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Controlling Mouse Events Using Eye Blink

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Abstract: In this paper, a human computer interface using eye blink and head motion is introduced. This system provides hand free computer access for people with severe disabilities. This technology is intended to replace the conventional use of computer mouse with head and eyes instead of human hands. The system track the computer users head movements with a video camera and translates them into the movements of the mouse pointer on the screen and it also detect the user eye blink and translates them into mouse click events on computer screen.

Keywords: Hand Free Mouse Control, Controlling Mouse Pointer by Head, Mouse Clicking by Eye Blink, Hand Free Mouse Events, Mouse Events Using Eye Blink, Head Tracking, Face Detection, Blink Detection.

I. INTRODUCTION

Now a day there has been a growing interest in developing natural interaction or hand free interface between human and computer. Several studies for human-computer interaction in many countries were computed and introduced in technical world. World-wide there are many users who, due to their physical disability are not able to use their hands or any part of body and want to access the computer in any other way. The paper proposes head movement and blink detection mechanisms to enable hands-free communication with computers for handicapped users. Most of them have good control of their eyes and head, therefore communication with the computer world is done using the movement of their head and eyes blink. The eyes blink can be replaced with mouse click functionality and head movement can be replaced with mouse cursor or mouse pointer movement on computer screen. The goal of our system is to efficiently track the head movement of a person from web-cam or from external web-cam and move mouse cursor according to that, if left eye blink detected then left click event will perform and if right eye blink is detected then right click event will perform. This blink is used to control computer and do some specific task. We propose a robust, most accurate algorithm to detect eye blinks, and interpret them in real time to control a non-intrusive interface for computer users with severe disabilities. The proposed system can detect both spontaneous and intentionally eye blinks and it does not require prior knowledge of face location or skin color, nor special lighting.

II. LITERATURE REVIEW

The following is the different authors review what they have done.

In [1] the system controls the computer cursor by the user's eye gaze. By looking at the control keys displayed on screen, a person can synthesize speech, control his environment, type, operate a telephone, run computer software, operate a computer mouse, and access the internet and e-mail. The eye-gaze system is a direct-select vision-controlled communication and control system. This software controls a computer cursor by the user's eye gaze. The only requirement is to operate the Eye gaze are control of at least one eye with good vision & ability to keep head fairly still. The system provides fair results as output and uses external device for voice command. It also reduces external noise from surrounding.

In [2] paper concentrates on Electrooculography (EOG) technique for moving the mouse cursor through eye retina. It sense eye signals which in turns used to control the movement of mouse cursor. The signals captured using electrode sensors, are first amplified, then noise is removed and then digitized, before being transferred to PC for software interfacing. The EOG is the technique used for retina tracking. The EOG electrodes are placed on user's forehead around the eyes to record eye movements. EOG is a very small electrical potential that can be detected using electrodes. The electrodes are placed in up, down, left and right so whenever the retina moves from center to towards the electrodes, this electrodes results in positive side that in turns move the mouse cursor in respective direction. This method uses external electrical circuit for tracking the retina movement. The output results i.e. the movement of the cursor is limited to left, right, up and down. The system cannot be implemented for cursor movement top corners and bottom corners.

In [3] the software is developed for face and retina detection. This software is simulated in Matlab and OpenCV to get the desire results. The face and retina tracking is done by using Viola–Jones object detection algorithm. Viola-Jones is first object detection algorithm that later used for detecting the human face. This algorithm is trained by passing thousands of human faces through the dataset. After training the algorithm can be able identify whether the given image contains human face or not. This algorithm is easily implemented in OpenCV by using in build function of OpenCV. The Viola-Jones algorithm provides the successful result i.e. human face and retina is successfully detected using Matlab and OpenCv in real-time simulation.

In [4] paper describes the various in which the eye retina tracks. It also describes how the blink detection work in

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various way. The various face detection technique is used. The face detection is done in two ways,

1. **Feature-based method:** In this facial features are detected like nose, eyes, mouth, etc. This is done verify that the given image contains human face or not.
2. **Image-based method:** In this method they simply used template matching technique to detect the human face. The various methods of face detection show desire output and provide the good results.

III.PROPOSED SYSTEM

The complete process of proposed system main under goes in following process which is as follow.

1. Viola-Jones Face Detection

The Viola-Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time and later used for face detection. This framework is proposed in 2001 by Paul Viola and Michael Jones. Although it can be trained to detect a variety of object classes like human face, animal face, non-human face. It was motivated primarily by the problem of face detection. This algorithm can easily implemented in OpenCV by using in build function cvHaarDetectObjects().

The function cvHaarDetectObjects() is called as Haar-Cascade Classifier. This function is not only used for face detection but also it is used for object detection. It is combination Haar Feature and Cascade Classification of Viola-Jones.

The Haar Feature is the detection technique is based on the idea of the wavelet template that defines the shape of an object in terms of a subset of the wavelet coefficients of the image. Like Viola and Jones we use a set of features which are reminiscent of Haar Basis functions.

Figure 1: Haar Feature of Human Face

The Cascade Classification is used for training the classifiers. After the object is detected through Haar Feature the image undergoes for training to check whether the image contains human face or not. The training is done by passing the thousands of human from different datasets.

The Cascade Classification is done as follow.

Stage 1: is there a face in the current rectangle according to classifier 1? If yes then go to stage 2, if no rectangle does not contain a face.

Stage 2: is there a face in the current rectangle according to classifier 2? If yes then go to stage 3, if no rectangle does not contain a face.

Stage n: is there a face in the current rectangle according to classifier n? If yes there is a face in current rectangle.

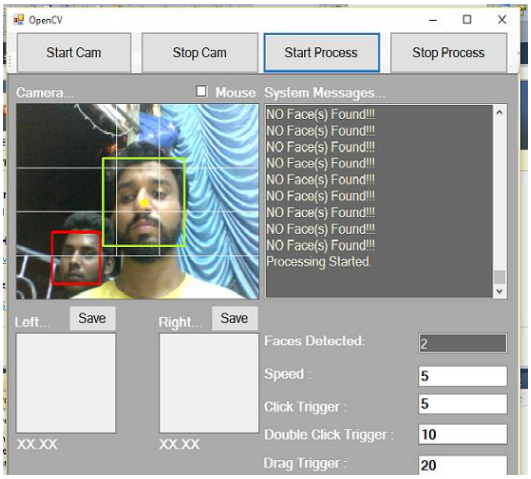

Figure 2: Multiple Face Detected using Haar-Cascade

2. Template Matching

We use Template Matching for eye blink detection in proposed system. Template matching is technique in image processing for finding small parts of an image which match a template image in real time system. It can be used in many real time systems for image recognition.

Template matching can be done two ways as follow

i. Feature-based Method
ii. Template-based Method

The Feature-based method is used when the template has the strong features. This approach may prove further useful if the match in the search image might be transformed in some fashion.

The Template-based method is used when the image or template doesn't have strong features. It also used when the bulk of the template image constitutes the matching image and provide good results.

As shown in Fig 2 we save left eye blink part in left box and right eye blink part in right box. After saving the images in left box and right box the saved images is compared with real time video which is captured through web cam or external camera. If saved images are found during real time video then mouse clicking function or events will occur. If left eye blink found then left mouse click event will occur. If right eye blink found then right mouse click event will occur. So by using Template Matching we can perform mouse clicking events.

IV.SYSTEM FLOW

The system flow for proposed system is as follow.

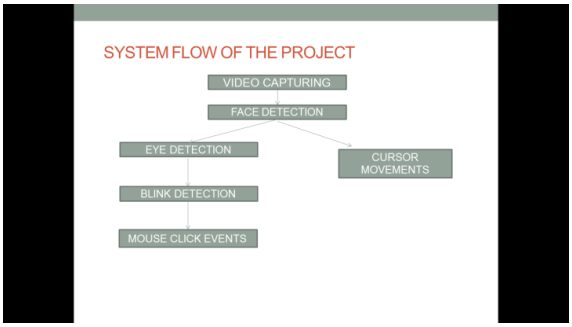

Figure 3: System Flow

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V. CONCLUSION

This paper focuses on the hand free interaction with computer system. To do this the proposed system is implemented successfully and movement of mouse cursor is implemented by head movement and mouse clicking events is implemented by eyes blink. The movements of mouse cursor were implemented using Viola-Jones algorithm and mouse clicking events were implemented using Template Matching algorithm. Therefore proposed system is successfully implemented.

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