Computer Graphics Project Report
Hand Gesture System Control

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How good the idea is?

The idea initially is based on the paper [1]. In this research they developed a **Gestural flick input-based non-touch interface for character input** using Kinect Sensor. This project has limited application of just for character inputs with different gesture recognition. Since, the Kinect sensors cannot be easily incorporated into simple laptops and mobile devices. We thus, need an application which works well without incorporating more detailed sensors or other accessories. This is where our idea kicks in. In our project we are designing a system control which can help the user to control his entire system with hand gestures and blink recognitions using Image Processing, and for this we are just using web-cams which are easily available to any user in his laptop or mobile devices.

Complexity/Intuitiveness –

The major complexity in the project was as to how to detect the hand among the background noises and other errors. We resolved this using a specified box with a certain width and height and then when the user places his hand into this box only then it detects the hand, so basically by reducing the area of detection this was easily resolved.

One of the other major complexity was as to how to detect the color of hand as people can have different color of hands, some may have a very darker hand as compared to others having lighter shade. So, simulating a proper range of color detection to cover this skin shade from maximum to minimum was a result of a good number of experiments.

Modifications –

Our project is an extended idea of the initial paper [1] published in springer in 2019. In this research we have developed the application from scratch using Image processing, CNN and other python libraries for system control. This project is not a modified version of any paper, research or project, instead an extended idea of the paper [1].

Limitations –

There are some limitations to the project –

1. The variation in lightening condition can disturb the detection of fingers.
2. Facial features detection is based on an already trained CNN model, So the project is bound with its prediction probability.
3. The project is also limited by the quality of camera used.

Difficulties Faced –

The major difficulty faced was for the non-uniform background detection, as it can have hints of any random color, or any permutation of hue, saturation, and value, thus, can interfere with the actual interpretation of the given video frame captured by the webcam. Noises in the background or low quality of web-cam will always be an issue to deal with. Also, we are using a Face Recognition CNN trained model which predicts facial features and thus are limited by those prediction probabilities as well.

Results –

The project works well with background being a little darker than the user hand or a bit lighter than that. Using this application, we can control the screen controls, by simple hand gestures, for e.g., gesture for 1 – helps the cursor to move left, and gesture of 2 – helps the cursor to move right, gesture 3 – move up, gesture 4 – move down, gesture 5 – left click and also the eyes gesture of blinking – right click.

Future works –

1. We can incorporate the color detection mechanism with auto tuning for different projects. Example will be discussed during presentation.

2. We can also design for background detection and thus make it easier to use at any place Example will be discussed during presentation.
3. We can also implement different option with combining hand gesture of two hands for more screen control.
4. A better facial recognition CNN predictor with better predictability can also be added to increase the efficiency of the application.

Supplementary Materials –

The working code of the project **Hand Gesture System Control** is attached along with this report. The code is written entirely in python. A README file is also added along with the code folder, having all necessary libraries and other installations needed to be included. The steps to run the project is also added along with proper code comment and documentation.

GitHub Link for the entire project is – Computer-Graphics-Project

References –

[1] Md. Abdur Rahim, Jungpil Shin, Md. Rashedul Islam, 2019 "*Gestural flick input-based non-touch interface for character input*" Springer-Verlag GmbH Germany, vol-36, no-10, 1559-1572.