

# **Artificial Intelligence Virtual Keyboard**

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**GitHub:** <https://github.com/KirPatel/AI-Virtual-keyboard>

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## **Abstract**

Computing is not limited to desktops and laptops; it has found its way into mobile devices like cell phones. I will create a Virtual keyboard using sensor technology and artificial intelligence in this project. The virtual keyboard should be accessible and functioning with the help of a camera image of a keyboard that will be fetched. For debugging this program, Tensorflow allows me to visualize the construction of the neural network with Tensorboard. The typing will be captured by the web camera, as the camera will capture finger movement, which processes these frames to perform the keyboard function such as clicking the alphabets. I will use the Python programming language and OpenCV with mediapipe library, which is a library of Python bindings designed to

solve computer vision problems. Pynput library allows me to control and monitor my input devices such as the keyboard and mouse to detect input. This project is based on deep learning for detecting the hands. AI virtual keyboard system is to develop an alternative system to perform and control the keyboard functions.

## **Introduction**

A virtual keyboard is a computer keyboard that a user operates by typing on or within a wireless- or optical-detectable surface or area rather than by depressing physical keys. Such a system can enable the user of a small handheld device, such as a cellular telephone or a Personal digital assistant to have full keyboard capability.

- This project is an AI based project in which I can assess the keyboard with gestures without physically touching the keyboard.
- The keyboard is the typical device for interacting with computers. Basically, the keys on a keyboard are operated with the help of persons Hands.
- This project is based on Image processing, and it uses libraries like OpenCV and other libraries with the help of which we would be able to detect points on hands.

In one technology, the keyboard is projected optically on a flat surface and, as the user touches the image of a key, the optical device detects the stroke and sends it to the computer. In another technology, the keyboard is projected on an area and selected keys are transmitted as wireless

signals using the short-range Bluetooth technology. Theoretically, with either approach, the keyboard could even be projected in space and the user could type by moving fingers through the air.

The term virtual keyboard is sometimes used to mean a soft keyboard , which appears on a display screen as an image map . In some cases, a software-based keyboard can be customized. Depending on the host system and specific software, the user who may be someone unable to use a regular keyboard can use a touch screen or a mouse to select the keys.

## Methods

OpenCV is the most popular library for the task of computer vision, it is a cross-platform open-source library for machine learning, image processing, etc. using which real-time computer vision applications are developed. MediaPipe library as its core that makes easy to run like hand tracking, face detection, facial landmark detection, pose estimation, etc., and image processing and other computer vision-related applications.

1. Implementation of Virtual Keyboard Using OpenCV.

```
---> pip install numpy  
---> pip install opencv-python
```

```
---> pip install pynput
```

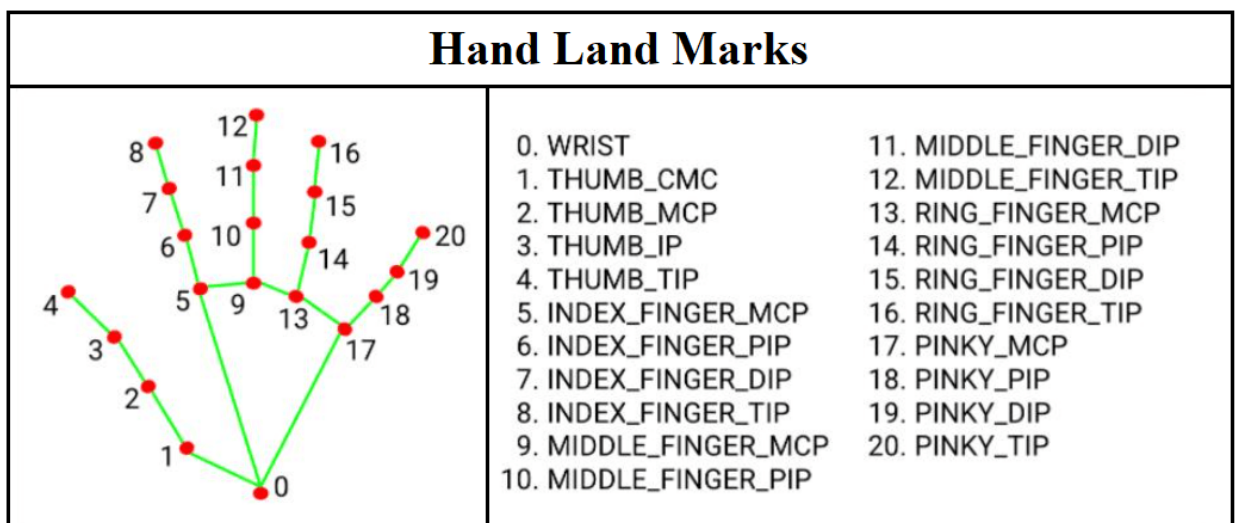
4

## 2. Import Libraries for Virtual Keyboard Using OpenCV.

Here importing the OpenCV, Mediapipe module and then in order to make the virtual keyboard work we need to import Controller and keys from pynput keyboard library.

```
import cv2
import mediapipe as mp
from time import sleep
import numpy as np
from pynput.keyboard import keys, Controller
```

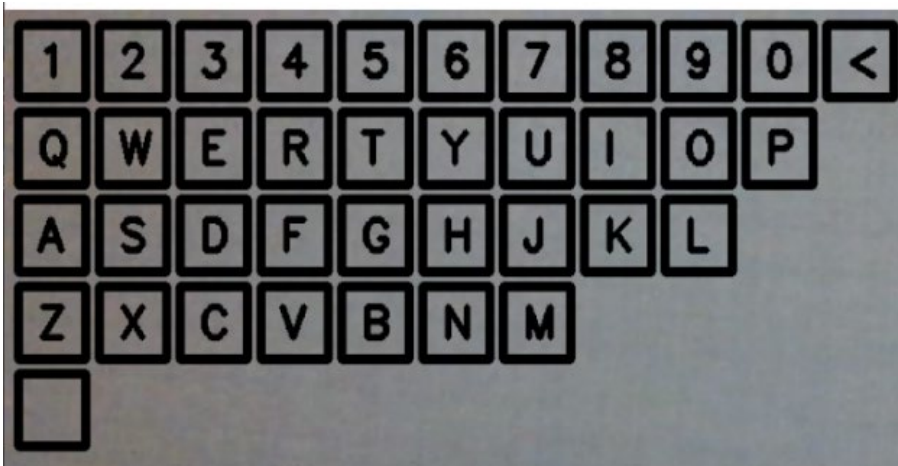
## 3. Hand-Tracking Using Mediapipe Library.



MediaPipe is Google's open-source framework, used for media processing. It is cross-platform, or we can say it is platform friendly. It is run on Android, iOS, web, and YouTube servers that's what Cross-platform means, to run everywhere. MediaPipe Hand is a high-fidelity hand and finger tracking solution. It employs machine learning (ML) to infer 21 3D landmarks of a hand from just a single frame.

In image, we need to find the position and bounding box information of that detected hand. Here finds the distance between the top point of our index finger and middle finger, if the distance between the two is less than a certain threshold, then we can type the letter on which we are indicating. Once we get the position then we loop through the entire position list. From that list, we find button position and button size and then we plot it on the frame according to a well-defined manner. After that, we need to find the distance between the top point of our index finger and middle finger. In the above image, you can see the top points which we require are point 8 and point 12. Hence, we need to pass 8, 12 inside a distance finding function to get the distance between them.

#### 4. Virtual keyboard design using Pynput library and Python.



Create an array of lists according to the layout of keyboard design and define an empty string to store the typed keys. This keyboard will have all the letters from 'A' to 'Z' characters, Numbers for 0 to 9 and it will also have space key and backspace key in it. If you need the keyboard layout to be more customized, we can make the keyboard layout transparent, editing the keys, changing the location of keys, adding keys. After you bring the index finger and middle finger close to each other on top of a particular letter, you can type that letter.

Pynput library allows me to control, and monitor listen to my input devices such as they keyboard and mouse. Pynput keyboard allows me to control and monitor the keyboard. It allows me allows you me to control and monitor your input devices such as they keyboard and mouse.

## Installation

1. OpenCV-Python version 4.5.5.62 specific version to execute this program.
2. Python pip 3.7 version that supports OpenCV.
3. Mediapipe 0.8.7 version for hand tracking and to make Mediapipe work with TensorFlow and Python 3.7.
4. Pynput library version 1.7.3 best version for making a keyboard with python language.
5. Import Matplotlib for math version 3.5.1 in program it used for allocating the keys and finding the distance between the fingers.
6. Setup the TensorFlow which is an open-source library for numerical computation and large-scale machine learning that ease Google Brain TensorFlow, the process of acquiring data, training models, serving predictions, and refining future results. TensorFlow bundles together Machine Learning and Deep Learning models and algorithms. It uses Python as a convenient front-end and runs it efficiently in optimized C++.

## **Results**

Typing without touching the keys is fulfilled to ignore obstructions covering the paper keyboard. The experiment results indicate that the overall recognition rate of the proposed virtual keyboard is 94.62%. The proposed virtual keyboard can be used for a smartphone in the future. Furthermore, as a blueprint, it can be applied to computers after it is improved to allow ten-finger recognition. Moreover machine-learning can be potentially embedded into virtual keyboard to greatly improve its figure recognition and performance.

End to end testing took place when webcam has been used for testing whether it's taking the image from outside or not, this was the most crucial step. If user has virtual keyboard printed in the camera, it surely be handled carefully. Without the proper input to the application, it won't result in detecting the alphabets, symbols, or numbers.

## **Conclusion**

Compared with previous basic keyboard, Virtual Keyboard has rather more advantages for personalization, convenience, and applicable to special environments. For individuals with disabilities and uses where several rapid keystrokes are required Virtual keyboard can be of great use. This keyboard is one of the few which uses microcomputer to implement the functions unlike many virtual keyboards. Hardware and Software implementations are explained in brief in



this paper. The precision and accuracy of keys has been tested thoroughly. Based on this confidently reach to a conclusion that this implementation is easily attainable and practical.

## Reference

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University of Waterloo. (2022). System recognizes hand gestures to expand computer input on a keyboard. *Science Daily*. Retrieved from <https://www.sciencedaily.com/releases/2022/01/220105094430.html>

Hernanto, S. (2011). Webcam virtual keyboard. *International Conference on Electrical Engineering and Informatics*. <https://www.diva-portal.org/smash/get/diva2:1504621/FULLTEXT01.pdf> Retrieved from

This articles and posts helped me in my work such as Hand tracking in VR allows you to interact without needing VR controllers. Sensors capture data on the position, orientation, and velocity of

your hands. Hand tracking software then uses this data to create a real-time virtual embodiment of them. It also gave me an idea on what Media Pipe is. A Framework for building machine learning pipelines for processing time-series data like video, audio, etc. This cross-platform Framework works in Desktop/Server, Android, iOS, and embedded devices like Raspberry Pi and Jetson Nano. The projects they are creating is using OpenCV which they are explaining that what are its benefits when using it and how it is a great tool for image processing and performing computer vision tasks. It is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more. It supports multiple languages including python, java C++. In their projects there is one thing is common that they are using Python which is a computer programming language often used to build websites and software, automate tasks, and conduct data analysis. Python is a general-purpose language, meaning it can be used to create a variety of different programs and isn't specialized for any specific problems.