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Virtual Mouse

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***Abstract*—** Many computer systems have been developed to help the people who are quadriplegic and nonverbal. Devices like external switches, systems that detect the muscular movements and infrared cameras have tremendously helped people in various fields. A Virtual Mouse will help the physically impaired people in performing mouse actions and executing mouse commands with face actions and voice commands to ease their computational process.

***Keywords*—** OpenCV; webcam; haar-cascade classifier.

I. INTRODUCTION

The design of traditional interfaces relies on the use of mouse and keyboard. For people with certain disabilities using these devices presents a certain problem. This is because they are either unable to find a suitable means of interaction or they simply cannot afford commercial solutions. We also found that available solutions do not promote the individual's sense of independence, as they require a third party to attach markers at various points of their anatomy. Our work addresses these shortcomings by providing a non-intrusive, reliable, inexpensive and robust visual tracking system. It allows persons, who may have disabilities ranging from not being able to use their hands to severe cases where the person is only able to move their head, to navigate and manipulate the graphical user interface using head movements and speech. Movement of the mouse cursor is an important action in the computational process which can be done by means of head movements. This is implemented using various tracking and image processing algorithms. Image processing algorithms are applied to the video stream to detect the user's face and follow tracking points to determine head movements. The face-detection component is fundamental to the functioning of our head-tracking system and is based on the Haar-Classifier cascade algorithm. This algorithm was first introduced by Viola and Jones (Viola & Jones, 2001). It is appearance-based and uses a boosted cascade of simple feature classifiers, providing a robust framework for rapid visual detection of frontal faces in grey scale images. The process of face detection is complicated by a number of factors. Variations in pose (frontal, non-frontal and tilt) result in the partial or full occlusion of facial features. Beards, moustaches and glasses also hide features. Another problem is partial occlusion by other objects. For example, in a group of people some faces may be partially covered by other faces. Finally, the quality of the captured image needs consideration. OpenCV is a open system computer vision library by Intel that provides a collection of basic algorithms and some sample data .This is used at the tracking layer for detecting the head movements. It is written and has its primary interface in C++ .It is cross platform and portable. It is used for real time tracking and can be used as a trainer or a detector.

II. REVIEW OF LITERATURE

The aim is to track the 3D position of the head and convert in into 2D coordinates on the computer screen.The main goal of this project is to develop a virtual mouse system where the physically impaired user can perform various mouse functions and commands with ease and simplicity, in a way which is effortless and not at all uncomfortable. Thus the person can manage and browse through various computational processes. The basic objectives of the system are:

- Enable user to perform mouse actions.
- Perform mouse commands on blink of an eye.
- Speech commands to perform respective functions.
- Navigate the screen with face movements.

In this project, initially the head tracking algorithm will start to track the head movement which in turn will determine the coordinates at each frame and based on the difference between the coordinates will move the mouse cursor. For performing various mouse commands like mouse click, scroll up-down, drag will be done on basis of speech recognition. Face expressions can also be used to perform the mouse actions and commands with the help of the Haar-Cascade Classifier by extracting the good features and comparing with the already stored images in the system. This will be implemented on the gray scale. One of the purposes of this realization is to explore what services can be realized when such a system is used with other systems for the physically impaired people. We hope that the end result of this project will lead to a simpler life by exploiting this increasingly ubiquitous technology.

In today's fast-growing technology world, many image processing algorithms are used for faster and efficient image based computations. Almost all these image processing algorithms Haar-Cascade Classifier is used for real time tracking of images. Compared to other classifiers technologies, Haar-Cascade has the following advantages:

- Calculation speed–Haar like features has more calculation speed than other algorithms.
- Pixel intensity-it has better pixel intensity which is useful for detecting face in real time.
- Inbuilt features–better inbuilt features which track all the good facial appearances in real time.

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Haar-Cascade Classifier can be used in two modes:

- *Haar trainer*: After a classifier is trained, it can be applied to a region of interest (of the same size as used during the training) in an input image. The classifier outputs a "1" if the region is likely to show the object (i.e., face/car), and "0" otherwise. To search for the object in the whole image one can move the search window across the image and check every location using the classifier.
- *Haar detector*: This algorithm detects the goof features captured by the web camera depending upon the images that are further converted to gray scale. The dark and the light regions are identified and on basis of the built in images the result is returned for the mouse accordingly.

The core basis for Haar classifier object detection is Haar like features. These features instead of using the intensity value of the pixels use rectangular contrast values. These contrast differences are used to identify the dark and the light areas. Two or three variable adjacent groups with contrast variance form the Haar-like features [1].

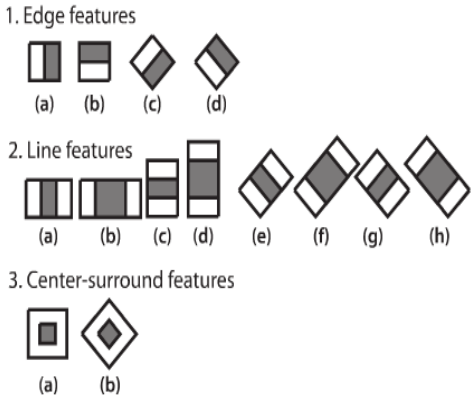

Fig. 1. Haar like features.

III. Problem Definition

Nowadays there are devices being developed to ease the life of the physically impaired people. There is an effort put to fulfill the computational needs of such people, hence our project Virtual Mouse will assist the physically impaired people in performing mouse movements and other related mouse actions. Various mouse movements will be simulated on basis of image processing algorithms and basic mouse actions and commands will be implemented with the help of speech recognition. The system will be implemented with the help of high frame grabbing web camera. The system has two main layers that forms the layout of the various interactions taking place. The layer visible to the user is called the client layer and the layer where the algorithms will be executed and the result will be computed is called the tracking layer [2].

IV. Implementation Methodology

The Client layer is implemented as an object oriented system in java. It consists of the graphical user interface that will inform the user about the faces that are being located. Constant inputs will be obtained from the web camera will be intepreted and analysed and will be sent to the tracking layer for further processing. It also consists of the mouse controller that will show the movements of the mouse once the faces are located and result is analysed.It also consists of the java native interface framework that will link to the tracking layer.

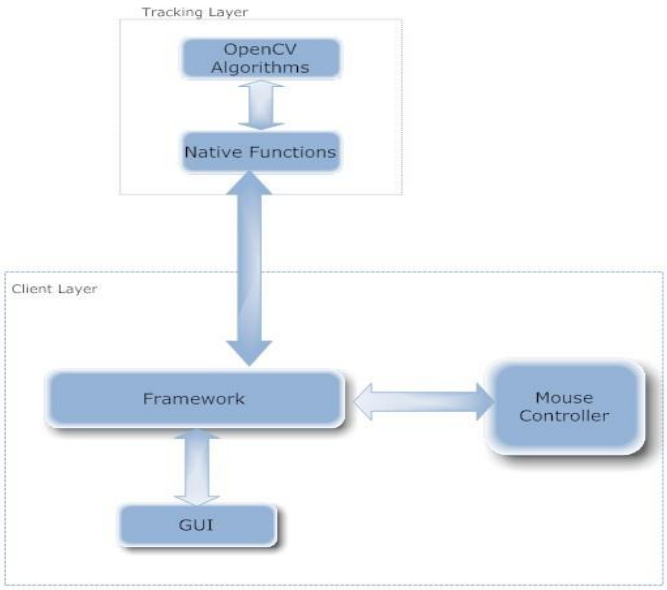

Fig. 2. Layer diagram.

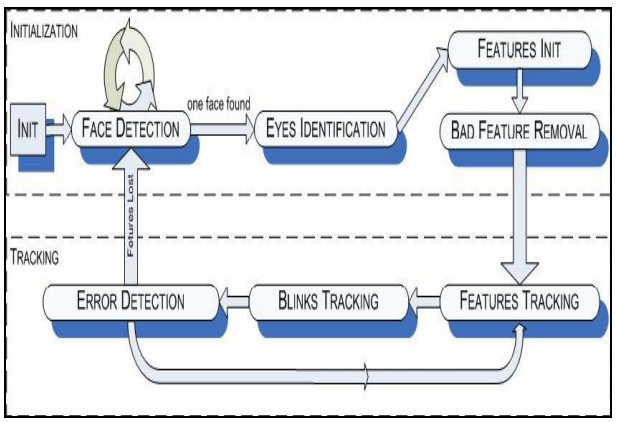

Fig. 3. Flowchart.

The tacking layer consists of the openCV algorithms that are developed by Intel. Here the Haar-Cascade Classifier will also be used that will help in real time tracking with the help of haar like features and assist in mouse movements and actions. There is the Java Native Interface that consists of the native functions to link the functions between c++ and java at the tracking layer and client layer respectively. Thus the two layers work hand in hand to simulate a vitual mouse and to fulfill the requirements. In our project initially a web camera will be used to capture frames and face detection. The client layer will be implemented in java and the tracking layer in OpenCV that's in c++. The Java Native Interface (JNI) forms a bridge the two layers. Once the face is found the good

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feature will be tracked by the Haar-Cascade Classfier and extracted. The coordinates of the face will be detected and in turn the difference between the coordinates will move the mouse cursor. Eye blinks and various face appearance can be used to perform mouse actions, but the response is not much as expected. Hence speech recognition is used where the voice will be recognized and accordingly perform the mouse actions and commands.

V. CONCLUSION

The proposed system will help in making the mouse system time efficient and effortless. Making the daily routine work of the physically impaired people more comfortable was one of the most important aspect. In the future, we plan to make the system better in accuracy and with additional features and comfortable for the user.

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