International Journal of Emerging Engineering Research and Technology
Volume 2, Issue 4, July 2014, PP 196-204
ISSN 2349-4395 (Print) & ISSN 2349-4409 (Online)

Cursor Controlling with the Help of Eye

Poonam Potraje
Department of Computer Science & Engineering
Rajiv Gandhi College of Engineering
Research & Technology, Chandrapur
Maharashtra, India
Potrajepoonam88@gmail.com

Prof.P.S.Kulkarni
Department of Computer Science & Engineering
Rajiv Gandhi College of Engineering
Research & Technology, Chandrapur
Maharashtra, India
kulkarnips1811@gmail.com

Abstract: *In this paper, we are going to introduced a technique for human computer interface with the help of eye that means the pupils of eye. Conventionally, we use keyboard and mouse to make the interaction between the system and the user as an input device. The goal of this paper is to present a hand free interaction device for the people who have certain medical issue or kind of disability. This equipment is planned to change the conventional computer screen pointing devices for the people who have certain disability. The paper gives a proposal to control the cursor of the computer with the help of users eye. This application allows the user to use the computer system with the help of users eyesight and move the cursor as per the direction that are given by the user. Aim of this application is to introduced a low cost based system for the people who have the disability and connect them with the real world.*

Keywords: *Assistive technology; Eye tracking system; Human-computer interface; eye gaze.*

1. INTRODUCTION

As we know that the advances in the computer system increases day by day very rapidly and tremendously. Every day a new technology introduced in the market. There are so many technology and applications are available in the market for the convenient life style of the user , but the person with the physical disabilities are not able to access these applications same as the other user . For that purpose here we are trying to introduced a technique that is available for the user who have certain disability or some medical issue. As we know that now a days there are tremendous increment in the road accident and the people lost there body parts in that accidents in such cases the people are not able to access the device like computer or laptops. This may creates a barrier between the user and the system. To lower down the barrier or the disturbance is a demanding task now a days.

There are so many techniques available in the market to make the interface with the system such as voice controlled device, facial recognition technique, Head movement technique but every technique have its own advantages and disadvantages. Apart from all the eye tracking system is the best alternative to make the communication between the system and the user. In eye tracking system users are allowed to use there pupil of eye to move the cursor on the screen where the direction of the eye indicates.

Here we are trying to introduced a low cost based application for the handicapped people to use there certain body parts and make the interface with the system and the user and connect them to the real world.

There are four module to implement the eye tracking system. Such as,

- Face Detection
- Eye Detection
- Template generating and Template Matching
- Cursor movement

2. OBJECTIVES

An eye tracking system is one of the best application for the handicapped person. To develop this application various algorithm methods and techniques of the image processing are used. These methods and techniques of image processing gives a well designed model for eye tracking system.

This application is useful for the face detection, features detection, template generation and cursor movement.

As we are very well known about the disabilities. In any case the person is not able to use their body parts they are to be consider as the disable person for such people here we are going to introduce a technique to connect them with the real world.

2.1. Objective 1

As per the mentioned objective the first module is the Face Detection System. In this module the exact face portion of the user is detected from the input image by applying viola jones rule.

2.2. Objective 2

As per the mentioned objective the second module i.e., Eye Detection System, in which the features are get separated from the face by applying the Leonardo da vinci rule, that means the eyes, nose and mouth are get separated from the face

2.3. Objective 3

As per the mentioned objective the third module i.e., Template Generation and Template Matching. In this module we have to generate the template of the eye and we have to save that template in the database as per the given direction such as up, down, right, left etc.

2.4. Objective 4

Finally, the last module of the eye tracking system is the cursor movement. In this section we have to find the direction of the cursor by comparing the template with the previously stored template. As we know that the minimum difference between the template gives the maximum match in the template.

3. METHODS AND APPROACHES

There are two different methods of the Face Detection System,

- Feature-based method
- Image-based method

3.1. Feature-Based Method

In this method we are able to find the features of the face and exact location of the features and the distance of features from each other.

3.2. Image-Based Method

Image based method is stand on the scanning the image. This category of face detection implies pattern recognition, and gives it with simple methods such as template matching or with more advanced techniques such as neural networks.

3.3. Eye Detection Approaches

3.3.1. Regression Approach

Tries to minimize the distance between the predicted and actual position of eye

3.3.2. Bayesian Approach

This approach learns model of eye appearance and non-eye appearance. This principle build a "probability of eye". Produces output for patches around each pixel of the input image.

3.3.3. Discriminative Approach

In this approach treat the problem as one of classification. A classifier is trained to produce positive output for patches around the eye and negative elsewhere

4. IMPLEMENTATION

In this paper the main approach focuses on the various methods of image processing, pattern recognition and the various algorithms to be used for the face detection and eye detection.

4.1 Face Detection

Face detection technique is the very first module of the eye tracking system. In this module we capture the image of the user with the help of low cost based camera. If more than one faces are available in front of camera then we have to check for the convenient image and display that image on the screen by applying the Viola and Jones rule[8]. Only the single image of the user have to be introduced. It introduced a technique to detect face of the user very rapidly and correctly in the image. However, the area of the image being analyzed for a facial feature needs to be regionalized to the location with the highest probability of containing the feature. By regionalizing the detection area, false positives are eliminated and the speed of detection is increased due to the reduction of the area examined.

Viola and Jones devised an algorithm, called Haar Classifiers, to rapidly detect any object, including human faces, using AdaBoost classifier cascades that are based on Haar-like features and not pixels [8].

4.2 Haar Cascade Classifiers

Haar classifier object detection is the Haar-like features. It uses the change in contrast value between the adjacent rectangular group of pixel not depend on the intensity value of the pixel. The varience in the group of pixel are useful for determining the light and dark area. Haar-like features, as shown in Figure 1 are used to detect an image [7]. Haar features can easily be scaled by increasing or decreasing the size of the pixel group being examined. This allows features to be used to detect objects of various sizes.

4.3 Integral Image

A plane rectangular area of the face is calculated by using an intermediate representation of an image, that is also called as called the integral image [6]. This integral image contains the sums of the pixels' intensity values located directly to the left of a pixel and directly above the pixel at location (x,y). Where

A[x,y] is the original image.

AI[x',y'] is the integral image.

Then the integral image is computed as follows.

$$AI[x,y] = \Sigma A(x',y') \quad (1)$$

x'<=x, y'<=y

The features rotated by forty-five degrees, like the line feature shown in fig.1(2e).The rotated integral image is calculated by finding the sum of the pixels' intensity values that are located at a forty five degree angle to the left and above for the x value and below for the y value.

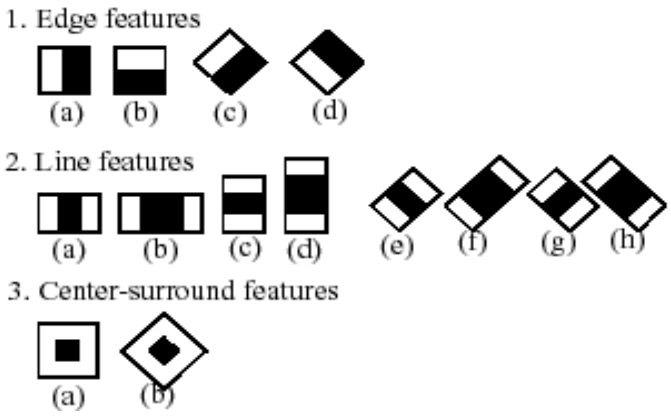

Fig1. *Common Haar Features [6]*

So if A[x,y] is the original image.

AR[x,y] is the rotated integral image.

Then the integral image is shown in equation 2 an illustrated in Figure 3.

$$AR [x, y] = \Sigma A (x',y') \quad (2)$$

$x' <= x, x' <= x- [y-y']$

As shown in equation 1 and illustrated in Figure 2.

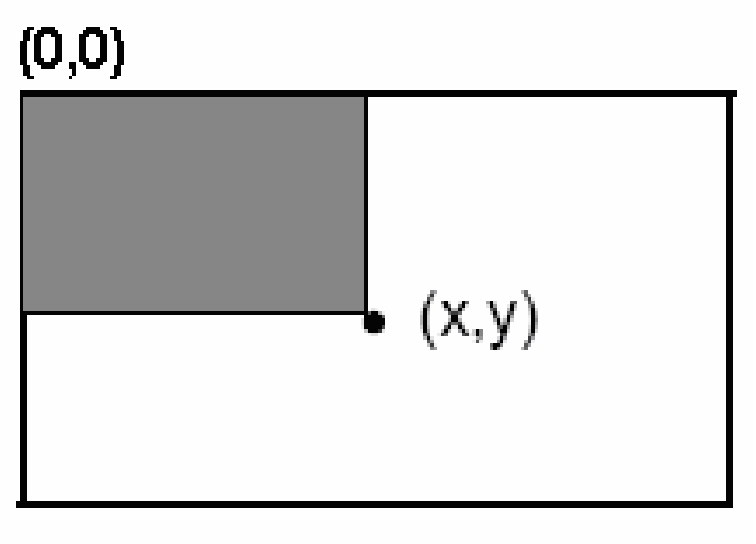

Fig2. *Summed area of integral Image [6]*

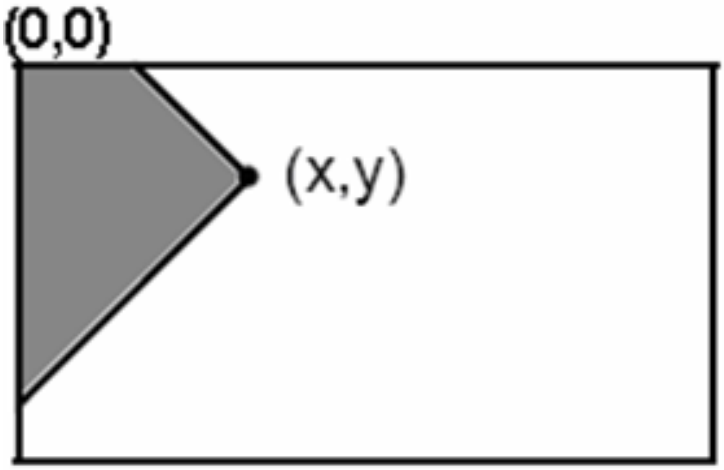

Fig3. *Summed area of rotated integral Image [6]*

Fig4. *Input Image[9]*

Fig5. *Face Detection [9]*

4.4 Eye Detection

Viola Jones Algorithm is used for the feature extraction. The Leonardo Da Vinci principal is used for determining the geometry of the faces. The distance between eyebrow to eye, eyebrow to nose top, nose top to mouth these features are selected from the images by applying the Leonardo da vinci principle. Here we get the separate result for each feature. By applying this method we can easily access the feature from the face. Features are shown in fig 6.

4.5 Algorithm

Distance from head to eyes is 50%

Eyes=50;

% from eyes to nose is 70%

Nose=70;

% remaining is mouth

Mouth=100;

Eyes= current_face (1:Eyes,:);

Nose= current_face(Eyes:Nose);

Mouth= = current_face (Nose:Mouth);

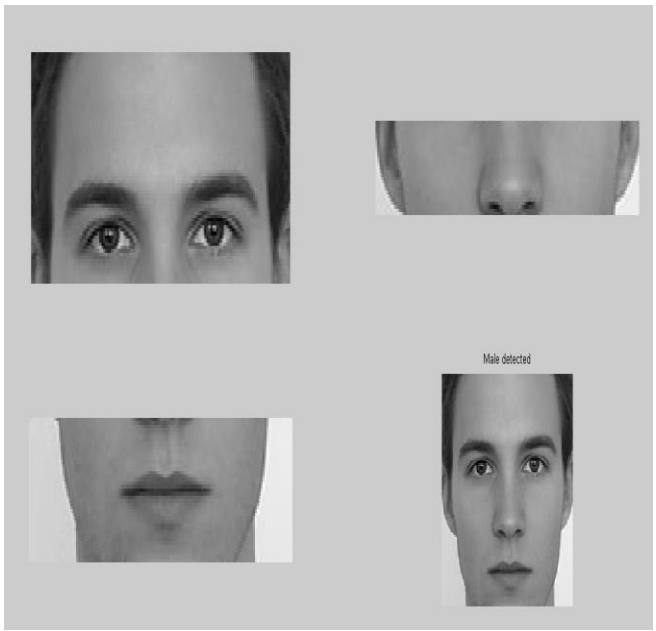

Fig6. *Features Extraction [9]*

4.6 Template Generating and Template Matching

In this module we are going to introduce the most possible region of the eye. By applying the Leonardo da vinci rule we are able to separate the eyes from the face, that template is nothing but the exact working area .Then we have to box of size E*E (e.g. 15*15) is drawn around the center of the working eye region, as shown in fig6. The image within this box is cropped out of the present image. The cropped image is saved as per the direction such as up, down, right, left in the database and each image in the database is consider as the template of the eye. We have to save different pattern for the single direction because there may be chances of showing the variation in the output. Finally we have to match that the current template of the user with the already stored template in the database. If two templates have minimum difference that means it gives the maximum match for each other. At last we are able to move towards the cursor movement.

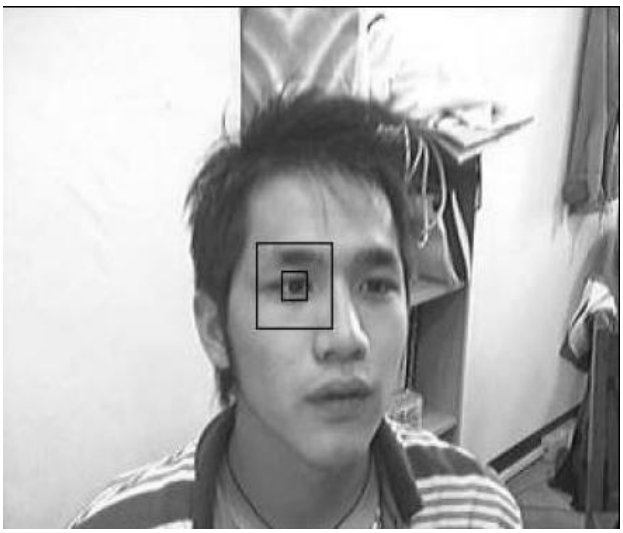

Fig7. *Original Image[5]*

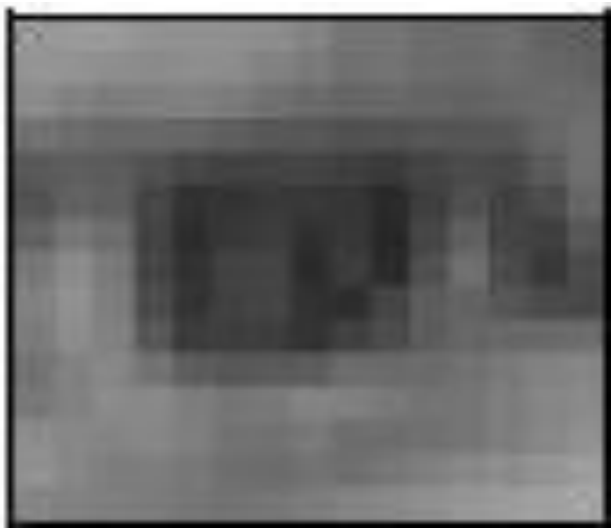

Fig8. *Template Image[5]*

4.7 Cursor Movement

Here we are trying to convert input medium to the eye movement. As we know that the eye movement is currently faster than the input, because eye can easily move to the target rather than the pointing device. Hence we can easily focus on the target.

The total eye of the user is not captured by the camera because of the upper and lower eyelid, etc.

4.8 Mouse Pointer Control

To control the mouse pointer (cursor) on the screen we use the pupil of the eye, the central coordinate of the screen is consider as the start point. This position is used as the base for gaze tracing, and the starting position of the mouse pointer is set as the center of the screen. The moving position of the cursor takes the initial position as the base. As the pupil move to some direction, the coordinate of the mouse pointer on screen change according to the movement of the pupil. When the pupils return to the original position, the cursor stops moving. The size of the pupil are getting bigger and bigger when user looks upward and the size of eye is getting small when the users eye position is downwards or the eyes are in slightly half-closed state. This phenomenon can be used for controlling the mouse pointer to move from top to bottom.

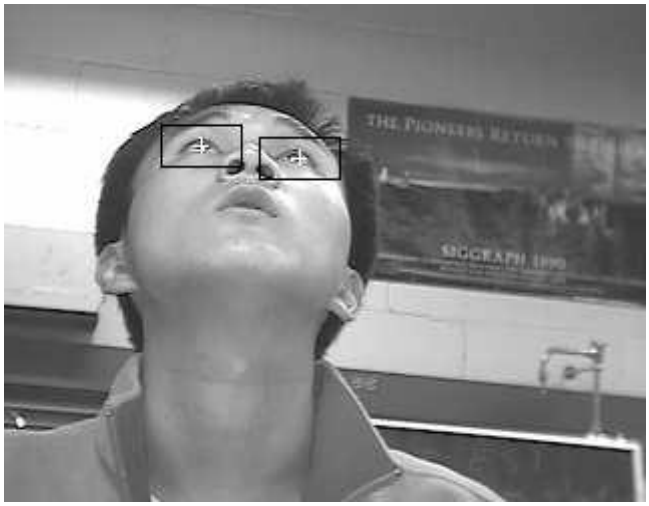

Fig9. *Cursor Movement (Upward Direction) [10]*

Fig10. *Cursor Movement (Downward Direction) [9,10]*

4.9 Motivation

In the previous system, people with the medical issue or disability are not able to take pleasure that are provided by the system, since conventional computer interfaces are designed with the able-bodies in mind. Therefore, to lower down the barriers or the disturbance between computers and people with disabilities is a difficult task for that purpose this system introduces. With the help of this system we are able to make interface between the system and the user and make allow them to access the advantage of the computer system and connect them with the real world.

5. CONCLUSION

Eye Tracking System plays a vital role in improving the usability of the system. It stresses on development of customers' relations and improving the requirement of system performance and other relevant factors. Eye Tracking System provides the support or platform to the disable person to access the device like a normal human being. In this paper we focused on the process of face detection, eye detection, template generating, etc. We have also gone through the various methods and techniques to

access the system like head movement, nose tip, voice recognition etc.. but every method have its certain advantages and disadvantages, apart from all eye tracking system is one of the best method to access the device in very easy format and at low cost, As the access of computer system is increases day by day. Hence we could think on increasing the access of the device in which the with the several disability can also access the device same as the normal person or we can says that this software can give the platform to the people who have certain disability, If the user can use his or her limited voluntary motions in addition to the head movements, there are many other options for them to choose for communications and computer access. Otherwise, the proposed eye Mouse is an ideal option because of it is a low-cost and non-instructive system.

FUTURE SCOPE

Future work may include improving the robustness against the lighting conditions. By using the highly qualified camera operate the operation to get more accurate result. Adding the scrolling movement (Using nose) functionality. Also add the speech module which will operated by users mouse and launch on the start of the PC. Also we can add scrolling functionality by using face movements and allow this application for playing games and banking sector also.

REFERENCES

[1] Margrit Betke "The Camera Mouse: Visual Tracking of Body Features to Provide Computer Access for People With Severe Disabilities" Vol.10, No. 1, March 2002

[2] Samah Ramadan &Christapher E. Smith"The III Indian Conference On Computer Vision, Graphics And Image Processing" USA December 2002

[3] Anthony J. Hornof "Eye Draw: Enabling Children with Severe Motor Impairments to Draw with Their Eyes" Portland, Oregon, USA. April 2–7, 2005.

[4] Chinyen Yeh1, Shawmin Hou3 "An Implementation of an Eye-blink-based Communication Aid for People with Severe Disabilities" 2008

[5] Mu-Chun Su&Gwo-Dong Chen," A Low-Cost Vision-Based Human-Computer Interface for People With Severe Disabilities" National Central University, Vol. 17 No. 6 December 2005

[6] Phillip Ian Wilson "Facial Feature Detection using Haar Classifier" Texas A&M University

[7] Open Computer Vision Library Reference Manual. Intel Corporation, USA, 2001.

[8] Viola, P. and Jones, M. Rapid "object detection using boosted cascade of simple features." IEEE Conference on Computer Vision and Pattern Recognition, 2001.

[9] Ms. Anushri Jaswante "Black Propagation Neural Network Based Gender Classification Technique Based on Facial Features" International Journal of Computer Science and Network, Volume 2, December 2013

[10] Ms. S.A.Chhabri "Controlling Mouse cursor using Eye Movement" International Journal of Application or Innovation in Engineering & Management (IJAIEM)

[11] Sidra Naveed, Bushra Sikander, and Malik Sikander Hayat Khiyal "Eye Tracking System with Blink Detection", IEEE,2012

[12] Robert J.K. Jacob," Eye Tracking in Advanced Interface Design" Human-Computer Interaction Lab Naval Research Laboratory Washington, D.C.2003

[13] Robert J.K. Jacob, Ph.D.," Commentary on Section 4. Eye Tracking in Human-Computer Interaction and Usability Research: Ready to deliver the Promises." Department of Computer Science Tufts University, 161 College Avenue, Medford, Mass. 02155, USA 2003

[14] M. C. Su, Y. H. Lee, C. H. Wu, S. Y. Su, and Y. X. Zhao :" Two Low-Cost Human Computer Interfaces for People with Severe Disabilities", Biomedical Engineering-Applications, Basis and Communications ; 16(6) : 344-349, 2004

[15] M. C. Su, S. Y. Su, and G. D. Chen : "A Low Cost Vision- based Human-Computer Interface for People with Sever Disabilities.",Biomedical Engineering- Applications, Basis, and Communications ; 17(6) : 284-292. 2005.

[16] D. G. Evans, R. Drew, and P. Blenkhorn, "Controlling Mouse Pointer Position using an Infrared Head-Operated Joystick," IEEE Trans. Rehab. Eng.,vol. 8, no. 1, pp. 107–117, 2000.

[17] Y. L. Chen, F. T. Tang, W. H. Chang, M. K. Wong, Y. Y. Shih, and T. S. Kuo, "The New Design of an Infrared-Controlled Human-Computer Interface for the Disabled," IEEE Trans. Rehab. Eng., vol. 7, pp. 474–481, Dec. 1999.

[18] R. B. Reilly and M. J. O'Malley, "Adaptive Noncontact Gesture-based System for Augmentative Communication," IEEE Trans. Rehab. Eng.,vol. 7, no. 2, pp. 174–182, 1999.

[19] S. Kawato and J. Ohya :"Two-step approach for real-time eye tracking with a new filtering technique". Int. Conf. on Systems, Man and Cybernetics,; 1366-1371, 2002

[20] R. S. Feris, T. E. Campos, and R. M. Cesar :"Detection and tracking of facial features in video sequences" Mexican International Conference on Artificial Intelligence;129-13, 2000.

[21] J. W. Davis :Recognizing movement using motion histograms. Technical Report No. 487, MIT Media Laboratory Perceptual Computing Section, April 1998.

[22] M. Ikeda, H. Ebine and O. Nakamura :Extraction of faces of more than one person from natural background for personal identification", IEEE Canadian Conference on Electrical and Computer Engineering, 2001;1: 323-328.2001

[23] R. L. Hsu, M. A. Mottaleb, and A. K. Jain :Face detection in color images. IEEE Trans. Pattern Analysis and Machine Intell. ;696-706.2002

[24] Z. Liposcak and S. Loncaric :Prediction and verification for face detection. in the First Int' 1 Workshop on Image and Signal Processing and Analysis, : 107-111, Pula, Croatia, 2000.

[25] R. C. K. Hua, L. C. D. Silva and P. Vadakkepat :Detection and tracking of faces in real environments. The 2002 International Conference on Imaging Science, Systems, and Technology (CISST02), : , USA, 2002.

[26] Akhil Gupta, Akash Rathi, Dr. Y. Radhika, "HANDS- FREE PC CONTROL" CONTROLLING OF MOUSE