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AI VIRTUAL KEYBOARD USING OPENCV

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ABSTRACT

As a result of the unceasing and ongoing progress in the domains of artificial intelligence and technology, we were inspired to develop a product within a related subject. We had the notion to create a virtual keyboard instead of a standard virtual keyboard that projects the keys onto a surface. Instead, we constructed an air-projecting keyboard that allows us to type letters using our hands and fingers. The area of artificial intelligence is enormous, and we have contributed to everyday experimentation by creating the digital and virtual world of the future. Devices that communicate with computers are keyboards. Here, we have tried to make the keyboard feature interactivity via hand gestures. eventually getting rid of the electronics. Consequently, using a virtual keyboard for control and typing Different hand motions will be used to do tasks like typing and dragging data. A camera is the IOT device required to make this happen. The screen of the system will display the camera's output, allowing the user to fine-tune it even further. We make use of technologies such as Python and OpenCV. The user may use their hand to hold color tapes or caps to type on the virtual keyboard, and they can use different hand gestures to click. In order to facilitate a natural human-computer interaction, we suggest using a hand gesture detection system to operate the virtual keyboard in this study.

Keywords: Hand Segmentation Module, Opencv, Gesture Control, Virtual Keyboard, And Recognition.

I. INTRODUCTION

Nowadays, the majority of cell phones communicate with the user using touch-screen technology. However, the cost of this technology prevents it from being employed on laptops and desktop computers. Our goal was to develop a more user-friendly virtual keyboard system that could replace a touch screen by utilizing a Web camera to communicate with the computer. The individual seated in front of the computer is being captured on camera by the webcam. In our constantly evolving technological environment, computer vision and artificial intelligence (AI) have combined to create new and engaging applications. One such program that creates a virtual keyboard that can be used without the need for physical contact is the AI Virtual Keyboard, which uses OpenCV (Open Source Computer Vision Library). Real keys and tangible items have always been a part of keyboards. However, advances in machine learning and computer vision have made it possible to design a keyboard that only exists virtually and is gesture-activated when projected onto a surface. This addresses accessibility issues for those with limited movement and adds a futuristic element to human-computer interaction. You may virtually perform keyboard operations that were previously only possible with certain physical keyboards by using a simple motion. In essence, OpenCV is an open-source software library for machine learning and computer vision. A Python module called Numpy offers straightforward yet effective data structures. An open-source library called Tensorflow is useful for a variety of machine learning tasks. The fundamental technique that will be employed in this project is Svm Hog, a convolutional neural network that uses linear support vector machines (Svm) for human categorization and feature extraction in the human detection process. Svm Hog is a histogram of an orientated gradient.

II. LITERATURE SURVEY

Y. Adajania and colleagues created a virtual keyboard using shadow analysis in 2010. This technique uses color to identify the keyboard, hand shadow, and finger tips. This system has a 3 fps analysis speed.

2011 saw the creation of a virtual keyboard approach utilizing a camera by S. Hernanto et al. This method uses two functions: location and finger detection. Two distinct cameras were employed by this system, one for location detection and the other for skin detection. This virtual keyboard has an average duration per character of 2.92 milliseconds and an average accuracy of 88.61%.

I. Patil et al. used eye gaze and eye blinking to build a virtual keyboard interaction system in 2015. Their method recognizes a face first, then the area around the eyes and nose to identify an eye blink. In this method, the OpenCV Java framework is utilized. This method achieves 48% accuracy in the 160x120 frame size and 98% accuracy in the 1280x960 frame size.

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In 2016, Hubert Cecotti developed a system for disabled people called a multimodal gaze-controlled virtual keyboard. The virtual keyboard has eight main commands for menu selection to spell 30 different characters and a delete button to recover from errors. Both the command and application levels' information transmission rates and speeds were used to assess the system's performance.

A webcam-based virtual keyboard interaction system was built by S. Bhuvana et al. in 2017. The hand position over the virtual keyboard may be detected by this technology. This technology recognizes which character is pointed at and displays an image of a virtual keyboard on white paper. This method took advantage of MATLAB's built-in Image Processing Toolbox feature.

An augmented keyboard system based on gesture recognition and finger recognition was demonstrated by Jagannathan MJ et al. in 2018. Previous systems had either a virtual keyboard or a virtual mouse, as the examined literature shows. These systems are unable to totally do away with the necessity for a mouse and keyboard. The goal of this project is to create an interactive computer system that can be used by hand gesture recognition alone, without the need for a hardware mouse or keyboard.

(2010) Adjania et al. Use shadow focus to create a virtual keyboard. The system uses color segmentation and Sobel processing to identify keyboard, hand shadow, and finger indications. The system should be the source of ambient illumination. 3 frames per second may be analyzed by the system. 2011 saw the creation of a technique by Hernanto and Supriana to use a camera as a virtual keyboard. For location measurement and fingerprint identification, this technique makes use of two functions ().

2016 saw the introduction of the Eye Gaze System for Work Virtual Keyboard for the Disabled by Saraswati, Sigit, and Harsono. In order to use the user's eye look as a marker in the following phase, it first recognizes the user's face. Utilize the Integral Projection method to determine the location of eye movement and the HaarCascade approach to extract face characteristics. His research indicates that the typical typing speed for the two languages utilizing their is 1:13. An enhanced keyboard system based on fingerprint recognition was presented by Mj et al. (2018). Python and the OpenCV library were used in the development of the system. Palm recognizes improved keyboard input. Finger motions are tracked by a virtual keyboard.

Analysis

Title of paper	Year of publication	Name of author	Algorithm/ technique/methodology used in paper	Results obtained	Advantages	Disadvantages / Limitations
AI Virtual Mouse and Keyboard.	2022	Shweta Pardeshi	• Used technologies such as Python, Media-Pipe, and Open-CV. • Hand tracking • Finger counting • Volume Control	• AI virtual keyboards were tried to be performed using a real-time camera • hand detection, and tracking. • The alphabets are properly aligned, and the keyboard simulates a genuine keyboard. • Keypress and the	• Implemented AI keyboard is very flexible. • The picture frame capture by the web camera has to be modified in accordance with the rather large keyboard. • System is quite autonomous.	Future work will concentrate on improving the algorithm by combining the generated models and creating a whole virtual system handler that can control the brightness, volume, and other features in addition to acting as a virtual mouse and keyboard. It also features

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				space bar and backspace key functions are included in the outcome.		keyboard enhancements.
An Interactive Computer System with Gesture-Based Mouse and Keyboard	2011	S. Hernanto et al.	• object detection • image processing in OpenCV • The process involves recording live video, analyzing each frame, formatting picture frames in HSV, creating a mask masking yellow, drawing contours for object tracking, locating the yellow object on the virtual keyboard, and printing the pointing character.	A stroke patient with limited left side control was tested using a system. After exercises, perform keyboard operations five times in a normal, lighted room. The experiment's parameters included a text with 44 characters and five tests.	• People who are paralyzed may find it easier to use computers with this system architecture. • created a virtual system that allows users to interact with computers without requiring a real / physical keyboard. • For some people who are limb-immobile, this system may be helpful.	• Many of the applications call for extra hardware, which can be highly costly. • In low light, the device might still function less accurately. • Additionally, the work can be expanded for a wide range of environments and tested with the advanced models currently in use.
Ai Virtual mouse and keyboard using Python And Opencv to abate the spread of Covid-19	2015	I. Patil et al	• Image Processing Techniques • Character recognition • Palm Detection Model • Hand Landmark Model • Camera Used in the AI Virtual Mouse System • Capturing the Video and Processing • (Virtual Screen Matching) Region for moving through the window • keyboard Functions Depending on the Hand Gestures and Hand Tip Detection Using	If the middle finger (tip ID 2) and index finger (tip ID 1) are both up and their distance from each other is less than twenty, you can click on a letter or type on a virtual keyboard. Typing is only possible in	Introduced a new multimodal, multiscript virtual keyboard that can be used to select instructions using a mouth switch, a mouse, a touchscreen, and gaze detection.	Only a keyboard prototype is shown in this suggested system, but it may be developed such that it can be used to type anywhere rather than only on the virtual keyboard in a designated area.

			Computer Vision.	the designated field that appears on the screen when the virtual keyboard is displayed, which is the prototype of a virtual keyboard.		
An Interactive Computer System with Gesture-Based Mouse and Keyboard	2017	S. Bhuvana et al.	• object detection • image processing in OpenCV • The process involves recording live video, analyzing each frame, formatting picture frames in HSV, creating a mask masking yellow, drawing contours for object tracking, locating the yellow object on the virtual keyboard, and printing the pointing character.	A stroke patient with limited left side control was tested using a system. After exercises, perform keyboard operations five times in a normal, lighted room. The experiment's parameters included a text with 44 characters and five tests.	• People who are paralyzed may find it easier to use computers with this system architecture. • created a virtual system that allows users to interact with computers without requiring a real / physical keyboard. • For some people who are limb-immobile, this system may be helpful.	• Many of the applications call for extra hardware, which can be highly costly. • In low light, the device might still function less accurately. • Additionally, the work can be expanded for a wide range of environments and tested with the advanced models currently in use.
Finger recognition and gesture based augmented keyboard	2018	Jagannatha n MJ et al	• image analysis techniques • skin segmentation • Finger tip detection algorithm	The virtual keyboard detects contour differences, draws a finger contour, selects and displays letters, analyses coordinates, and allows	• Using a finger to click a sequence of letters. • Multiple touches and swiping gesture are supported.	• Moreover, swipe keypads that recognize motions in air view can be used. • Typing speed can be increased. • Simply swapping out the keypad's keys allows for

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				user movement with swiping motion.		multilingual use of the same keypad.

III. PROPOSED METHOD

Our hand tracking module and hand movements on the keys were executed smoothly and comfortably without any lag or latency thanks to the libraries and functionalities of Python. Using Python Interpreter, we first installed the necessary libraries so that we could use OpenCV to code the AI Virtual Keyboard. We then began writing the code, and by using the trial-and-error process, we were able to create a workable mock module for the project at hand. Finally, after making several adjustments and consistently reducing the number of mistakes, we were able to build the project's real code. Lastly, to improve the overall appearance of our project, we employed a variety of color insertion techniques as well as eye-catching and appealing techniques to create an exquisite keyboard design. Tracking Module by Hand The first approach to be tested was this one. In order to monitor the finger outlines and maintain continuity between finger bendings, we developed a module that could recognize and identify finger prints. Additionally, we included a functional real-time FPS (frames per second) monitor. Operation of Virtual Keyboard Following the Hand Tracking Module's successful testing, we began utilizing Python to construct a virtual keyboard that would be used to operate a computer using fingerprints. We created the virtual keyboard using the same Python language and a number of packages, including OPENCV ZONE, MEDIAPIPE, HAND TRACKING MODULE, PYNPUT, NUMPY, and TIME. We added new parameters to the keyboard, like keyboard keys, a box to display texts, and a real-time FPS display, using the Hand Tracking Module as dummy code.

OpenCV

The computer vision library OpenCV includes object detection and picture processing methods. A computer vision library for the Python programming language called OpenCV may be used to create real-time computer vision applications. The OpenCV library is used for analytical tasks including object and face detection as well as image and video processing.

Detection of Fingertip

We utilize the geometrical properties of the resulting contours and areas to estimate the user's finger positions (in image space). Determine the user's fingers' positions. Check to see whether any fingers are touching the surface.

IV. RESULTS AND DISCUSSION

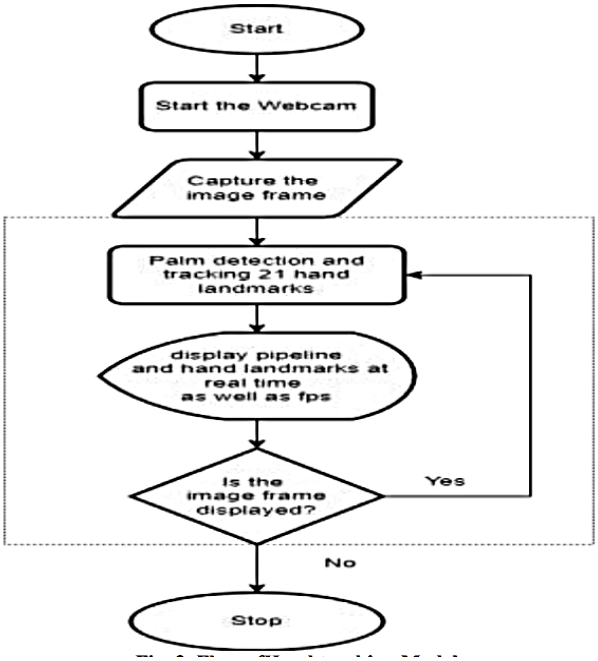

Fig 1: Flowchart of Hand Tracking

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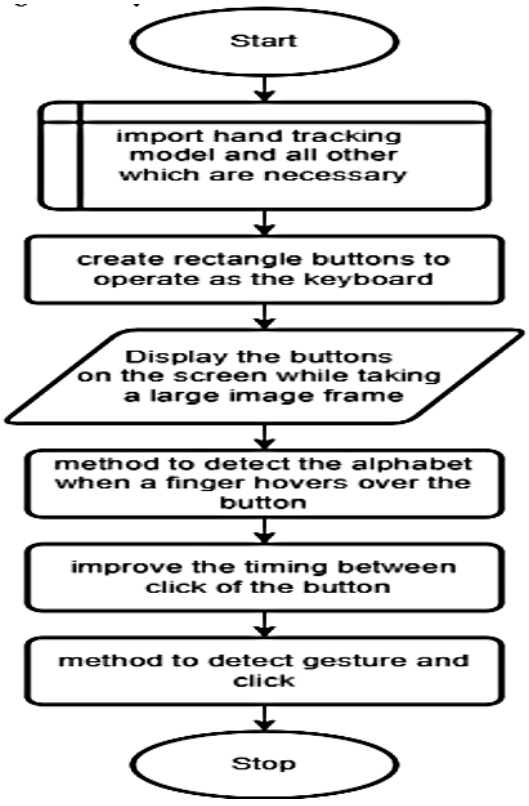

Fig 2: Flowchart of Virtual Keyboard

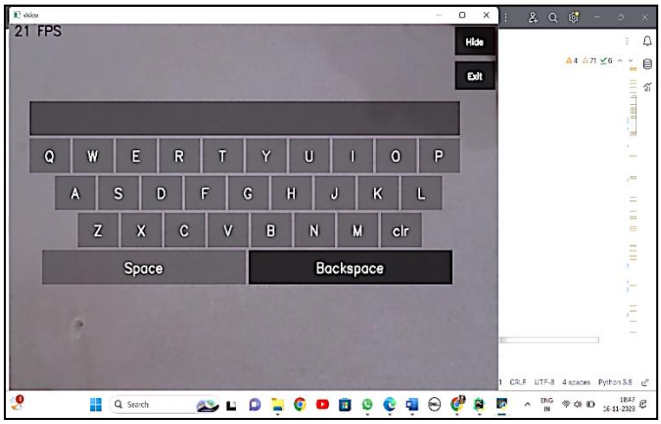

Fig 3:

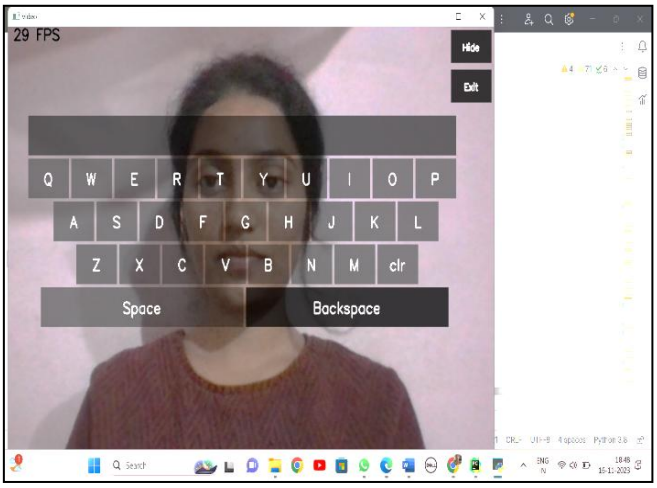

Fig 4:

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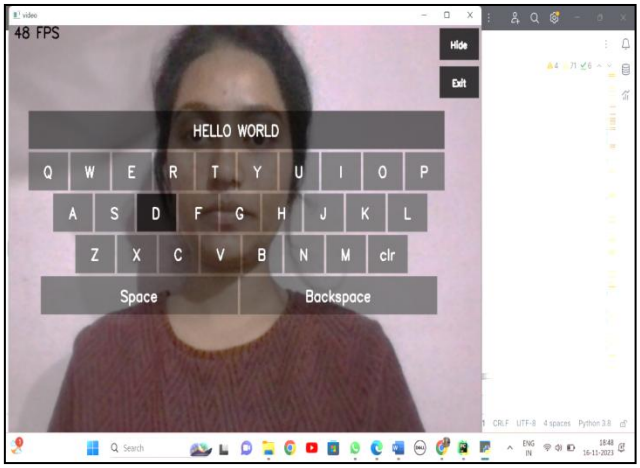

Fig 5:

A suggested system called an AI keyboard simulates a virtual keyboard for us to use on the screen. When a finger moves over a certain alphabet on the screen, the letters are picked up. The action of touching the middle and index fingers is used to type the letter. The built AI keyboard is incredibly adaptable. The picture frame capture by the web camera has to be modified in accordance with the rather large keyboard.

V. CONCLUSION

A major advancement in the field of human-computer interaction is the AI Virtual Keyboard project, which combines the flexibility of computer vision with the sophistication of artificial intelligence. This project makes use of OpenCV. With this project, we have shown that it is possible to rethink traditional input techniques and go beyond physical keyboards. The successful combination of projection mapping and OpenCV for real-time gesture recognition has made it possible to type without using your hands. By utilizing natural hand gestures, users can engage with a virtual interface that is projected onto a surface and communicate with digital systems. Beyond just being convenient, the potential applications address accessibility issues and offer a fresh approach for people with physical disabilities. The AI Virtual Keyboard project piques interest in what lies ahead for human-computer interaction. This project's innovative combination of cutting-edge technologies challenges conventional ideas about how humans interact with digital devices and paves the way for future research and innovation in gesture-based interfaces. In conclusion, the AI Virtual Keyboard with OpenCV not only provides a useful way to type without using your hands, but it also shows how AI and computer vision can have a revolutionary impact on how interactive technology develops in the future. This project is proof of the limitless opportunities that exist at the nexus of artificial intelligence and user-centric design. It's an exciting journey from physical keyboards to virtual interfaces.

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