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Cursor Control Using Facial Movements for Physically Challenged People

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ABSTRACT

As computer technology is growing rapidly, the importance of human interaction is also increasing immensely. We tend to depend on computers a lot for everything nowadays. Computers are designed to be readily accessible for normal individuals. Unfortunately, people with certain disabilities cannot able to operate the computers. The idea of this paper is to provide a simple and convenient method by using the user's facial movements and voice. The movement of the cursor is accessed by automatically adjusting the eye and facial movements. And the voice is used to access the web-browser for various purposes. Main focus is to create a human-computer interaction cost effectively. Moreover, implementing a control system helps them to operate the computer by eliminating the help of another individual.

Keywords: Human-Computer Interaction, Computer vision, Voice, Python.

I. INTRODUCTION

to Nowadays personal computer systems are playing a vital role in our everyday lives as they are used in almost everything such as in work, education, and enjoyment. The use of computer's has advanced so much such that it has become a basic necessity in today's world.All these applications have one thing in common is that the use of personal computers where mostly the input method is based on keyboard and mouse. Computer is one of the biggest gifts of technology. While this isnot aproblem for a healthy individual, this may be an insurmountable bound for certain physically challenged persons such as people with limited freedom of movement of their limbs. It would create a barrier between user and the system. It is also mentioned that the number of disabled friendly facilities are still minimum in major countries. They need to seek constant help from others. In these cases, it would be preferable to use input methods that are based on more abilities of the region such asfacial movements and voice since eye tracking is the best alternative and effective method to make communication between the system and user. Developing communication devices for disable people, have been intensively studied by many in the world. The proposed system incorporates computer vision and machine learning. Computer vision is an interdisciplinary scientific field that deals with how computers can gain high-level understanding from

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digital images or videos. Computer vision tasks include methods for acquiring, processing, analysing and understanding digital images, and extraction of high-dimensional data from the real world. Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It isseen as subset of artificial intelligence. The eye gaze is tracked using the camera and the voice is used for the control of web automation. The eye and facial movements are tracked for the various mouse control operations like right click, left click, double click, etc and the voice is recorded using the microphone to control the web automation. The method described in this paper is distinctive because unlike the existing system there is no hardware used to track the facial movements making it easily accessible and cost-effective.

II. LITERATURE SURVEY

A greatamount of research work has been done in the field of Computer Vision, Machine Learning, Speech Recognition. Dharshini,et al.have proposed a cursor control using eye with Raspberry pi-based interfacing using image processing. The image processing module consists of webcam and python customized image processing whichcaptures the eye movement and is transmitted to Raspberry pi microcontroller for processing with OpenCV to derive the coordinate of eyeball [1]. However, the use of Raspberry pi microcontroller makes the system design more complex. Navpreet Kaur, etal. presented a system which incorporated the use of the electrical potentials developed by eye movements known as Electrooculography which is used for the control of cursor movements. EOG signal is used to detect eye movement and features. The EOG signal is recorded from electrodes placed at appropriate positions around the eyes and allows movement of cursor where the eye gaze is pointed [2]. The work presented by Vasanthan et al. also revolves around the use of microcontroller. It uses web-camera for capturing the facial expression and sends the data into BASIC STAMP microcontroller and Movements of markers are detected through its x-y coordinate's and each facial expression is uniquely represented by a binary number. As a result of change of x-y co-ordinates, the BASIC STAMP microcontroller sends the binary code to the computer for controlling the mouse actions.[3]. The work by Anamika Mali et al. in “Optimal System for Manipulating Mouse Pointer Using Eye” is based on using light-reflection based systems with non-imaging sensors, thus providing an alternative to computer mouse. It will capture the change in the iris positions with the help of IR sensors to track the point of gaze in order to translate it to some events that communicate with the computer. Data Acquisition is used which acts as the intermediate block between the Eye tracking goggle and the computer [4]. Ashwini Shinde et al.have proposed the work named “Eyeball Movement Based Cursor Control”uses computer vision with the help of MATLAB. The MATLAB equations are incorporated for the detection of the eye. The iris is located which is used for controlling the cursor and the predefined MATLAB equation are used in order to find the locations accurately and the mouse cursor is moved to the area where the eye gaze is being pointed [5]. All the above proposed works lack the incorporation of a various method for proper control of the cursor in real time making it a complex system.

III. METHODOLOGY

The first step was to use a face detection algorithm to locate the face on the image frame captured by an webcam. The next step was to detect only the eyes and the mouth region accurately on this frame. We then track the iris movement and the mouth movement for the various cursor operations like right click, left click, double click, scroll, etc. The iris movement allows the movement of the cursor on the screen and right wink, left wink, etc are the various

actions to be performed in order to operate the mouse for left click, right click, etc. The mouth movement was detected for the ON/OFF of the scrolling mode using the graphical user interface (GUI). Finally, the voice control module was added so as to achieve the web automation control. Various voices commands were developed for controlling the web-application.

IV. IMPLEMENTATION

The algorithm for controlling the cursor using the facial movements and the voice-based web automation was achieved through the following steps:

A. Face Detection

In order to detect and capture the face image accurately, the user sat in front of the webcam upright with eye level.The image of the user's face is captured using the predefined Face Landmark Detection algorithm offered by Dlib which is used to detect 68-landmark points on the face accurately as shown in Fig.1.

Fig 1. Pre trained Dlib shape_predictor_68

B. Eye and Mouth Detection and movement

After the face gets detected, it finds and locates our eye and mouth co-ordinates. The functions done by the movement of eye and mouth are as follows; Opening the mouth activates our framework and initiates the other functions. Squinting of eyes activates Scrolling. Right eye wink is used for Right click and left eye wink is used for left click. Similarly opening the mouth in the end deactivates the framework and squinting of eyes deactivates the scrolling.

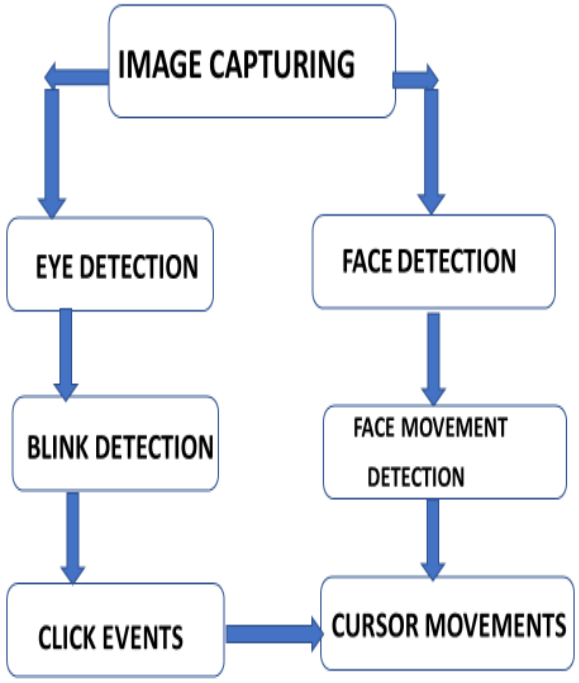

Fig 2. Facial movement-based cursor control

C. Cursor Controls

The mouse cursor is now controlled by our eye and facial movements. The up and down movements of the cursor is controlled by up and down movements of face. Similarly, right and left movements of cursor is controlled by right and left movements of face. As the coordinates of face are placed in our framework, the movements help in the cursor movements.

D. Speech Recognition

The Speech Recognition module is used for the automatic recognition of human speech. It has many built-in functions which allows it to recognize speech from an audio file or live from a microphone and then converts it to text as shown in Fig 3. In order to transcribe the audio from the microphone instead of converting it to text, the PyAudio library function is

used. The captured speech is then processed using the PyAudio which is used to record and play audio.

Fig 3. Speech recognition module

E. Web Automation Using Voice

The Speech Recognition module has a recognizer within it in order to recognize the user's speech. It first recognises and identifies the speech so as to access the web different commands are used. The commands like 'open google' is used to open the google webpage similarly 'open youtube' is used to open the youtube webpage. The searching can be done with the help of 'search' voice command. The various functions like switching the tab or closing the tab has been executed through voice control with the help of speech recognition module. In case of an invalid command or if it fails to recognize the user's voice, 'Not a valid command, please try again' command is played out for the user. Hence, the web automation has been made cost-effective and interactive.

V. RESULTS AND OUTPUT

A Machine Learning and computer vision-based algorithm for mouse cursor control using facial movements and speech recognition-basedvoice control for web automation has been implemented and tested successfully. The face was captured using the computer webcam and then the location of the iris was tracked accurately. The iris was used for moving the cursor across the screen and for various mouse actions like right click, left click, etc., and the mouth is used for scrolling action. The various cursor movements were implemented and all the movements were tested with different threshold provided the best result in real-time. The speech recognition module was used for the voice-controlled web automation. The voice commands are used for controlling the web application for opening a website or searching in a website. It was tested successfully with different voices and provided great results.

VI. CONCLUSION

The goal of the proposed system is to help physically challenged people with certain disabilities to overcome the obstacle of using the personal computer without the help of other individuals so that, they don't feel left out and they could get access to the technology like normal individuals. The proposed system is implemented using computer vision for tracking the eye and facial movements for the controlling the cursor and voice is used for the control of web automation. In the future, this method can be incorporated in platforms like phones, tablets where touch is used and can also be used in controlling home appliances, driving a car, etc. The system is made in a way to be more effective real-time solution and cost-effective making it readily available for physically challenged people.

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