Artificial Intelligence (AI) Based Mouse Controller

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Abstract: The mouse is one of the wonderful inventions of Human-computer interaction technology. At present wireless mouse or bluetooth mouse are in usage and it is not free because it uses a battery for power and dongle to connect it to the pc. so the main theme of Ai based Mouse controller is to overcome this limitation by employing webcam or a built-in camera for capturing of hand gestures. To create AI based Mouse controller we will first detect the hand landmarks and then track and click based on these points. We will also apply smoothing techniques to make it more usable. Hence, the proposed system will avoid covid-19 spread to an extent by eliminating the human intervention and dependency of devices to control the computer.

Keywords: Artificial Intelligence, Covid-19, Hand Gestures.

Introduction

While using a wireless or a Bluetooth Device, some devices such as the mouse, the dongle to connect to the PC, and also, a battery to power the mouse to operate, are used. With the development technologies in the areas of augmented reality and devices that we use in our daily life, these devices are becoming compact in the form of Bluetooth or wireless technologies. The Project AI Based Mouse Controller Proposes A system that makes use of the hand gestures and hand tip detection for performing mouse functions in the computer using computer vision. The algorithm used in the system makes use of the machine learning algorithm.

The algorithm is based on deep learning for detecting the hands. Hence, the proposed system will avoid COVID-19 spread by eliminating the human intervention and dependency of devices to control the computer. Python programming language is used for developing the AI based virtual mouse system, and also, Open CV which is the library for computer vision is used in the AI based virtual mouse. In the proposed AI virtual mouse system, the model makes use of the MediaPipe package for the tracking of the hands and for tracking of the tip of the hands, and also, Pynput, Autopy, and PyAutoGUI packages were used for moving around the window screen of the computer for performing functions such as left click, right click, and scrolling functions. The results of the proposed model showed very high

accuracy level, and the proposed model can work very well in real-world application with the use of a CPU without the use of a GPU.

Literature Survey

J. T. Camillo et al [1]. Vision-based Multimodal Human-Computer Interaction using Hand and Head Gestures year of public 2013 using techniques Viola Jones algorithm, ANN Gradient method Finite state automata with methodology Pre-processing common to hand and head gesture Recognition Method specific to hand gesture recognition. Method specific to Head gesture recognition. Integration of hand and head gesture recognition modules. advantages are Fast, robust and accurate method for hand gestures recognition under unconstrained scenes Satisfactory recognition percentage of the Gestures.

D.-S. Tran et al [2].Recent methods in vision-based hand gesture recognition[2].year of publish 2016 using Techniques ANN with methodology Image Capture Image Processing Feature Extraction Classification Evaluation and Comparison The gestures are more intuitive and user friendly. Hand and Head gestures were used increased accuracy

V. Bazarevsky et al [3].Vision-based Gesture Recognition for Human- Computer Interaction and Mobile Robot's Freight Ramp Control[4].published in year 2010.using techniques Motion detection and Gesture recognition algorithm using methodology Image acquisition. Image segmentation. Feature extraction and gesture recognition advantages are

Fast, robust and accurate method for hand gestures recognition under unconstrained scenes

J. George et al.[4] Vision based Computer Mouse Control using Hand Gestures Published in year 2015 Using techniques Camera based colour detection technique., Video acquisition Real-time with methodology Video Acquisition, Flipping of Individual, Video Frames Extraction of Red and Blue component region extraction Filtering Binary Image Generation Removal of small objects Centroid Detection Mouse Left and Right Click .advantages are It can be widely used in the fields of robotics, biomedical instrumentation, computer gaming and many more.

L. Thomas et al.[5] Hand Gesture Parameters using Image Processing. Published in year 2015.using techniques Camera and Computer vision technology using methodology Image Capturing ImagePreprocessing Region of Interest Extraction Finger Counting Logic Gesture Classification Display Recognition Result .advantages are Further studies are going on in this topic to develop the applications using these parameters.

.A. Haria et al.[6] Hand gesture recognition using principal component analysis. Published in year 2015.using techniques Sensor base and Vision base are hand gestures recognition techniques. PCA with methodology Image Acquisition Hand Segmentation Feature Extraction Gesture Recognition Empowers the medical experts to pass the instruction to the robotic hands remotely to add the accuracy in the operations.

Proposed Approach

Using the current system even-though there are a number of quick access methods available for the hand and mouse gesture for the laptops, using our project we could make use of the laptop or web-cam and by recognizing the hand gesture we could control mouse and perform basic operations like mouse pointer controlling, select and deselect using left click, and a quick access feature for file transfer between the systems connected via network LAN cable. The project done is a "Zero Cost" hand recognition system for laptops, which uses simple algorithms to determine the hand, hand movements and by assigning an action for each movement[2]. But we have mainly concentrated on the mouse pointing and clicking actions along with an action for the file transfer between connected systems by hand action and detection algorithm to produce more accurate results.

the movements. The system we are implementing which is been written in python code be much more responsive and is easily implemented since python is a simple language and is platform independent with a flexibility and is portable which is desirable in creating a program which is focused in such an aim for creating a AI based virtual mouse . The system be much more extendable by defining actions for the hand movement for doing a specific action. It could be further modified to any further extent by implementing such actions for the set of hand gestures, the scope is restricted by your imagination.

Advantages

This work overcome the issues identified in existing model and improves the finger tip
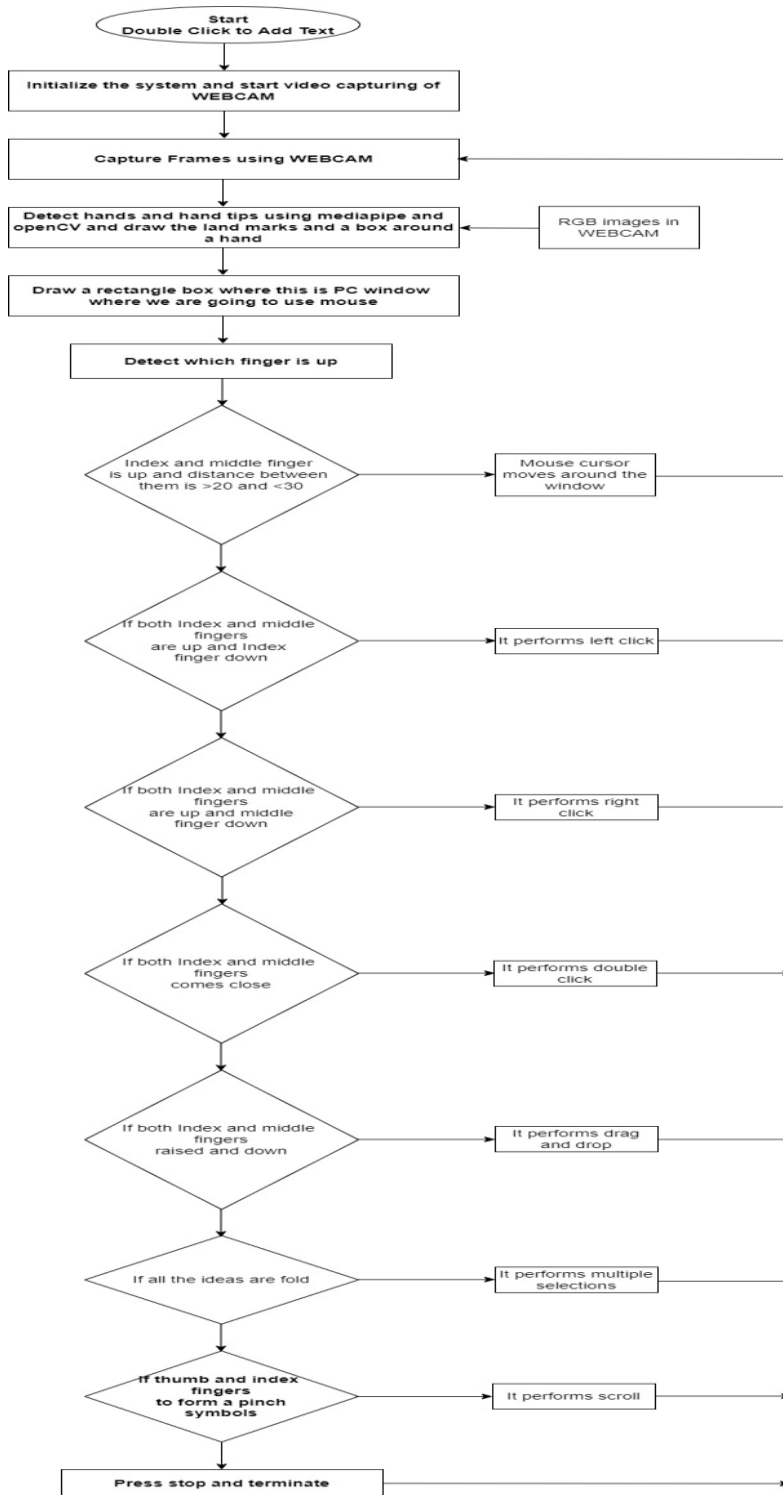
Figure 1: System Architecture Flow

System Architecture

AI Based Mouse Controller system is based on the frames that have been captured by the webcam in a laptop or PC. By using the Python computer vision library OpenCV, the video capture object is created and the web camera will start capturing video, . The web camera captures and passes the frames to the AI Based Mouse Controller .The AI Based Mouse controller uses the webcam where each frame is captured till the termination of the

program. The video frames are processed from BGR to RGB color space to find the hands in the video frame by frame The AI Based mouse controller system makes use of the transformational algorithm, and it converts the co-ordinates of fingertip from the webcam screen to the computer window full screen for controlling the mouse. When the hands are detected and when we find which finger is up for performing the specific mouse function, a rectangular box is drawn with respect to the computer window in the webcam region where we move throughout the window using the mouse cursor.

Experimental Results

The experiments are conducted by using Python programming language. PyCharm is the framework that works better on AI based applications. The following steps shows the installation of PyCharm.
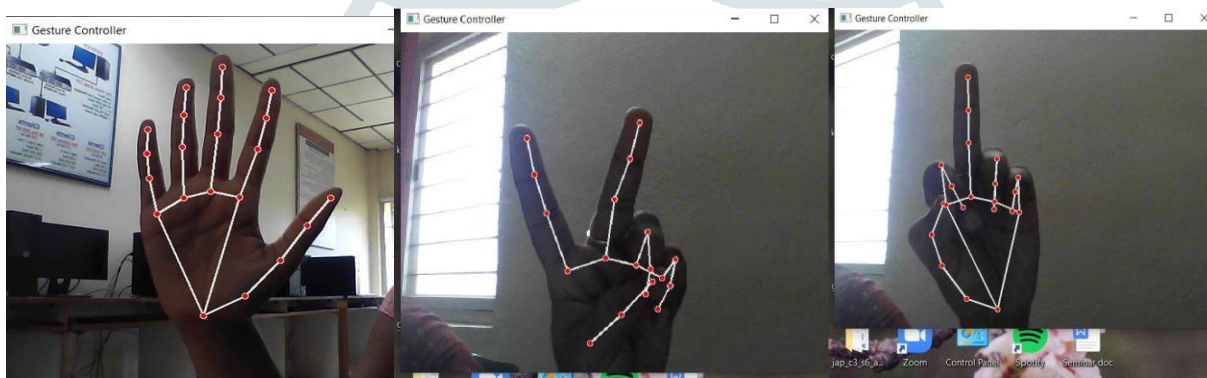

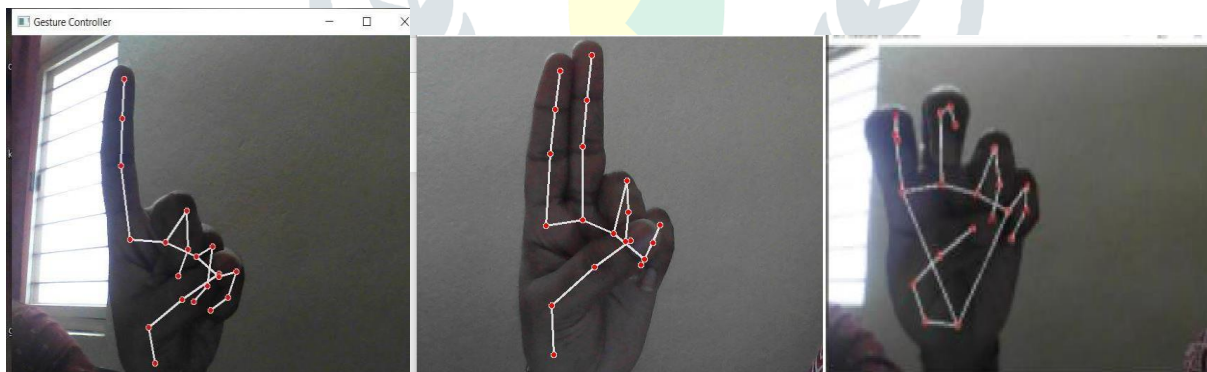Figure 2 (a) (b) (c) Hand Gestures showing Number 5, 2 and 1.

Figure 3 (a) (b) (c) Hand Gestures showing Number 1, 2 and 4.

Figure 4: Processing of Hand Gesture Features using Proposed Approach

Performance Metrics

The performance is analyzed by using the various metrics **such as** True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN) are used by these metrics.

Accuracy: This will calculate the overall accuracy of the detection rate.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

Table 1: Performance Metrics

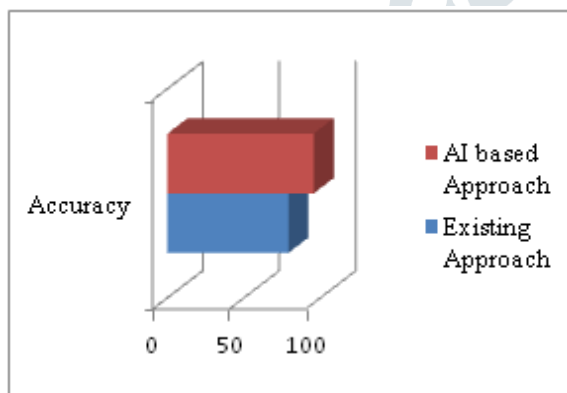| Algorithms	Accuracy
Existing Approach	78.98%
AI Based Approach	95.67%

Figure 5: Performance of Existing and Proposed Approach

Conclusion

The main objective of the AI based virtual mouse is to control the mouse cursor functions by using the hand gestures instead of using a physical mouse. The proposed system can be achieved by using a webcam or a built-in camera which detects the hand gestures and hand tip and processes these frames to perform the particular mouse functions. From the results of the model, we can come to a conclusion that the proposed AI virtual mouse system has performed very well and has a greater accuracy compared to the existing models and also the model overcomes most of the limitations of the existing systems. Since the proposed model has greater accuracy, the AI virtual mouse can be used for real-world applications, and also, it can be used to reduce the spread of COVID-19, since the proposed mouse system can be used virtually using hand gestures without using the traditional physical mouse. The proposed method can be developed to handle the keyboard functionalities along with the mouse functionalities virtually which is another future scope of Human-Computer Interaction.

References

[1] J. Katona, "A review of human–computer interaction and virtual reality research fields in cognitive InfoCommunications," Applied Sciences, vol. 11, no. 6, p. 2646, 2021.

[2] D. L. Quam, "Gesture recognition with a DataGlove," IEEE Conference on Aerospace and Electronics, vol. 2, pp. 755–760, 1990.

[3] D.-H. Liou, D. Lee, and C.-C. Hsieh, "A real time hand gesture recognition system using motion history image," in Proceedings of the 2010 2nd International Conference on Signal Processing Systems,

IEEE, Dalian, China, July 2010.

[4] S. U. Dudhane, "Cursor control system using hand gesture recognition," IJARCCE, vol. 2, no. 5, 2013.

[5] K. P. Vinay, "Cursor control using hand gestures," International Journal of Critical Accounting, vol. 0975–8887, 2016.

[6] L. Thomas, "Virtual mouse using hand gesture," International Research Journal of Engineering and Technology (IRJET, vol. 5, no. 4, 2018.

[7] L.P. Nandhini, J. Jaya, and J. George, "Computer vision system for food quality evaluation—a review," in Proceedings of the 2013 International Conference on Current Trends in Engineering and Technology (ICCTET), pp. 85–87, Coimbatore, India, July 2013.

[8] J. Jaya and K. Thanushkodi, "Implementation of certain system for medical image diagnosis," European Journal of Scientific Research, vol. 53, no. 4, pp. 561–567, 2011.

[9].P. Nandhini and J. Jaya, "Image segmentation for food quality evaluation using computer vision system," International Journal of Engineering Research and Applications, vol. 4, no. 2, pp. 1–3, 2014.

[10] .J. Jaya and K. Thanushkodi, "Implementation of classification system for medical images," European Journal of Scientific Research, vol. 53, no. 4, pp. 561–569, 2011.