

Virtual Mouse Using Hand Gesture

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The field of computer vision is becoming more popular, and technology that is readily available and capable of supporting new advances is being developed and improved quickly. This article discusses and puts into

Abstract - Recent improvements in gesture detection and hand tracking have brought about both opportunities and challenges. Try out a few of these options while outlining challenges and exciting future possibilities for virtual reality and user engagement. Given the popularity of COVID19, the goal of this research is to reduce interactions between people and the reliance on technology to operate computers. These results will motivate additional research and, in the long run, support the use of virtual environments. In the proposed era, there are no such restrictions and gesture recognition may be used as a substitute. It may be possible to click and drag objects during this adventure using a variety of hand actions. The suggested project's input technique will only require a camera. The languages Python and OpenCV.

Key Words: Gesture control, Media pipe, OpenCV.

1.INTRODUCTION

Users who don't have a physical mouse can nevertheless use a virtual mouse to control their computer. Because it utilises a normal webcam, it may be viewed as hardware. Input devices like a genuine mouse or a computer keyboard can be utilised with a virtual mouse. A camera-controlled virtual mouse uses a variety of image processing methods. Mouse clicks are interpreted from user hand motions. The default setting on a web camera is for continuous image capturing. Facial recognition security software has recently started being used on PCs using webcams.

This can be done by utilising the vision-based CC capability of the webcam, which eliminates the need for computer mice and keyboards. A camera can be used for a variety of additional HCI applications, including sign language, databases, and motion controllers. The

Microsoft Kinect and Nintendo Wii are two recent advancements in HCI gaming technology. This new gaming technology has boosted the fun and involvement of playing video games.

A good example of how motion controllers transform gaming is the Nintendo Wii, which sold more than 50 million units in its first year. A Natural User Interface (NUI) is provided by hand gestures, which are highly intuitive and effective for one-on-one computer contact. It's been extensively studied how to control the cursor with hand motions. There are new methods and technologies available. The ability to discriminate between sign languages and HCI makes hand gesture detection essential..

2.BODY OF THE PAPER

LITERATURE SURVEY

We may utilise a hand recognition system to control the mouse pointer, left click, right click, drag, and other fundamental mouse functions in the existing virtual mouse control system. The use of hand recognition won't be around in the future. There are many systems for recognising hands, but the system they used is static hand recognition, which only recognises the shapes that hands make and defines an action for each shape. This system is limited to a small number of defined actions and causes a lot of confusion.

As technology advances, there are more and more alternatives to using a mouse. Gesture Controlled Virtual Mouse makes using a computer with a human being simple by combining voice commands and hand motions. There is very little direct contact with the computer. A voice assistant and static and dynamic hand motions can practically perform all i/o tasks. This project recognises hand movements and verbal commands using cutting-edge ComputerVision and Machine Learning algorithms without the usage of any additional gear. It uses models developed by Media Pipe, which uses pybind11 as its

foundation. We'll utilise ESP32-CAM and OpenCV to build a gesture-controlled virtual mouse. The wireless mouse tracking and clicking functions may be managed using the ESP32 Camera Module and a Python application. To begin, it is necessary to have a firm grasp of Python, image processing, embedded systems, and the Internet of Things. We will first gain an understanding of how to control mouse movement and clicks as well as all of the prerequisites required to launch a Python application. To test the full Python script, we will start by using a webcam or internal camera from a laptop. The second phase will use an ESP32-CAM Module to run the Python code. Therefore, input will be delivered through the ESP32-CAM rather than a computer camera or any other external camera.

The suggested AI virtual mouse system's major objective is to develop an alternative to the current mouse system that can perform and control mouse operations. This can be accomplished with the help of a web camera that captures hand motions and hand tips and processes these frames to carry out a particular mouse action, like a left-click, right-click, or scrolling action. Gesture Controlled Virtual Mouse makes user-computer interaction simple by combining voice instructions and hand motions. There is very little direct contact with the computer. A voice assistant and static and dynamic hand motions can practically perform all i/o tasks.

Table -1: Comparison table

S. No	Name of the journal	Methods Used	Accuracy
1.	Virtual Mouse using Hand Gestures	Human Computer Interaction, Python, Color Detection, Web camera, Hand Gestures.	82%
2.	Virtually controlling computer using hand-gestures and voice	CNN implemented by Media Pipe running on top of pybind11, OpenCV python.	89%
3.	Gesture Controlled Virtual Mouse with ESP32-CAM & OpenCV	ESP32-CAM & OpenCV	83%

PROPOSED SYSTEM

To design a hand-tracking, finger-only virtual mouse that can track movements. We used several combinations of fingers to do various mouse movements, depending on whatever specific combination of fingers was identified. When there is a need to conserve space or when moving about, the use of a virtual mouse might be observed. The proposed system's users are not required to use any gadgets or sensors, and they are not required to paint their fingertips a particular colour.

It makes computer user interaction possible without a hardware mouse device. It is moreover affordable and easy to utilise. For computer vision tasks, the OpenCV library is employed, and the Media Pipe framework is used for tracking and identifying hand movements. The application monitors and differentiates between hand motions and hand tips using machine learning algorithms. A machine learning pipeline uses a Google open-source technology referred to as Media Pipe.

The developer builds systems for application-related reasons as well as for graph-based system creation and analysis utilising the Media Pipe framework. The pipeline configuration is where the actions in the Media Pipe-using system are carried out. The flexibility of the pipeline to run on many platforms enables scalability on desktops and mobile devices.

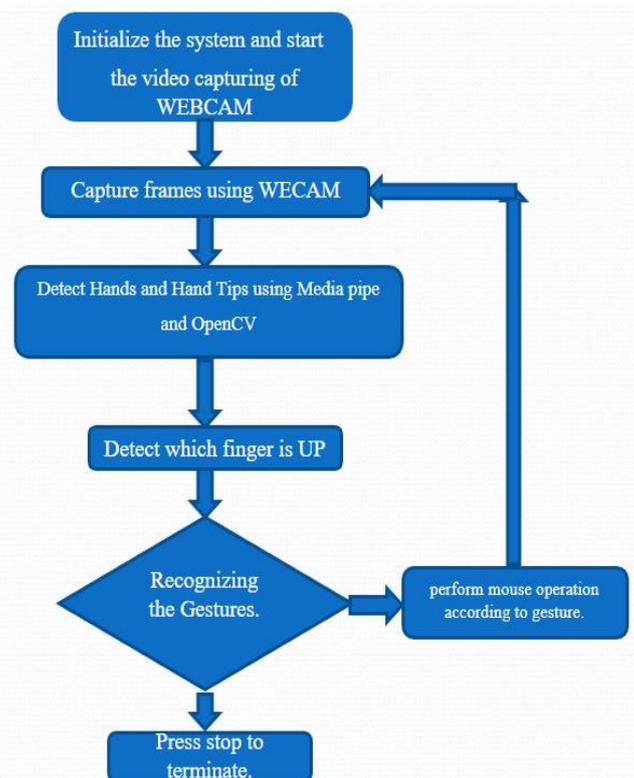


Fig -1: Figure

Algorithm

Step 1: Start the program.

Step 2: Open the file and using that file location go to cmd.

Step 3: Using some libraries installed for the code run the program.

Step 4: Initialize the system and start the video capturing of WEBCAM.

Step 5: Capture frames using WECAM.

Step 6: Detect Hands and Hand Tips using Media pipe and OpenCV.

Step 7: Detect which finger is UP.

Step 8: Recognizing the Gesture.

Step 9: Perform mouse operations according to gesture.

Step 10: Stop the program.

METHODOLOGY

The transformational method is used by the gesture-based virtual mouse system to translate the fingertip's coordinates from the camera screen to the full-screen computer window for operating the mouse. A rectangular box is generated in relation to the computer window in the camera zone where we move the mouse pointer around the window when the hands are identified and we determine which finger is capable of completing the specified mouse operation.

Modules:

- OpenCV
- Media Pipe
- PyAutoGUI
- Math

A. OpenCV

A computer vision package called OpenCV contains techniques for processing images that detect objects. Real-time computer vision applications may be made using the Python computer vision package known as OpenCV. The OpenCV library is used to analyze data from photos and videos, including face and object detection. A free and open-source software library for computer vision and machine learning is called OpenCV. A standard infrastructure for computer vision applications was created with OpenCV in order to speed up the incorporation of artificial intelligence into products. OpenCV makes it simple for companies to use and alter the code because it is a product with an Apache 2 license.

B. Media Pipe

A framework called Media Pipe is a Google open-

source framework that is applied in a machine learning pipeline. Since the Media Pipe framework was created utilizing time series data, it may be used for cross-platform programming. The Media Pipe architecture supports several audio and video formats since it is multimodal. The Media Pipe framework is used by the developer to create and analyze systems using graphs as well as to create systems for application-related purposes. The pipeline configuration is where the actions in the Media Pipe-using system are carried out. Scalability on desktops and mobile devices is made possible by the pipeline's flexibility to execute on several platforms. The three essential components that make up the Media Pipe framework are performance evaluation, a system for accessing sensor data, and a group of reusable pieces known as calculators. A pipeline is a graph made of units called calculators that are connected to one another by streams via which data packets pass. In order to create their own application, developers can add, remove, or redefine custom calculators anywhere in the graph.

C. PyAutoGUI

In essence, PyAutoGUI is a Python software that runs on Windows, MacOS X, and Linux and allows users to imitate keyboard button pushes as well as mouse cursor movements and clicks. A Python package for cross-platform GUI automation for people is called PyAutoGUI. A Python automation module called PyAutoGUI may be used to click, drag, scroll, move, etc. It may be used to click precisely where you want. used to automate the control of the keyboard and mouse. There are several techniques to programmatically control the mouse and keyboard in each of the three main operating systems (Windows, macOS, and Linux). This frequently involves complex, enigmatic, and highly technical elements. PyAutoGUI's role is to conceal all of this complexity behind a straightforward API.

D. Math

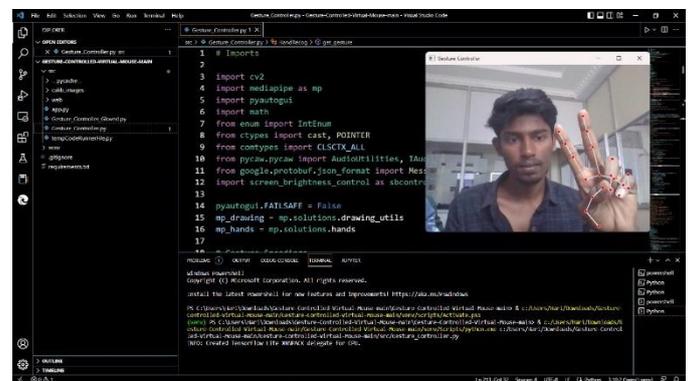
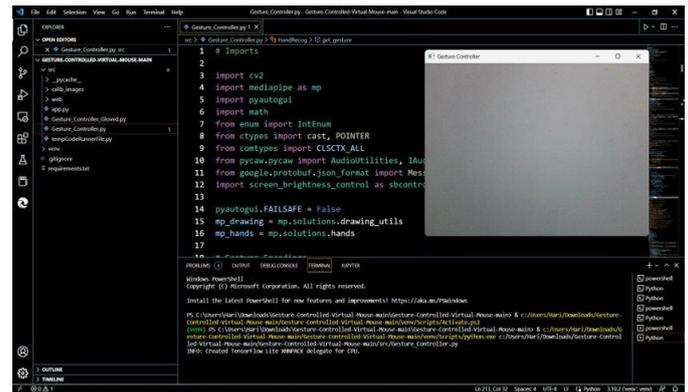
A crucial component created to deal with mathematical operations is the Python math module. It has always been there and is supplied with the default Python version. The majority of the mathematical functions in the math module are only thin wrappers for the C platform's equivalents. The math module is effective and adheres to the C standard since its underlying functions are built in CPython. The Python math module gives you the possibility to perform common and useful mathematical operations within your programme. The Python math module offers a number of pre-set constants. There are many advantages to having access to these constants. One advantage is that by not having to manually hardcode them into your programme, you might save a lot of time. They also guarantee consistency throughout your entire code.

PROJECT DESCRIPTION

As computer use has been engrained in our daily lives, human-computer interaction is becoming more and more convenient. While most people take these areas for granted, people with disabilities frequently struggle to use them properly. In order to imitate mouse activities on a computer, this study offers a gesture-based virtual mouse system that makes use of hand movements and hand tip detection. The major objective of the recommended system is to replace the traditional mouse with a web camera or a computer's built-in camera to perform computer mouse pointer and scroll functions. Real-time detection and identification of a hand or palm is accomplished using a single-shot detector model. The Media Pipe uses the single-shot detector concept. Because it is simpler to learn palms, the hand detection module initially trains a model for palm detection. Furthermore, for tiny objects like hands or fists, the Non maximum suppression performs noticeably better. Finding joint or knuckle coordinates in the hand area is a model for a hand landmark. The camera frames from a laptop or PC serve as the foundation for the planned Gesture virtual mouse system. The video capture object is constructed using the Python computer vision package OpenCV, and the web camera begins recording footage. The virtual system receives frames from the web camera and processes them. The transformational method is used by the gesture-based virtual mouse system to translate the fingertip's coordinates from the camera screen to the full-screen computer window for operating the mouse. A rectangular box is generated in relation to the computer window in the camera zone where we move the mouse pointer around the window when the hands are identified and we determine which finger is capable of completing the specified mouse operation.

RESULT

As computer use has been engrained in our everyday lives, human-computer interaction is becoming more and more convenient. While most people take these areas for granted, people with disabilities frequently struggle to use them properly. In order to imitate mouse activities on a computer, this study offers a gesture-based virtual mouse system that makes use of hand motions and hand tip detection. The main goal of the suggested system is to swap out the conventional mouse for a web camera or a built-in camera on a computer to perform mouse pointer and scroll tasks.



3. CONCLUSIONS

The virtual mouse system's main objective is to eliminate the need for a hardware mouse by allowing users to manage mouse cursor functions with hand gestures instead. The described method can be used with a webcam or an integrated camera that analyses frames to recognise hand movements and hand tips and execute specific mouse actions. The model has some shortcomings, including some difficulties with dragging and clicking to select text and a slight loss of precision in right-click mouse capabilities. We will now concentrate on improving the fingertip identification algorithm in order to overcome these limitations.

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