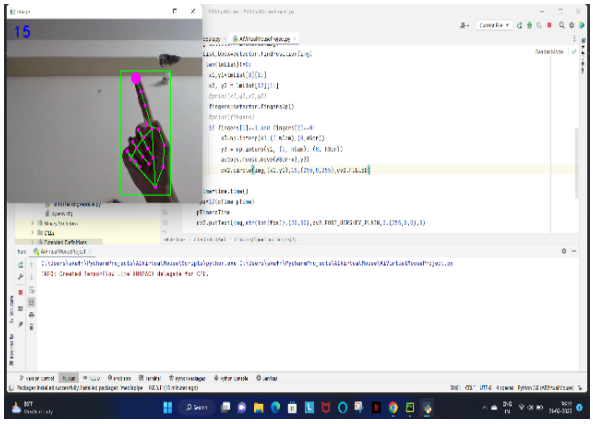

Fig 10: Identification of index finger

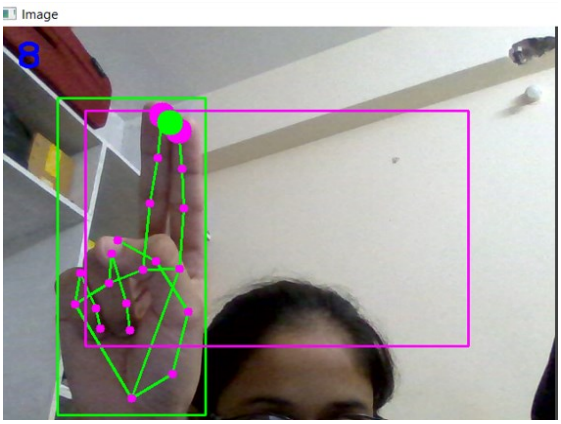

Fig 11: Click and double click

Tapping the index and middle finger for once leads to click as shown in the above fig and twice leads to double-click.

VIII. CONCLUSION

The fundamental objective of the hand gesture-based virtual mouse is to eliminate the need for a physical mouse in favour of hand gestures for cursor control. The virtual Mouse with hand gestures make use of a camera to direct the cursor of mouse and carry out its function. We implemented mouse selection and navigation. This includes icons, their associated duties, and actions like left, right, double click. The model has some drawbacks like dragging and scrolling. In order to get over these restrictions and deliver more accurate results. In the end, we draw the conclusion that working on the projects taught us a lot about how toa use open computer vision, its library, and the python programming language. In a word, it can be said that future goal is to electronically give mouse to students who are physically disadvantaged and students who desire to do away with the physical mouse. The accuracy of this project is 98.6%. The major drawback is that it can perform all cursor operations except scrolling function.

IX. FUTURE SCOPE

This AI-driven device Virtual Mouse enables users to move their hands or make gestures on their computers to control the cursor. It recognises hand

gestures and movements and converts them into cursor movements and clicks using Artificial Intelligence (AI). This technology can be applied in a number of areas, including gaming, processing 3D video content, office work, web browsing, and more. Users benefit from its versatility and ease as they are able to complete tasks without a traditional mouse.

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