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FREE GUY- A Hand Gesture Game Based on ML

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Abstract- *Human Computer Interaction techniques became a bottleneck within the effective utilization of the obtainable info flow. The development of user interfaces affects changes in the Human Computer Interaction (HCI). The naturalness and intuitiveness of the hand gesture has been a major motivating factor for researchers in the HCI field to invest their efforts in researching and developing the most promising means of Human-Computer Interaction. This paper will let you know about the creation of hand gesture recognition program and implementation of its techniques in the computer game by controlling the movements of character introduced. The machine learning part is accomplished by the libraries like Tensorflow and OpenCV for setting up the detection, recognition and image processing techniques.*

Keywords: *HMI (Human Machine Interaction), Tensorflow, OpenCV, Image Processing Techniques*

I. INTRODUCTION

Hand gestures are an aspect of body language that can be conveyed through the center of the palm, the position of the finger, and the shape constructed by the hand. Hand gestures can be categorized into static and dynamic. As the name suggests, static gesture refers to the stable shape of the hand, while dynamic gesture includes a series of hand movements such as waving. Research files based on manual gestures have adopted different techniques, including those based on computer vision technology and instrumented sensor technology.[1] The vital goal of constructing hand gesture recognition system is to create a hands-free interaction among human and computer in which the identified gestures may be used for controlling a robot or conveying significant information. Human-Computer Interaction (HCI), also known as Human-Machine Interaction (MMI), denotes the relationship between man and the computer, or more precisely the machine, and since the machine is unsuitable without proper use of people. There are main traits ought to be deemed whilst designing a HCI system as referred to in capability and usability. System capability noted the set of features or offerings that the system equips to the users, even as system usability noted the extent and scope that the system can function and carry out unique person functions efficiently. The system that attains a suitable stability among those ideas taken into consideration as influential overall performance and effective system.[2]

This system is consequently geared toward investigating and growing a Computer Control (CC) system with the use of hand gestures. In order to harness the entire capability of a webcam, it can be used for imaginative, and prescient primarily based totally CC, which could effectively cast off the want for a computer keyboard.[3]

II. PROBLEM DEFINITION

With rapid changes in the technology and with increasing use of computer advancements there is a demand for friendly and easy interfaces to communicate with the machines. So Human Machine Interaction is a realistic term which refers to communication and interaction between human and a machine via user interface. Using hand gesture recognition as a real time input is a better way of communication with computer through more natural and intuitive behavior. Earlier gaming with computers accessories like keyboard, mouse, joystick, etc. has always been a repetitive thing for gamers and when for long hours of usage, it becomes a repetitious task. This ultimately affects in the game company's loss as gamers get fed up with all this. In order to make this gaming world more interactive, attractive and more enjoyable, it is necessary to make a new way to play and use games. Ahead of all this it is necessary for a revolution to occur in order to make new developments, generate new opportunities for the gamers to play games in a new operative way.

So basically, we are focusing towards two major things. A) To minimize the interaction between human and machines as natural as human interactions. B) To reduce the need for any input space i.e., the input devices and so can be implemented by inputting the data by just executing bare hand gesture.

III. TECHNOLOGY USED

[A] Python is a computer programming language frequently used to construct web sites and software, automate tasks, and behavior statistics analysis. Python is a preferred motive language, which means it could be used to create plenty of exceptional applications and isn't always specialized for any particular problems. We used python as our base language for programming the hand gesture software. Mediapipe is a library used for constructing multimodal pass platform implemented Machine Learning pipelines. With this library a pipeline may be constructed as graph of modular components.[4]

Hand Landmark Model:

As the name specifies this model places and distinguishes each joint of the hand that is visible in the screen to track the movements.

Fig-1: Hand Key Points.

BlazeHand:

BlazeHand after detecting the hand position from the input image with BlazePalm, points of the hand are detected from the live hand image with BlazeHand. The hand detection by BlazePalm is very demanding.[4]

Fig-2: Hand Detection by BlazePalm

TensorFlow is an open source library created and maintained by Google. The API is mainly for the Python. Not like different numerical libraries meant to be used in Deep Learning like NumPy, TensorFlow turned into designed to be used each in studies and improvement and in producing systems.[4]

[B] 1) About unity:

We had to make something that would connect properly help us to show the hand gestures technique, so we thought of making a game using Unity as it was the best option for us according to the knowledge we have. Unity is a cross-platform game engine with a built-in IDE developed by Unity Technologies. It is used to develop video games for web plugins, desktop platforms, consoles, and mobile devices. Unity provides us with multiple platforms like 2D,3D, etc. We chose to go with the 3D platform game to show a more detailed explanation of the project.[6]

2) Mixamo:

Then according to our game, we started importing the assets into Unity. The model was imported using the online site known as Mixamo. It is a web-database of characters and mocap animations that anyone can access to be utilized in art projects, movies, and games. It is a particularly user-friendly program aimed toward people with little to no experience in creating and animating characters.[5]

Fig-3: Arena and Character in Development

3) C# (c sharp language)

C# is pronounced as "C-Sharp". It's an object-acquainted programming language created by Microsoft that runs on the **.NET Framework**. C# has roots in the C family, and the language is close to other popular languages like C and Java. The first interpretation was released in time 2002. The rearmost interpretation, C# 8, was released in September 2019. C# is used for Mobile operations ,Desktop operations, Web operations, Web services, Web spots ,Games , VR ,Database operations.[5]

4) Why Use C#?

a) It's one of the most popular programming languages in the world b) It's easy to learn and simple to use c)It has a huge community support.[5]

Fig-4: Front and Back view of the character

IV. METHODOLOGY

To incorporate all the future problems, we imported all of the required packages in the begin of software at the same time as programming the hand gesture program. Various applications like OpenCV, MediaPipe, Tensorflow and Numpy have been used. Right after uploading the packages the fundamental issue is to initialize them in an effort to get their benefits. Next comes the venture of capturing and studying the frames. This venture is performed with the aid of using OpenCV. The `cap.read()` function is used for reading and `cv2.flip()` flips the frames horizontally following with the `cv2.waitKey()` function which displays the live feed. Then using `mpDraw.draw_landmarks()` function we draw all the landmarks in the frame. This landmark model is a crucial element of the code because it facilitates to become aware of the gestures made through the consumer through marking numbers on every joint of the hand. Capturing frames need to be accompanied through studying it and studying them. The `model.predict()` function takes a list of landmarks and returns a prediction of the hand gesture made by the user.[4]

After the development and creation of game arena and character and setting up the hand coordinates for the movement of character, the hand gesture codes programmed in python and game and character codes in C-sharp need to be linked for continuous communication between the game and code. For this, "socket" library in python was imported and the hand gesture code was put inside the code and then it was connected with the c-sharp code and the game was established with continuous communication with the hand coordinates and the character responded to the hand gestures captured via webcam and processed by the program. [4]

Fig-5: Methodology

V. FUTURE SCOPE

This implementation can be considered as a starter to the HCI operation grounds, thus large upgradations can be done to it. This implementation can be extended out to the mouse cursor control also using some further HCI generalities & Open CV Algorithms. Much more accuracy can be obtained with the help of Neural Networks based logics. Tracking performance can be improved to ensure better results. The accuracy of the hand gesture recognition can be improved if the template matching hand gesture recognition method is used with a machine learning classifier. This will take a lot longer to implement, but the accuracy of the gesture recognition will improve.

VI. CONCLUSION

The machine vision grounded keyboard cursor control using hand gesture system is developed in the Python language, using the Open CV library. The system is suitable to control the movement of a keyboard cursor by tracking the individual hand for playing a game. The keyboard cursor functions will perform by using different hand signals. The system has the eventuality of being a feasible relief for the computer keyboard, still due to the constraints encountered; it cannot fully replace the computer keyboard. The delicacy of the hand gesture recognition can be bettered, if the template matching hand gesture recognition system is used with a machine learning classifier. Open CV substantially stretches towards real- time vision operations and takes advantage of MMX (Multimedia Extension) and SSE (Streaming SIMD Extensions) instructions when available.

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