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VIRTUAL MOUSE OPERATION USING WEBCAM

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Abstract: *The idea of eye controls of great use to not only the future of natural input but more importantly the handicapped and disabled. It is more helpful to handicapped peoples. In this Web camera is capturing the image of face and detect the position of eye. Then the different variation on face position gets different movement of cursor. These face movements are then graphed to a computer screen to position a mouse cursor accordingly. Controlling of mouse cursor is obtained by face movement and mouse events are controlled through eye blinks. To perform these operations different algorithms like HAAR CASCADE algorithm, Template Matching and Hough transformation are used.*

Keywords: *Human Computer Interface, Web cam, HAAR CASCADE algorithm, open CV.*

I. INTRODUCTION

Nowadays personal computer systems are carrying a huge part in our everyday lives as they are used in areas such as work, education and enjoyment. What all these applications have in common is that the use of personal computers is mostly based on the input method via keyboard and mouse. While this is not a problem for a healthy individual, this may be an insurmountable bound for people with limited freedom of movement of their limbs. In these cases, it would be preferable to use input methods which are based on more abilities of the region such as eye movements. To enable such

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substitute input methods a system was made which follows a low-price approach to control a mouse cursor on a computer system. The eye tracker is based on images recorded by a mutated webcam to acquire the eye movements. These eye movements are then graphed to a computer screen to position a mouse cursor accordingly. The movement of mouse by automatically adjusting the position of eyesight. Camera is used to capture the image of eye movement. In general, any digital image processing algorithm consists of three stages: input, processor and output. In the input stage image is captured by a camera. It sent to a particular system to focus on a pixel of image that's gives, its output as a processed image. Embedded system is combination of hardware and software. An embedded system can be an independent system or it can be a part of a large system. An embedded system is a microcontroller or microprocessor-based system which is designed to perform a specific task. For example, a fire alarm is an embedded system; it will sense only smoke Python is a high-level language. This means that Python code is written in largely recognizable English, providing the Pi with commands in a manner that is quick to learn and easy to follow. This is in marked contrast to low-level languages, like assembler, which are closer to how the computer ―thinks‖ but almost impossible for a human to follow without experience. As the computer technologies are growing rapidly, the importance of human computer interaction becomes highly notable. Some persons who are disabled cannot be able to use the computers. Eye ball movement control mainly used for disabled people. Incorporating this eye controlling system with the computers will make them to work without the help of another individual. Human-Computer Interface (HCI) is focused on use of computer technology to provide interface between the computer and the human. There is a need for finding the suitable technology that makes the effective communication between human and computer[1]. Human computer interaction plays the important role. Thus there is a need to find a method that spreads an alternate way for making communication between the human and computer to the individuals those who have impairments and give them an equivalent space to be an element of Information Society. In recent years, the human computer interfaces are attracting the attention of various researchers across the globe. Human computer interface is an implementation of the vision-based system for eye movement detection for the disabled people. In the proposed system, we have included the face detection, face tracking, eye detection and interpretation of a sequence of eye

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blinks in real time for controlling a non-intrusive human computer interface. Conventional method of interaction with the computer with the mouse is replaced with the human eye movements. This technique will help the paralyzed person, physically challenged people especially person without hands to compute efficiently and with the ease of use. Firstly, camera captures the image and focuses on the eye in the image using OpenCV code for pupil detection. This results the center position of the human eye (pupil). Then the center position of the pupil is taken as a reference and based on that the human or the user will control the cursor by moving left and right [2].

The vision-based interface technique extracts motion information without any high-cost equipment from an input video image. Thus, vision-based approach is taken into account an effective technique to develop human computer interface systems. For vision-based human computer interaction, eye tracking is a hot issue. Eye tracking research is distinguished by the emergency of interactive applications. However, to develop a vision-based multimodal human computer interface system, an eye tracking and their recognition is done. Real time eye input has been used most frequently for disabled users, who can use only their eyes for input. There are different reasons for which people need an artificial of locomotion such as a virtual keyboard. The number of people, who need to move around with the help of some article means, because of an illness. Moreover implementing a controlling system in it enables them to move without the help of another person is very helpful The proposed work includes face detection, face tracking, eyeblink detection, voice recognition and interpretation of a sequence of blinks in real time to control a non-intrusive human–computer interface [3].

To replace the traditional mouse with the human face and eye movements to interact the computer. It is to assist the physically challenged persons without hands to use the computer efficiently and also easy Eye tracking is used to study users' attention patterns during task performance or to allow hands-free interaction with a computer for persons unable to use the traditional mouse and keyboard-based control inputs. As eye-tracking technology advances into the future, it can be clearly seen that it is advantageous to utilize eye-tracking as a replacement for traditional control tasks especially for disabled users. In some cases, the use of eye tracking fits naturally with the intended task, for example a camera that utilizes the user's

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eyes to focus the lens at the location that the user is currently looking. At the same time, the performance of eye tracking equipment can vary due to many factors including low accuracy[4]

MOTIVATION

The idea of face and eye controls of great use to not only the future of natural input but more importantly the handicapped and disabled. All ordinary devices require manual control and cannot be used by persons impaired in movement capacity. There is a need for developing alternative methods of communication between human and computer that would be suitable for the persons with motor impairments and would give them the opportunity to become a part of the Information Society. A vision-based system for detection of eye and face movements is presented, together with its implementation as a Human – Computer Interface for people with disabilities.

II. LITERATURE SURVEY

Vandana Khare, et al.[5], "Cursor Control Using Face Movement", Because of their illness , a few people and groups are unable to use computers. In this case, it makes more sense to provide a computer operating method that is easily accessible, even when taking into account the infirmities of the differently abled. The human face can be used as a suitable replacement for computer operating hardware. An Internet protocol camera was utilised to capture an image of a face frame for cursor movement in this paper. In this regard, we must first concentrate on the role of the FACE. We use a Raspberry Pi for pupil identification since it can handle the computer's cursor, and in this task, a Face Aspect Ratio (FAR) is calculated, which corresponds to the snaps of the face (left or right) using the Python programming language's Open Source Computer Vision module. The major purpose of our suggested methodology is to improve the computing experience of physically challenged people by assisting them in overcoming challenges such as mouse usage.

Aditya Dave1 and C. Aishwarya Lekshmi [6] ,"Eye-Ball Tracking System for Motor-Free Control of Mouse Pointer", Recent developments in the field of image processing have resulted in a number of high-quality feature detection techniques. While there is a constant need for new algorithms, there is also a need for an equal number of applications of such algorithms in order to achieve their full potential and use by the general public. For building a robust eye ball tacking system for directing the mouse pointer, this work uses a combination of Viola-Jones,

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Kanade–Lucas–Tomasi (KLT), and Circular Hough transform algorithms. The system's new feature is the ability to represent clicks. A single click is represented by one blink, and a double click is represented by two blinks in a short period of time. Other methods that were tried but failed to track characteristics are also described in the study. Because computer dependence has risen so dramatically in recent years, this technique can help people with motor difficulties browse through their files on the computer more quickly. Different algorithms excel at different things. So, rather than creating one algorithm extremely complex in order to perform well on all parameters, combining the best features of all three methods greatly simplifies the work and provides a better result than any of the three alone. The system was tested in a variety of lighting settings and distances from the screen, and it successfully tracked the iris with an accuracy of about 96%, which is impressive given that this is a real-time implementation.

The authors' ultimate goal is to create a software package out of this system and make it open source, therefore ease of implementation has been a top priority in order to improve user understanding of the algorithm.

Sivasangari.A et al. [7]"Eyeball based Cursor Movement Control", A human computer interference system is being introduced one at a time. Human computer interference systems used the mouse and keyboard as input devices in the past. Those who are afflicted with a specific ailment or ailment are unable to use computers. For handicapped and impaired people, the idea of controlling computers with their eyes will be extremely useful. This form of control will also eliminate the need for other people to assist with the computer. This approach will be particularly effective for people who are unable to function with their hands and must instead rely on their eyes. The movement of the cursor is directly related to the pupil's centre. As a result, the initial step would be to locate the point pupil's centre. The Raspberry Pi and OpenCV are used to build this pupil detection procedure. The SD card is inserted into the SD/MMC card port of the Raspberry Pi. The operating system that is required to start up the Raspberry Pi is installed on the SD card. Once the application programme is loaded into the Raspberry PI, it will run.

Pierluigi Cigliano et al.[8]"Robotic Ball Catching with an Eye-in-Hand Single-Camera System "This study proposes a unified control framework for realising a robotic ball catching job utilising only a

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moving single-camera (eye-in-hand) system capable of recording flying, rolling, and bouncing +balls in the same formalism. To visually track the thrown ball, a circle detection approach is used. Following the recognition of the ball, the camera must follow a baseline in the space to capture an initial collection of visual measurements. To obtain an initial estimate of the catching point, a linear technique is applied. Then, using a nonlinear optimization methodology and a more exact ballistic model, new visual measurements are acquired on a regular basis to keep the current estimate up to date. A typical partitioned visual servoing technology is utilised to operate the translational and rotational components of the camera separately. Experiment results on an industrial robotic system indicate the efficacy of the proposed solution. Using a motion-capture system, ground truth is employed to validate the proposed estimating technique.

Osama Mazhar et al. [9]"A Real-time webcam based Eye Ball Tracking" The Eye Ball Tracking System is a technology designed to help individuals who are unable to conduct any voluntary duties in their daily lives. Patients who can only control their eyes can use assistive gadgets like the one proposed in this research to communicate with the outside world. This device uses a human-computer interface to make judgments based on the user's eye movements. A webcam captures a real-time data stream that is serially transferred to MATLAB. Then, using a reference axis, a sequential image processing algorithm segments the iris of the eye and determines the centroid, providing a control signal. Using a USB microcontroller interface, the control signals are then used to manipulate the position of a motorized platform.

R.Rithi, et al.[10] "CURSOR control using eyeball Movement with raspberry pi", Some people are unable to use computers due to disease. Not only for the future of natural input, but also for the handicapped and crippled, the concept of eye controllers is extremely useful. Furthermore, by including a control system, they will be able to run the computer without the assistance of another person. This device is particularly useful for people who can move their cursor with their eyes. The image of eye movement is captured using a camera in this research. It begins by determining the position of the pupil's centre. Then, depending on the pupil location, the cursor moves in different ways. The Pupil Detection process is carried out on a Raspberry Pi and on the terminal of the Raspier image loaded on the Raspberry Pi. The Raspberry Pi is a single computer or SoC the size of a credit

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card that runs on the ARM1176JZF-S core. System on a Chip (SoC) is a method of putting all of the circuitry needed to run a computer on a single chip. To get started, the Raspberry Pi requires an operating system. The Raspberry Pi does not have any on-board non-volatile memory to store boot loaders, Linux kernels, or file systems, as seen in more traditional embedded systems, in order to save money.

III. PROPOSED WORK

- Firstly, the input video has been captured by using either I/P cam or external camera (USB), the detection of face then takes place through this.
- The HAAR CASCADE algorithm used for detecting the faces available in the given image. After detecting the face of an image, the markings of the eye get tracked. By fixing the points in the face it is achieved. Based on the value between the marking points in the face it is get alerted when it's gone below the threshold value.

SYSTEM ARCHITECTURE

ALGORITHMS

Haar-cascade Algorithm:

The **Viola-Jones algorithm** (also known as **Haar cascades**) is the most common algorithm in the computer vision field used for face detection on the image. The Viola-Jones algo is used not only to detect faces on images but also, we can train the model to detect different objects like cars, buildings, kitchen utensils, fruits, etc.

Understanding Face Detector Method:

The image to be used is divided into different kinds of sub-windows and multiple Haar-like features to compute it at different scales and positions for each sub-window. Then each sub-window is checked for the presence or absence of face using a cascade of classifiers**.**

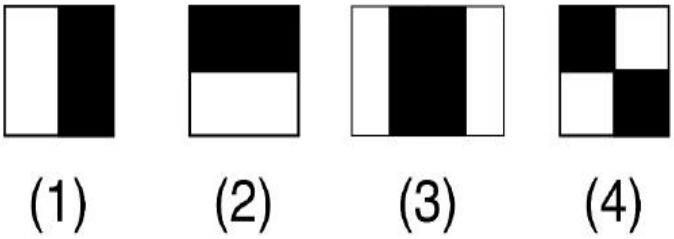

Fig.1 Haar features

Example Haar features

The detection algorithm uses a cascade of classifiers which use Haar-like features. Thus, it is also called the **Haar Cascades based detector**. features = sum(pixels in the black area) - sum(pixels in the white area)

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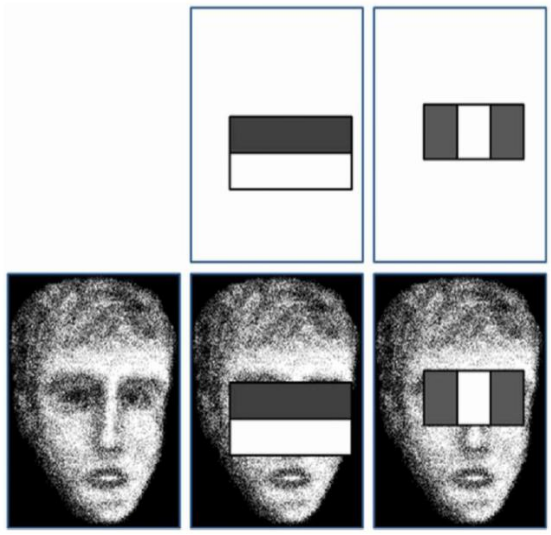

Fig.2 Detecting image features

In the figure shown above, when we calculate the second image features, it will give more features because the bridge is lighter than the nearby area. But if the same features, we keep on the head of the face, we will get fewer features. In the third image, we also get more features as it can detect the eye region since the eye region is darker as compared to the region below it.It should be noted that only a single feature is not capable of detecting faces with high accuracy. But, when many such features vote for the presence or absence of a face, the detection becomes very accurate and robust

These features have actual real importance in the context of face detection:

1. Eye regions tend to be darker than cheek regions.

2. The nose region has more bright pixels than the eye region.

Therefore, from the above given five rectangles along with the corresponding difference of sums, we are able to get the features which can classify the face. To detect which features belong to face from the available number of features we use the AdaBoost algorithm to select which ones correspond to facial regions of an image.

As we can imagine, using the above **rectangle fixed sliding window** on the image across every **(x, y) coordinate of an image**, followed by computing all those features using Haar to classify the face features

Hough transformation:

Hough Transform (HT) is one of the useful algorithms in pattern recognition. It is popularly used to detect straight lines, circles and curves in images. This study discovered a new feature detection and extraction using the HT. The intensity of the input image was enhanced and histogram plot of the stretched image was obtained. However, HT functions perform transformation of Hough matrix, locate peak values and superimpose a plot on the features representing the original image. Hence, face features were detected and the extracted features proceeded for verification. Cross Correlation Technique (CCT) and Euclidean Distance (ED) were

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computed to determine the similarity between test images and neutral image. The experiment on FEI face database demonstrated the effectiveness of the new technique and obtained recognition with minimal error. Furthermore, the application of HT was improved and the benefits of the proposed algorithm were verified. It is believed that, the discovery is new in the domain.

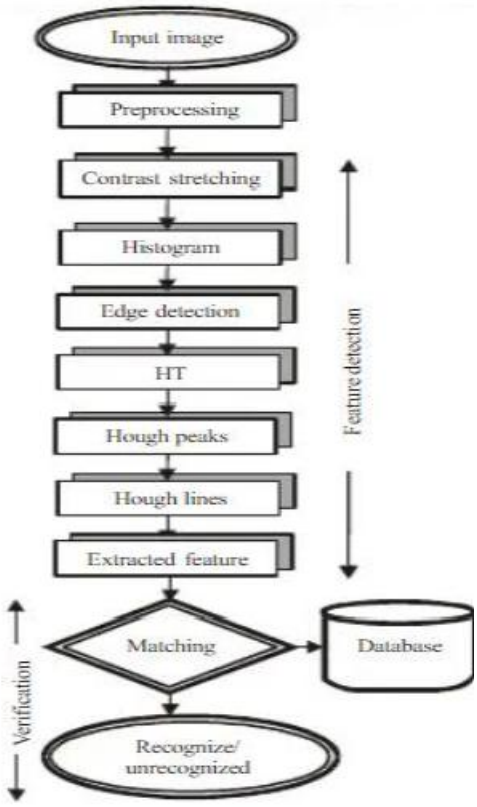

Fig.3 Flow chart of Hough Algorithm

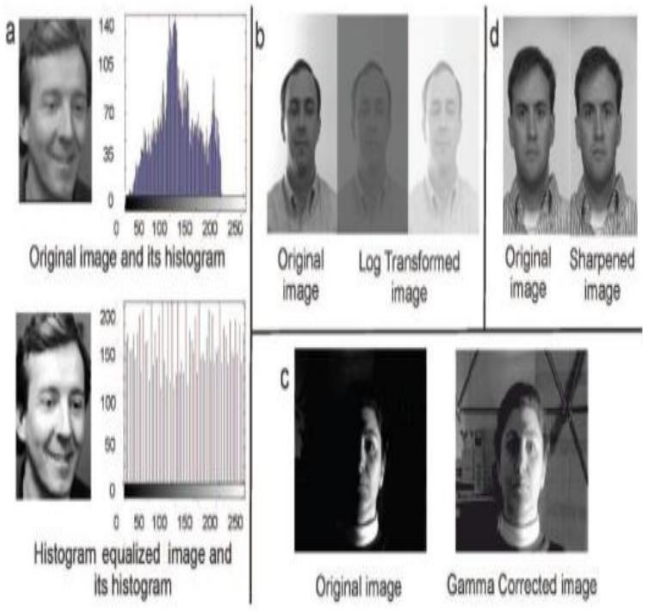

Fig.4 Edge detection process

MODULE DESCRIPTION

Open CV

OpenCV (Open-Source Computer Vision) is an open-source computer vision and machine learning software library [10]. OpenCV was initially built to provide a common infrastructure for applications related to computer vision and to increase the use of machine perception in the commercial products. As it is a BSD-licensed product so it becomes easy for businesses to utilize and modify the existing code in OpenCV.

Around 3000 algorithms are currently embedded inside OpenCV library, all these algorithms being efficiently optimized. It

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supports real-time vision applications. These algorithms are categorized under classic algorithms, state of art computer vision algorithms and machine learning algorithms. These algorithms are easily implemented in Java, MATLAB, Python, C, C++ etc. and are well supported by operating system like Window, Mac OS, Linux and Android.

A full-featured CUDA and OpenCL interfaces are being actively developed for the betterment of technology. There are more than 500 different algorithms and even more such functions that compose or support those algorithms. OpenCV is written natively in C++ and has a templated interface that works seamlessly with STL containers. For OpenCV to work efficiently with python 2.7 we need to install NumPy package first.

NumPy

NumPy is a Python library, including support for enormous, multi-dimensional clusters and frameworks, alongside a huge assortment of significant level numerical capacities to work on these exhibits. The predecessor of NumPy, Numeric, was initially made by Jim Hugunin with commitments from a few different designers. In 2005, Travis Oliphant made NumPy by consolidating highlights of the contending Numarray into Numeric, with broad alterations. NumPy is open-source programming and has numerous givers.

Such clusters can likewise be sees into memory cradles distributed by C/C++, Python, and Fortran expansions to the CPython mediator without the need to duplicate information around, giving a level of similarity with existing numerical libraries. This usefulness is misused by the SciPy bundle, which wraps various such libraries . NumPy has worked in help for memory-mapped ndarrays. • NumPy focuses on the Python reference execution of Python, which is a non-streamlining bytecode translator. Numerical calculations composed for this rendition of Python regularly run much slower than assembled counterparts. NumPy addresses the gradualness issue incompletely by giving multidimensional clusters and capacities and administrators that work productively on exhibits, requiring changing some code, generally internal circles utilizing NumPy

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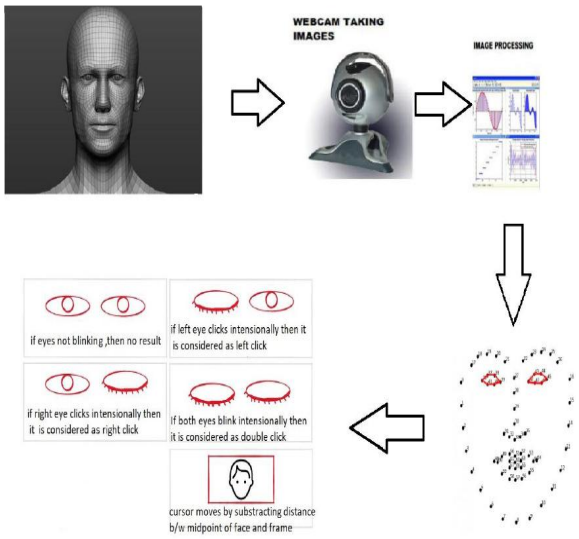
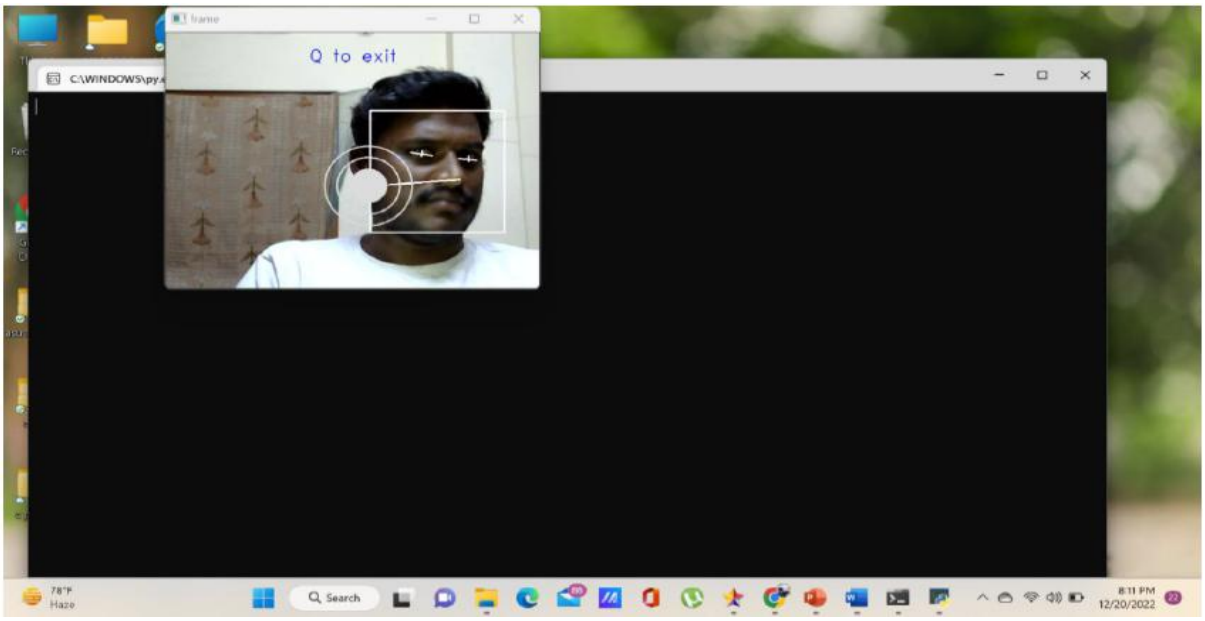


Fig.5 System architecture.

ARCHITECTURE OF DISCRIPTION

- In the first step the user image will be captured through the web camera.
- The captured image will be pre-processed
- The features of the pre-processed image will be extracted.
- Then, the training phase will be done.
- Now ,an identification process takes place i.e., if the trained image is matched with the image present in the database, then access will be granted.

IV. RESULTS



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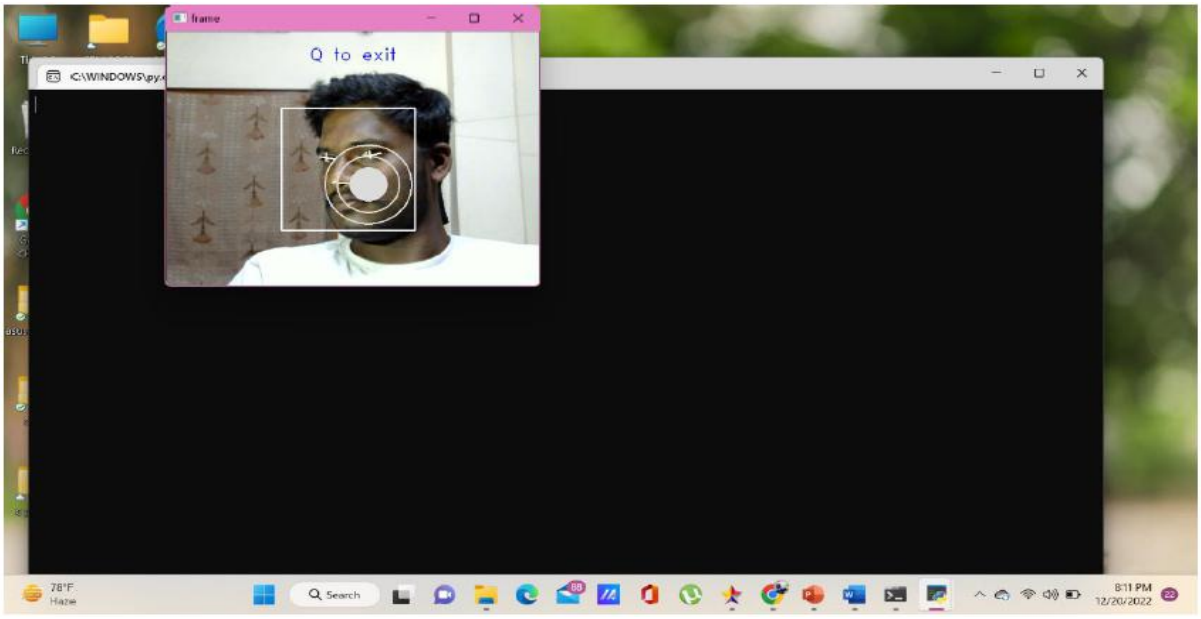

V. CONCLUSION

Due to disabilities many people are not able to use the computer without using keyboard and mouse User cannot interact with a computer system. To solve this problem virtual mouse is one of the solutions. This provides a review on different technologies for the virtual mouse. First detect the face. Then the different variation on face position gets different command set for virtual keyboard. The signals pass the motor driver to interface with the virtual keyboard itself. The motor driver will control both speed and direction to enable the virtual keyboard to move forward, left, right and stop. The face is not rotated more than 5° around the axis that passes from the nose tip in detection mode for accurate localization of eyes and nose (as long as the eyes fall in sectors S1 and S3 of the SSR filter). The face is not rotated more than 30° around the axis that passes from the neck for accurate localization of eyes and nose. Our detecting methodology is unaffected by the use of glasses. When it comes to different scales, it's advisable to stand about 35 cm away from the webcam. When the frame rate is 20 fps or above, the results in tracking mode are quite stable; the user can move extremely quickly without the program losing his facial features. The glasses reflect light and create bright spots, causing our program to lose track of the eyes on occasion. Because side light causes erroneous face detection and subsequently affects the tracking process, the lighting conditions must be tuned so that the light is frontal and spreads uniformly across the face for accurate and robust detection and tracking.

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