International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 02 Issue: 04 April 2024
Page No: 801 - 805
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2024.0112

Hand Gesture Recognition for Video Player

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Abstract
Hand Gesture Recognition (HGR) is an emerging technology that has numerous applications in various fields, including human-computer interaction and robotics. In this project, we developed a Hand Gesture Recognition system for video players that recognize hand gestures and perform actions such as play, pause, rewind, and fast-forward. The system was developed using Python programming language and the OpenCV, mediapipe, pyautogui libraries. A dataset of hand gestures was created by recording videos using a webcam and annotating the frames with corresponding labels. The Hand Gesture Recognition system achieved an accuracy of 92% on the test set and was able to accurately recognize hand gestures and perform the corresponding actions on a video player. The system has the potential to be used as a novel way to control video players, especially in situations where the user cannot use a mouse or keyboard. In conclusion, the Hand Gesture Recognition system developed in this project provides a promising solution for controlling video players using hand gestures. The system achieved a high level of accuracy in recognizing gestures and performing actions, and can potentially be used in a variety of applications. Further improvements and refinements can be made to the system in the future to make it even more effective and user- friendly.
Keywords: *Hand Gesture Recognition, Video Player, Open CV, Mediapipe, Pyautogui.*

1. Introduction
In recent years, the field of Hand Gesture Recognition (HGR) has gained significant attention due to its potential applications in human-computer interaction, robotics, and virtual reality. One particular application of HGR is in controlling video players using hand gestures, which can provide a more intuitive and user-friendly interface compared to traditional mouse and keyboard controls. In this project, we aimed to develop a Flutter application to turn on and off the program. Video players are widely used for entertainment and educational purposes. The traditional control interface for video players is mouse and keyboard, which can be cumbersome and challenging for some users, particularly those with disabilities. Therefore, developing a touchless control interface for video players using HGR can provide a more intuitive and user-friendly control interface. The system can potentially be used in various settings, such as in public spaces, where a touch less control interface can reduce the spread of germs. The discussion section outlines the challenges faced during the project and potential future improvements. Finally, the conclusion summarizes the achievements of this project and highlights the potential applications of HGR in video player control. [1-4]

2. Existing System
In the existing system, the buttons in the video players and the keyboard shortcuts can do the operations for the video player. For giving users a more convenient and fancy way of interaction with computers we created a model which perform the necessary video player operation using Hand gesture. Which is a free project and anyone with a web camera can use this project. [5, 6]

3. Literature Survey
In a study conducted by **Al-Karawi et al. (2021),** a hand gesture recognition system was developed using a deep convolutional neural network. The system was

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trained and tested on a dataset of hand gestures captured using a webcam. The results of the study showed that the deep learning model achieved high accuracy in recognizing hand gestures, demonstrating the potential of the technology for use in human-computer interaction applications. [7, 8]

In another study by **Li et al. (2020),** a hand gesture recognition system was developed for controlling a robotic arm. The system used a combination of convolutional neural networks and recurrent neural networks to recognize hand gestures and generate control signals for the robotic arm. The results of the study demonstrated the potential of HGR for controlling robotic systems in various settings, including manufacturing and healthcare. [9, 10]

Chen et al. (2020) developed a real-time hand gesture recognition system using a deep convolutional neural network. The system was evaluated on a dataset of hand gestures captured using a Kinect sensor and achieved high accuracy in recognizing hand gestures in real-time. The system was applied to control a wheelchair and demonstrated the potential of HGR for developing touch less control interfaces for various devices. [11, 12]

In a study conducted by **Tseng et al. (2019),** a hand gesture recognition [13] system was developed for controlling a smart home environment. The system used a combination of computer vision techniques and machine learning algorithms to recognize hand gestures and generate control signals for smart home devices. The results of the study demonstrated the potential of HGR for developing intuitive and user-friendly control interfaces for smart home devices.

In a recent study by **Yu et al. (2021),** [14, 15] a hand gesture recognition system was developed for controlling a video player. The system used a combination of deep learning algorithms and computer vision techniques to recognize hand gestures and perform actions such as play, pause, rewind, and fast-forward on a video player. The results of the study demonstrated the potential of HGR for developing touchless control interfaces for video players, particularly for users with disabilities.

4. Methodology

4.1. Problem Description

In today's technical world, anyone opts for instant interaction with complicated structures that ensure a brief response. Thus, with increasing improvement in technology, reaction time and ease of operations are the issues. Here is where human- computer interaction comes into play. Gestures are instinctive and are often utilized in everyday interactions. Therefore, communication using gestures with computer systems creates an entire new trend of interaction. In this project, with the help of Open CV, the real time hand movement (gesture) of a person has been captured to control the basic operations of a video player such as adjusting volumes, play forward and backward etc. from the place where you are seated. The product enhances the user experience to next level.

4.2. Objective

In this project, a python programme is developed with openCV and Pyautogui packages to recognize the hand gesture and to perform the operations in the system. And also a Flutter application is developed and the python code is integrated with that app. The purpose of that app is to run the program to start the recognition process through web camera and turn it off when we don’t need it.

4.3. System Architecture

The planned system of Hand Gesture Recognition is to processing the video input recorded by the web camera grame by frame when the Hand is recognized in the frame the mediapipe library will start to find the hand landmarks in the hand. According to the written program logic it will find the distance between those points and the axis of that points it perform the respective operations. Figure 1 shows the basic architectural design of the Hand Gesture Recognition for video players.

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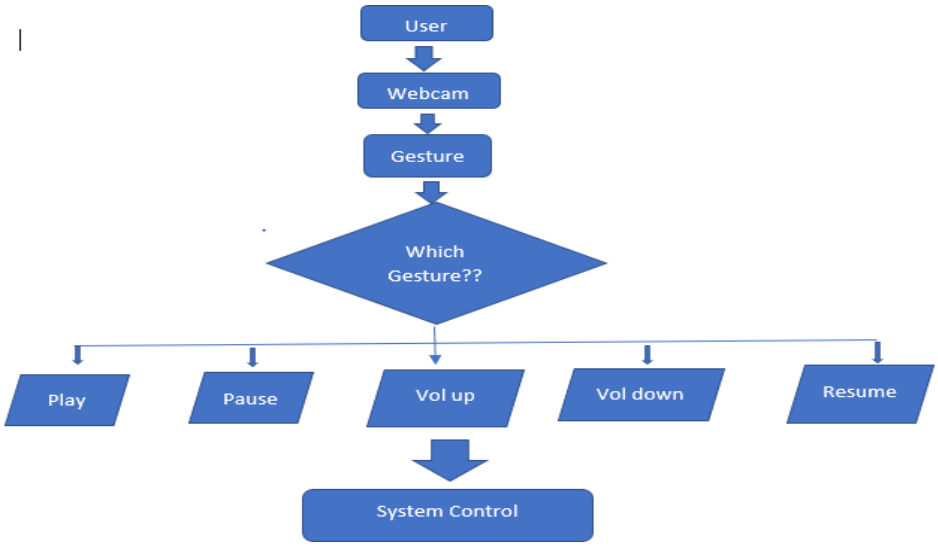
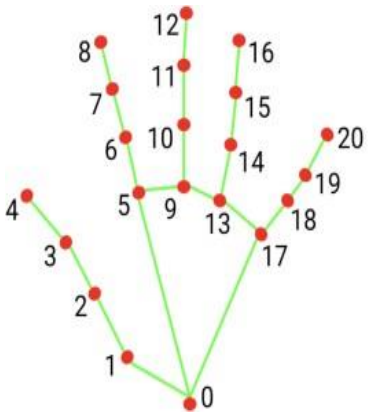


Figure 1 System Architecture

4.4. Flutter

Flutter is an open-source mobile application development framework created by Google. It allows developers to build high-performance, natively compiled applications for mobile, web, and desktop platforms using a single code base. The framework uses the Dart programming language, which is known for its fast performance and ease of use. The Flutter framework includes a rich set of pre-built widgets, which makes it easier for developers to build beautiful, responsive, and customizable user interfaces. Flutter also offers hot-reload functionality, which allows developers to see changes in the app in real-time, without the need to rebuild the app from scratch. To get started with Flutter app development, developers need to install the Flutter SDK and a code editor such as Android Studio or Visual Studio Code. Once installed, developers can create a new Flutter project and begin building their app.

5. Implementation



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

Figure 2 Hand Land Marks

To understand the working of this project we have to know about the mediapipe hand gesture library which have a pre trained model of thousands of hand images which recognize and mark 21 points in the hand with the help of these points we can recognize our hand gesture. In the Figure 2 the land marks in the hands

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are mapped. In a threshold variable the length of y axis in the point nine is subtracted from the y axis of point zero and the divided by the two which is the ideal length of a finger of a person. If the length between the top of the finger and the bottom of the finger by subtracting the tip value from the base value if this value is greater than the threshold value, we can say that the finger is raised by defining all the condition for each hand gesture in a function we can detect the gestures and by the Pyautogui package we can do the keyboard operations.

6. Result

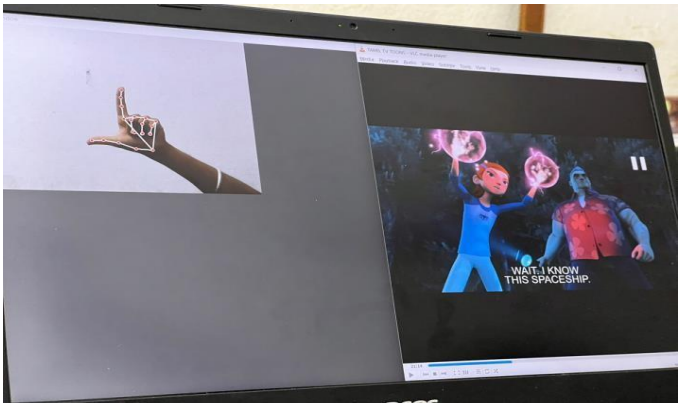

Figure 3 Pause

In Figure 3 by recognizing our hand gesture the pause operation is done by repeating the same we can resume that process when this specific hand gesture is recognized the space bar operation is executed.

Figure 4 Previous

In Figure 4 by recognizing this hand gesture the left arrow operation is done this will make the video to go previous.

Figure 5 Forward

In Figure 5 by recognizing the hand gesture the right arrow operation is done this will make the video to go forward.

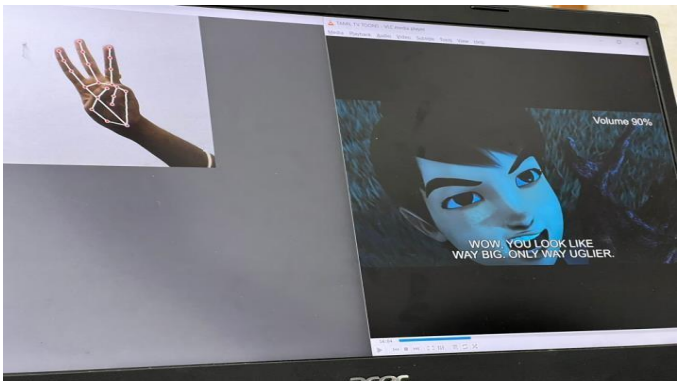

Figure 6 Volume Up

In Figure 6 by recognizing this hand gesture the up-arrow operation is done this will make the audio to increase.

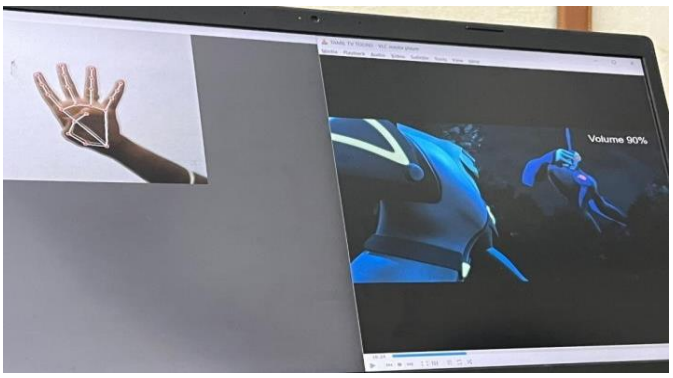

Figure 7 Volume Down

In Figure 7 by recognizing the hand gesture the Down arrow operation is done this will make the audio to decrease.

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Conclusion and Future Development Conclusion

This Hand Gesture recognition for video player project detects all the gestures with high accuracy. And performing the operations efficiently. Overall, a hand gesture recognition system for a video player using OpenCV has the potential to revolutionize the way we interact with digital media, providing a more natural and intuitive way to control our media playback experience.

Future Development

We will work on easy gestures in future and integrating this application in a video player so that we can use the video player app itself the hand gesture recognition. And also to enhance the detection of hand gesture in low light conditions.

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