AI Virtual Keyboard For Typing

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Abstract — **Today, technology-based navigation is used to make users comfortable and communicate, safety information, daily work convenience, etc. Human has changed the world and his lifestyle to meet the needs. In this case, hand gesture information offers users another way to interact with humans, machines or robots. That's why we want the character input system to use the virtual keyboard as hand analysis. Information from previous guidance is used to define the proposed model. Experimental results show that gesture recognition is best. Along with many other virtual gesture keyboards available, our keyboard is based on artificial intelligence and is more responsive than existing ones. We can also reduce the complexity of the system and make it easier to work with the system, which can make the user's work more flexible and at the same time reduce the cumbersomeness of the system. The addition of artificial intelligence is what makes it so advanced. The project was built in Pycharm software using python and OpenCV and using libraries like mediapipe and CVzone.**

Keywords— Virtual keyboard, CVZone, Mediapipe

I. INTRODUCTION

New human-computer interfaces have been designed to offer multiform interactions as the demand for computing environments changes between people and computers. Yet, the keyboard and mouse continue to be the primary means of communication between people and computers.Desktops and laptops employ a keyboard to enable human-computer interaction.Although the keyboard is not very portable as a typical and traditional human-computer interface, users nonetheless accept it in most cases. Keyboards will continue to be the preeminent interface for text input until trustworthy natural language interfaces are made accessible.

The Virtual Keyboard is a cutting-edge technology that we are showcasing here. The virtual keypad has no physical form, as its name suggests. A virtual keyboard is a programme that virtualizes a physical keyboard with several layouts, enabling the user to alter the layout according to the application.The head tracking, gaze, speech recognition, and hand gesture forms of user interfaces are specifically being coupled with the technologies.Virtual reality (VR) and augmented reality (AR) technology have recently been used in a variety of fields, including games, education, health care, video, and sports. Gestures are one of the features that is frequently employed ,since anyone may easily and rapidly control a machine. Along with future virtual office environments will require developing effective and practical text entry systems. In this paper we propose a virtual keyboard that detects gestures,clarifies and applies gestures to the interface of virtual keyboard layout.

The rest of this article is organized as follows. Section II provides the literature review. Proposed methodology in section III. CVzone is presented in Section IV and mediapipe in Section V.Details about user interface is given in Section VI. Finally, Section VII concludes this article.

II. LITERATURE REVIEW

In order to solve the issue that a colour-based GR method does not perform well when the background colour is comparable to the skin color, the VKB algorithm uses a

DL-based GR approach.To get over the problem of the finger travel time, it expands a previous one-hand VKB layout to an ambidextrous VKB layout.To be more precise, only the index figure is moved while keeping the click gesture if the current key is close to the prior key[1].The proposed system describes the design, implementation and evaluation of a text input system called Air Typing, which requires only a standard camera and enables a user to type The steps in the proposed system include Image Capturing,Pre-processing,InvertImage,Connected,Component detection, Determining the Edges[2].To prepare the image for edge recognition and forthcoming processing, unwanted pixels are removed using morphological procedures like erosion and dilation. The fingertip required for key selection is likewise kept apart from the virtual keyboard using this technique[3].

When typing is done with both the left and right hands, an ambidextrous layout is suggested.Here is a new virtual keyboard that recognises finger gestures in an effort to speed up typing by utilizing the freedom of hand mobility.[4].The computer's camera will be able to read a picture of various hand movements made by a person.The computer's Mouse or pointer will move in accordance with the movements of the gestures; you can even use separate gestures to accomplish right and left clicks[5].This method is a new type of virtual keyboard that allows users to type at any level on any device. The virtual keyboard is customized and printed on plain paper so you can place it on an incline or tape it to the wall. Capture the complex movements of human hand gestures using 3D hand models[6].Depending on the gesture movement, the computer mouse or cursor may move and even perform right and left clicks with different gestures. The only hardware in the project is the webcam and the coding is done in Python using the Anaconda platform. [7].

III. PROPOSED METHODOLOGY

A result of developments in computer vision and machine learning technology, AI virtual keyboard is using hand tracking with CVzone and Mediapipe. Modern algorithms and models are used to quickly and accurately translate the user's hand movements into virtual keystrokes by properly detecting and tracking those movements in real-time.

One of the main advantages of the AI virtual keyboard with hand tracking is its adaptability. The system can be altered to support a number of hand gestures and input methods, including finger tapping, finger swiping, and even hand motions for virtual reality or gaming applications. It may therefore be customized to satisfy a range of needs and use cases because it is a versatile and adaptable technology.

Any webcam-equipped device, whether a laptop, tablet, or smartphone, may be used with the system, which is also quite portable. It becomes a convenient and user-friendly mobile input technique as a result.

Modern technology offers various advantages over conventional input methods, such as the AI virtual keyboard that combines hand tracking with CVzone and Mediapipe. It provides a clean, touchless interface, is very customizable and versatile, and can be used with a variety of hardware configurations.The system has the potential to significantly modify how we interact with computers and other technology, making research and development in this area fascinating and productive.

With the use of CVzone and Mediapipe's AI virtual keyboard with hand tracking, users may type on a keyboard without a physical input device, which is a novel and cutting-edge technological advancement. To transform the user's hand gesture into virtual keystrokes, the system tracks them usingcomputer vision algorithms.

In comparison to conventional physical keyboards, this technology offers a number of advantages,including a touchless and hygienic interface that can be especially helpful in settings where hygienic conditions are crucial, such as hospitals and public places. It is also very flexible as and has configurable gestures.

Depending on the particular use case and specifications, the AI virtual keyboard can be implemented utilizing a variety of hardware configurations, such as single-camera or multi-camera setups. To precisely detect and track hand movements and convert them into virtual keystrokes, the system employs Mediapipe's hand tracking and landmark estimation models, as well as a hand gesture recognition algorithm.

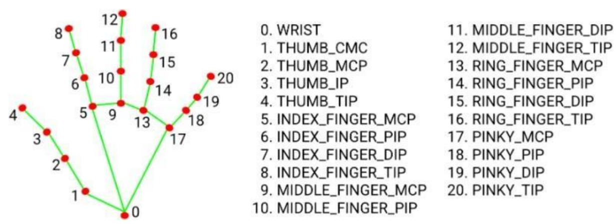

Fig. 1. Hand Landmarks

IV. CVZONE

A variety of computer vision tools and functions are available for developers through the open-source computer vision library known as CVzone. With the use of a combination of skin color segmentation and template matching approaches, the hand tracking module in CVzone is a well-liked tool that allows programmers to follow hand movements in real-time video streams. We will give a thorough description of the algorithm utilized in the CVzone hand tracking module in this article.

Step 1 : Segmenting skin tones

Skin color segmentation on the input video stream is the initial stage in the CVzone hand tracking algorithm. By doing this, the areas of the image that are most likely to contain a hand are located. By transforming the input video frame from the RGB color space to the HSV color space, the skin color segmentation is carried out. The areas of the image that match the skin color are then found by looking at the hue, saturation, and value (HSV) components of the picture. This is commonly accomplished by applying a threshold to the image's HSV components to separate the regions with skin tones.

Step 2 : Morphological operations

The next stage is to carry out morphological procedures to eliminate noise and fill in gaps in the segmented image after the skin color regions have been detected. A group of image processing methods known as morphological operations work on the structure and form of the image. Erosion and dilation are the morphological procedures that are most frequently utilized in hand tracking systems. Small, isolated portions of the image are removed using erosion, and spaces between sections are filled by dilation.

Step 3 : Manual template matching

The segmented image is compared to a hand template as the next stage in the CVzone hand tracking algorithm to determine where the hand is. The shape and organization of a hand are represented by the hand template, a binary picture. Using a correlation-based matching technique, the segmented image is compared to the template. The algorithm looks for the region that most closely resembles the template by comparing it to various segments of the segmented image. The location of the hand is established once a match is discovered.

Step 4 : Monitoring hand motions

Tracking the hand's motions in succeeding video frames is the last step of the CVzone hand tracking algorithm. This is accomplished by combining Kalman filtering with optical flow techniques. A computer vision method called optical flow monitors the movement of pixels between subsequent video frames. Kalman filtering is a statistical method that infers an object's current position and speed from its prior position. By combining these methods, it is possible to determine where the hand is in each video frame and follow its movements over time.

In conclusion, the CVzone hand tracking module detects and tracks hand movements in real-time video streams by combining skin color segmentation, morphological processes, hand template matching, and tracking algorithms. With the help of this algorithm, programmers may create hand tracking applications for a variety of industries, such as gaming, virtual reality, and augmented reality.

V. MEDIAPIPE

An extensive selection of computer vision and machine learning techniques, including a hand tracking module, are offered by the well-known open-source library known as Mediapipe. The Mediapipe hand tracking module detects and tracks hand movements in real-time video streams by combining Convolutional Neural Networks (CNNs) and geometric reasoning techniques. The algorithm employed by the Mediapipe hand tracking module will be thoroughly described.

Step 1 : Detection of a palm

In the input video stream, the Mediapipe hand tracking algorithm starts by seeing the hand's palm.Using a detector built on CNN that has been trained to recognise the characteristics of the hand palm, this is accomplished. The CNN model is capable of reliably detecting the palm of the hand even in challenging lighting circumstances because it was trained on a sizable dataset of hand photos.

Step 2 : Estimating hand landmarks

In order to determine the locations of hand landmarks like the fingertips and the base of the thumb,the hand palm must first be identified. Using a second CNN model that has been trained to identify the landmarks based on the location of the palm, this is accomplished. Even when the hand is partially obscured or moving, the landmark estimation algorithm is able to determine the locations of the landmarks with accuracy.

Step 3 : Calculating the hand pose

Estimating the hand's posture, or the hand's orientation and location in three dimensions, comes after the landmarks for the hand have been determined. A geometric reasoning technique is used to accomplish this, fusing the known geometric structure of the hand with the estimated landmark positions. Even when the hand is in complex positions or orientations, the algorithm is still able to predict the hand pose accurately.

Step 4 : Hand tracking

These video frames are tracked as part of the Mediapipe hand tracking algorithm's last stage. For this, the hand pose in each frame is continuously approximated, and the estimated pose is used to track the hand's progress. The hand can be accurately tracked by the tracking algorithm even when it is moving swiftly or changing orientation, and it can deal with occlusions and variations in lighting.

Finally, the Mediapipe hand tracking module detects and tracks hand motions in real-time video streams by combining CNN-based landmark estimation, detection, and tracking algorithms. In a variety of industries, such as gaming, virtual reality, and augmented reality, this algorithm gives programmers a potent set of tools for creating hand tracking applications.

VI. USER INTERFACE

The evolution of technology has changed the way we interact with our devices, and one notable advancement is the arrival of AI virtual keyboards. Powered by artificial intelligence, these virtual keyboards have revolutionized the text input user interface on a variety of devices, including smartphones, tablets, and computers. Here we will explore the features and benefits of the AI virtual keyboard user interface.

The user interface of AI virtual keyboards is designed to be highly intuitive and user-friendly. These keyboards use the power of AI algorithms to analyze user input and provide accurate predictions, corrections, and suggestions in real time.The interface is typically minimalist, with a clean and elegant design that favors ease of use. The keys are usually large and well-spaced, so users can comfortably type with precision even on smaller screens.

The keyboard layout, theme, and other visual elements are typically customizable by the user. With gesture typing, users may connect letters to form words by moving their finger across the keyboard. This feature makes it possible for users to type on larger devices like tablets using just one hand and without taking their finger off the screen.

In addition to the above features, the AI virtual keyboard user interface also favors accessibility. These keyboards often come with built-in accessibility options such as larger keys for users with motor disabilities, haptic feedback for users with visual impairments.

Webcam and Mediapipe hand tracking are used to create an easy-to-use user interface for a basic AI virtual keyboard used for typing.The user's screen usually displays the interface, which consists of a virtual keyboard that can be operated using hand motions detected by the webcam.

The user moves their hand in front of the webcam to use the virtual keyboard, and Mediapipe's hand tracking technology recognises the hand's location and movements. The user can then control the cursor location and choose keys by moving their hand in the desired direction after the virtual keyboard has been displayed on their screen.

The virtual keyboard can be altered to support various keyboard layouts and linguistic systems, making it usable across a wide range of nations and geographic areas. Many hand gestures and input modalities, including finger tapping, finger swiping, and even hand movements for virtual reality or gaming apps, can be supported by the interface with bespoke customization. The user is allowed to select the input technique that seems most natural and comfortable to them.

Essentially, the Mediapipe basic AI virtual keyboard's user interface is designed to be easy to use and relies on webcam and hand tracking. Users may text on a virtual keyboard without a physical input device thanks to its touchless, hygienic interface, which is highly customizable and adjustable to satisfy a variety of use cases and needs.

VII. CONCLUSION

This study suggests a virtual keyboard that recognises hand gestures and takes the place of a physical keyboard.Using this keyboard it is able to print alphabets and other capabilities by gestures. The skin segmentation technique is used to isolate the hand's color and picture from the background. The full body being taken into the camera can be resolved using the remove arm technique. The suggested approach has the ability to detect and understand hand gestures, allowing it to control keyboard functionalities and produce a real-world user interface.This project can be simply implemented and used in a variety of fields where calculation is necessary.

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