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Gesture Recognition using Open CV

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Abstract: *With advanced technologies in this digital era, there is always scope for development in the field of computing. Hands free computing is in demand as of today it addresses the needs of quadriplegics. This paper presents a Human computer interaction (HCI) system that is of great importance to amputees and those who have issues with using their hands. The system built is an hand gesture-based interface that acts as a computer mouse to translate finger movements towards the mouse cursor actions with this we have implemented eye recognition/ detection. The system in discussion makes use of a simple webcam and its software requirements arespyder(anaconda 3), OpenCV, NumPy and a few other packages which are necessary for gesture recognition. The gesture detector can be built using the HOG (Histogram of oriented Gradients) feature along with a linear classifier, and the sliding window technique. It is hands free, and no external hardware or sensors are required..*

Keywords: Hands free computing

I. INTRODUCTION

As we know, the vision-based technology of hand gesture recognition is an important part of human-computer interaction (HCI). In the last decades, keyboard and mouse play a significant role in human-computer interaction. However, owing to the rapid development of hardware and software, new types of HCI methods have been required. In particular, technologies such as speech recognition and gesture recognition receive great attention in the field of HCI. Gesture is a symbol of physical behavior or emotional expression. It includes body gestures and hand gestures. It falls into two categories: static gesture and dynamic gesture. For the former, the posture of the body or the gesture of the hand denotes a sign. For the latter, the movement of the body or the hand conveys some messages. Gestures can be used as a tool of communication between computer and human. This section considers the application of eye movements to user interfaces, both for analyzing interfaces (measuring usability) and as an actual control medium within a human–computer dialogue. The two areas have generally been reported separately; but this seeks to tie them together. For usability analysis, the user's eye movements while using the system are recorded and later analyzed retrospectively, but the eye movements do not affect the interface in real time. As a direct control medium, the eye movements are obtained and used in real time as an input to the user–computer dialogue.

These uses of eye tracking in HCI have been highly promising for many years, but progress in making good use of eye movements in HCI has been slow to date. We see promising research work, but we have not yet seen wide use of these approaches in practice or in the marketplace. We will describe the promises of this technology, its limitations, and the obstacles that must still be overcome. Work presented in this and elsewhere shows that the field is indeed beginning to flourish. Markets and Markets that the gesture recognition market will reach $32.3 billion in 2025, up from $9.8 billion in 2020. Today's top producers of gesture interface products are, unsurprisingly, Intel, Apple, Microsoft, and Google. The key industries driving mass adoption of touchless tech are automotive, healthcare, and consumer electronics.

II. MOTIVATION & RELATED WORK

Our motivation is to help people in this pandemic, in such a way that when they try accessing or using their devices it is easy to use without the mode of touch, hence we introduced the vision of using devices such as laptops and PCs with gesture recognition. The system will work like a mouse but instead of a mouse we humans are using our hands to let the system work. As in using fingers for moving the mouse pointer, bending fingers to click and tap on things in the system. The related work was to create, " Motion sensors in a device that can track and interpret gestures, using them as the primary source of data input. A majority of gesture recognition solutions feature a combination of 3D depth-sensing cameras and infrared cameras together with machine learning systems. Machine learning algorithms are trained based on labeled depth images of hands, allowing them to recognize hand and finger positions".

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We have also focused on the theory of Retina sensoring, hence we have also added a future scope in our module to detect eyes/ retina and using them users will be able to move their mouse pointers on different locations in the system, by blinking of eyes the user will be able to click on the items, this was generally an idea for the amputees.

III. PROPOSED SYSTEM

Most gesture recognition methods usually contain three major stages. The first stage is object detection. The target of this stage is to detect objects in the digital images or videos. Many environment and image problems are needed to solve at this stage to ensure that the contours or regions can be extracted precisely to enhance the recognition accuracy. Common image problems contain unstable brightness, noise, poor resolution and contrast. The better environment and camera devices can effectively improve these problems. However, it is hard to control when the gesture recognition system is working in the real environment or is becoming a product. Hence, the image processing method is a better solution to solve these image problems to construct an adaptive and robust gesture recognition system. The second stage is object recognition. The detected hand objects are recognized to identify the gestures. At this stage, differentiated features and effective classifiers selection are a major issue in most research. The third stage is to analyze sequential gestures to identify users instructions or behaviors.

3.1 Prerequisites

1. We used Python version 3.8 This project implements a hand recognition and hand gesture recognition system using OpenCV on Python 2.7. A histogram based approach is used to separate out a hand from the background image. Background cancellation techniques are used to obtain optimum results.
2. Spyder(anaconda) : Spyder is an IDE aimed at mainly scientific researchers, data analysts, or those involved in scientific package creation. Spyder's developers have designed it hence, to be the ideal tool for developing Python applications, and Spyder itself has been created using Python.
3. OpenCV : OpenCV is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing, video capture and analysis including features like face detection and object detection.
4. NumPy : NumPy is a Python library used for working with arrays. It also has functions for working in the domain of linear algebra, fourier transform, and matrices. NumPy was created in 2005 by Travis Oliphant. It is an open source project and you can use it freely. NumPy stands for Numerical Python.
5. AutoPy : AutoPy is a simple, cross-platform GUI automation library for Python. It includes functions for controlling the keyboard and mouse, finding colors and bitmaps on-screen, and displaying alerts. Currently supported on macOS, Windows, and X11 with the XTest extension. Python 2.7, or Python 3.5 and up.
6. MediaPipe MediaPipe is an open-source, cross-platform Machine Learning framework used for building complex and multimodal applied machine learning pipelines. It can be used to make cutting-edge Machine Learning Models like face detection, multi-hand tracking, object detection, and tracking, and many more.

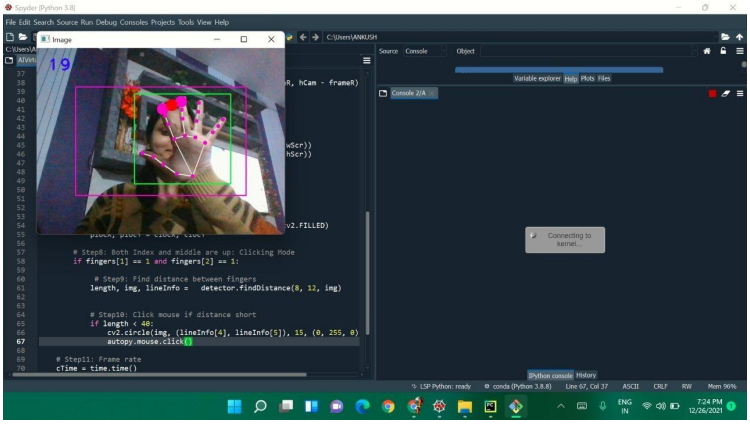

Fig 3.1 : This is our detected hand will look like, along with the code

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Hand gesture image capture The construction of a database for hand gestures (i.e., the selection of specific hand gestures) generally depends on the intended application. A vocabulary of six static hand gestures is made for HCI

Looking on to eye sensor for the amputees, the module looks like:

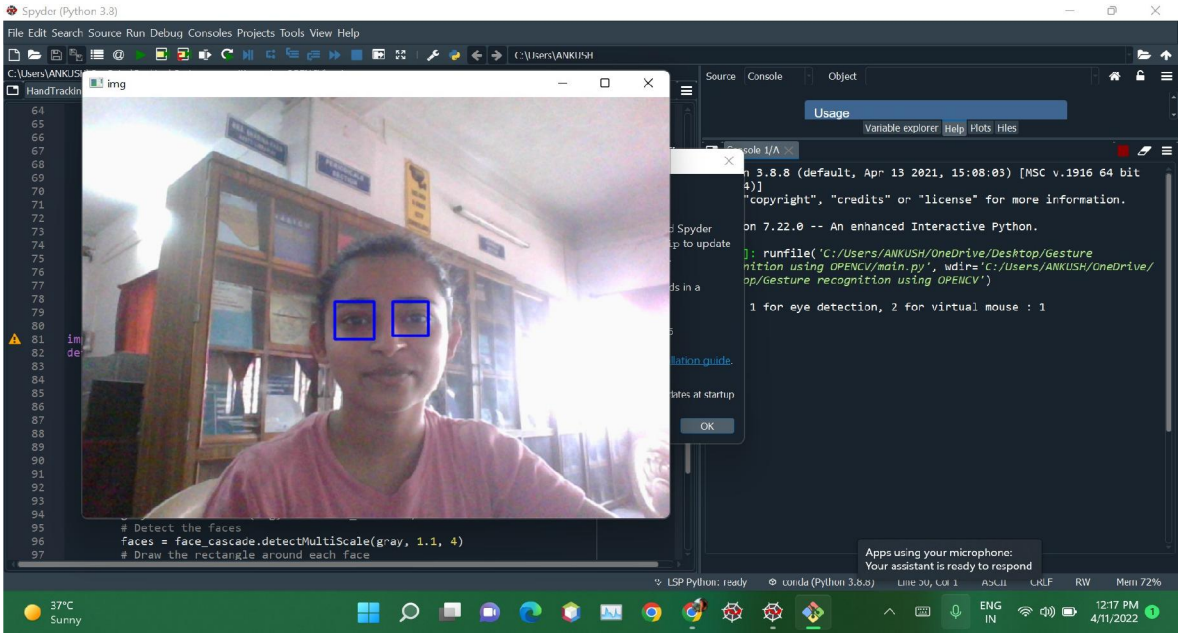

Fig 3.2 : Retina detected by user

3.2 Advantages

1. Touching random device is avoided
2. Easily work done with simple use of hands

IV. CONCLUSION & FUTURE SCOPE

The hand region is detected from the background by the background subtraction method. Then, the palm and fingers are segmented. On the basis of the segmentation, the fingers in the hand image are discovered and recognized. We provide hand tracking based control system and eye recognition. The system includes the mouse functions, so that users can use our system to achieve almost all of the inputs to the computer without traditional input equipment. Currently, this system is applied for the general operating behavior to interact with computers by simulating mouse and keyboard. In the future, we will try to add new operation functions for more usage situations for users to communicate with media and adjust our system on new platforms, such as tablets or phones. We will also develop series operation modules in order to achieve a complete operating experience for users from turning on to turning off the computer.

The performance of the proposed method highly depends on the result of hand detection. If there are moving objects with the color similar to that of the skin, the objects exist in the result of the hand detection and then degrade the performance of the hand gesture recognition.

However, the machine learning algorithms can discriminate between the hand from the background. ToF cameras provide the depth information that can improve the performance of hand detection. So, in future works, machine learning methods and ToF cameras may be used to address the complex background problem and improve the robustness of hand detection.

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