IMPLEMENTATION EYES MOVEMENT TO HELP COMMUNICATION PERSONS DISABILITIES

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Abstract

Different ways to help people with disabilities. Among others is to help hand and foot disabled people to read on the computer. In order not to depend on others, it needs a tool used for example to read on a computer monitor. In this discussion, I do face-detection and then continued eye-detection. Eye motion will be used to continue reading on computer monitor. The process used in this system, eye detection is done one of the eyes only the left eye is captured by a camera connected to the computer (camera on the laptop). With Haar- Cascade detection and searching for the midpoint of the eye then in detect the position of the iris. The position of the iris of the eye determines the movement of the computer monitor that is when the eyeball is looking to the left without the movement of the head, the monitor page will shift left. Similarly, if the eyes see the right without head movement, then the monitor page shifted right. Each monitor-page is different, for example a hand and foot defect that can not be enabled is reading "Al Quran" on the computer

Keywords: *disable, eye-detection, Haar-Cascade, monitor-page*

1. Introduction

Handicapped motoric such as hands can not be moved and feet can not be ordered to move, but normal eyes and mouth, it is very difficult to interact with computers for daily needs or other needs. Then we need a tool such as to move the screen on the computer monitor when changing pages. Replacement of the computer screen is usually done manually by moving the mouse or keyboard with the fingers of the hand when the finger finger condition can not be moved normally. Instead it is the iris detection to move the page shift. How it works is a computer camera fixed to the eye. To go to the eye must face detection first. After getting the eye image, then in the middle point detection to get the iris movement moves to the right or to the left. This eye motion is used to change the computer screen pages when needed.

2. Related Study

In a previous study, there were several views of eye-tracking development built on many tools with the concept of human-computer interaction. Some of them use additional hardware, such as infrared (IR) [4] or electroculograph (EOG) [6] which has a lack of cost or complexity. There are several researches that have built eye-catching tracking systems that are implemented in desktop environments using web cameras installed on PCs and using head movements [1] [5]. The eye tracking system also implements a communication system but still requires additional infrared [2]. This system uses the user's eye view as a cursor on the computer screen to select a menu in the interface. There is an applied eye-tat system in the HCI concept built in a virtual keyboard environment [3]. In this discussion the user must make some gesture movements either right or left to select the displacement of the monitor screen on the computer. The center coordinates of the eye used as a reference pointer are used as a move to the computer monitor screen. This system is implemented in PC and uses one eye as input.

3. Proposed Method

The most notable eye gaze features in every user's face is iris center. When user look in different side, the position of user's eyeball also change, so do iris center coordinate. With the change of that, it can be used as pointer reference to activate the menu in user interface. Generally, the proposed method can be shown in Fig. 1. In Figure 1 this is a step for face detection until the migration of computer screen pages.

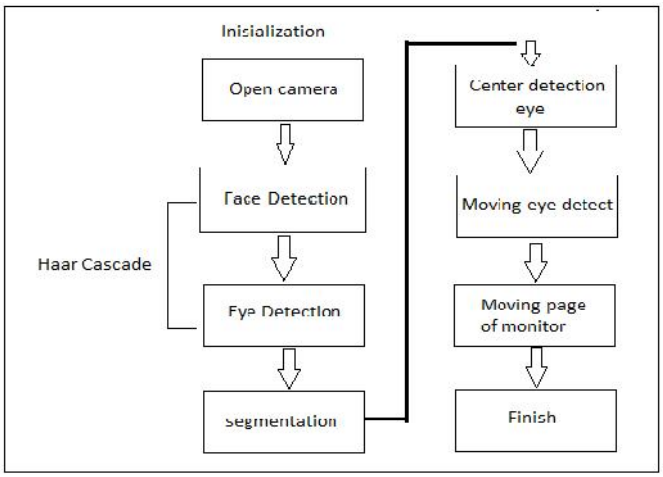

Fig. 1 *General proposed method*

A. Inisial Setup

This research system is built on a laptop computer or desktop computer equipped with 2MP camera on the monitor screen. Users can use this system by being in front of the monitor screen. For the first, the user must see in front of the monitor screen with the condition all the user's face can be captured by the camera. There will be a camera preview on the system, so users can predict the best position when running this system.

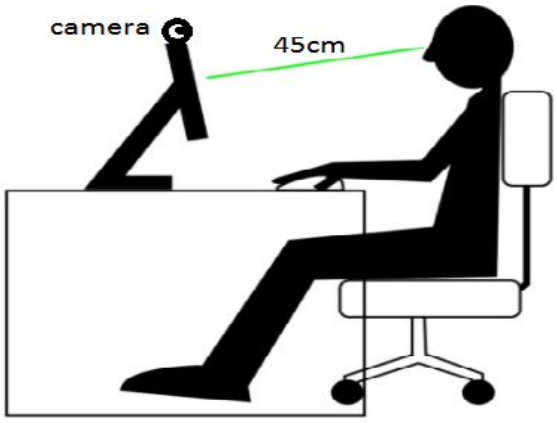

Fig. 2 *Position and distance in front of computer*

First the face is in front of the computer camera. The computer used is a laptop computer. The distance between the face with the camera about 45 cm (see in table 1) so that the face is detected perfectly that all the user's face should be visible to the camera. It takes sufficient radiation when shooting, if less light will cause the image is too dark and will affect face detection and eye detection. As shown in Figure 3

Table 1. *Distance Examination*

User	Distance (cm)				
	15	30	45	60	75
1	X	V	V	V	X
2	X	V	V	X	X
3	X	V	V	X	X
4	X	V	V	X	X
5	X	V	V	X	X
6	X	V	V	X	X
7	X	V	V	X	X
8	X	V	V	X	X
9	X	V	V	V	X
10	X	V	V	X	X
11	X	V	V	X	X
12	X	V	V	X	X
13	X	V	V	X	X
14	X	V	V	X	X
15	X	V	V	X	X
16	X	V	V	X	X
17	X	V	V	V	X
18	X	V	V	X	X
19	X	V	V	X	X
20	X	V	V	X	X

B. Face detection

First the face is in front of the computer camera. The computer used is a laptop computer. The distance between the face with the camera about 45 cm so that the face is detected perfectly that all the user's face should be visible to the camera. It takes sufficient radiation when shooting, if less light will cause the image is too dark and will affect face detection and eye detection. As shown in Figure 3

Fig.3 *Face detections Result*

C. Eye detection

the image of the face has been detected by the camera and the system will then process the right eye detect. Right eye detection performed with Haar Cascade method. The next process is soon in the eyeball detection. See in figure 4.

Experiment with 20 users for eye detection has been considered successful as seen in table 2.

Fig.4 *Eye location and detection*

Table 2. *Eye Left Localization*

User	Result	Details
1	Success	Right eye detected
2	Success	Right eye detected
3	Success	Right eye detected
4	Success	Right eye detected
5	Success	Right eye detected
6	Success	Right eye detected
7	Success	Right eye detected
8	Success	Right eye detected
9	Success	Right eye detected
10	Success	Right eye detected
11	Success	Right eye detected
12	Success	Right eye detected
13	Success	Right eye detected
14	Success	Right eye detected
15	Success	Right eye detected
16	Success	Right eye detected
17	Success	Right eye detected
18	Success	Right eye detected
19	Failed	Right eye cropped
20	Failed	Right eye cropped

D. Right Moving Eye

The movement of the right eyeball to move right has been detected as shown in Figure 5.

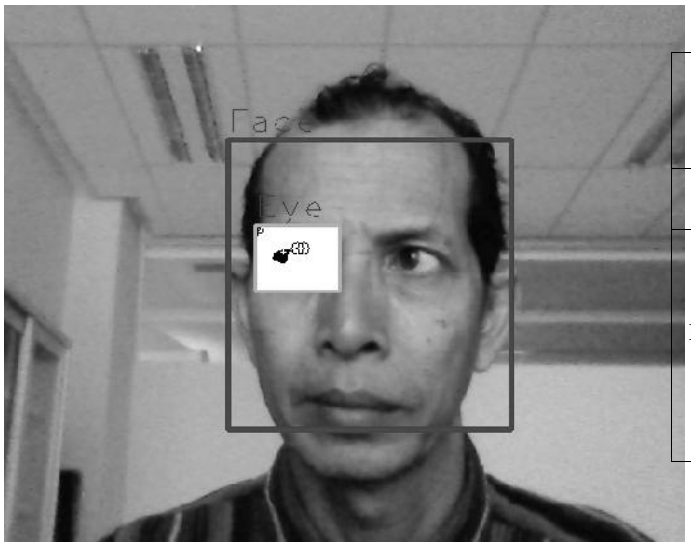

Fig. 5 *Right Moving Eye Detection*

E. Left Moving Eye

Eye movement detection to glance to the left can be detected. Some sometimes fail because the eyeball closes the eyelid. See Figure 6.

Fig. 6 *Left Moving Eye Detection*

Further detection of a flickering of the eye for the process of detecting the movement of the eyeball, flickering twice from the eye to end the detection of eyeball movement. Between the flickering process and 2 flickering times, it is used to read the Quran and not detect the motion of the eyeball while reading the Quran. Flickering 3 times are used to detect terminating applications. As shown in table 3.

Table 3. *Eye Blink Classification*

Eye Blink Classification		**Contour (Large & Long)**	**Duration (ms)**	**Action**
No Blink		>500 & >100	-	No Action
Blink	Spontaneous eye blink	<500 & <100	< 250 ms	No Action
	Click eye blink		> 250 ms	Choose menu and give audio output.

F. Example of Quran Aplication

As already discussed above that the application of this program to read Al Quran. With the camera on the monitor screen to capture eye shots. Examples of Al Quran sheets as shown in figure 7

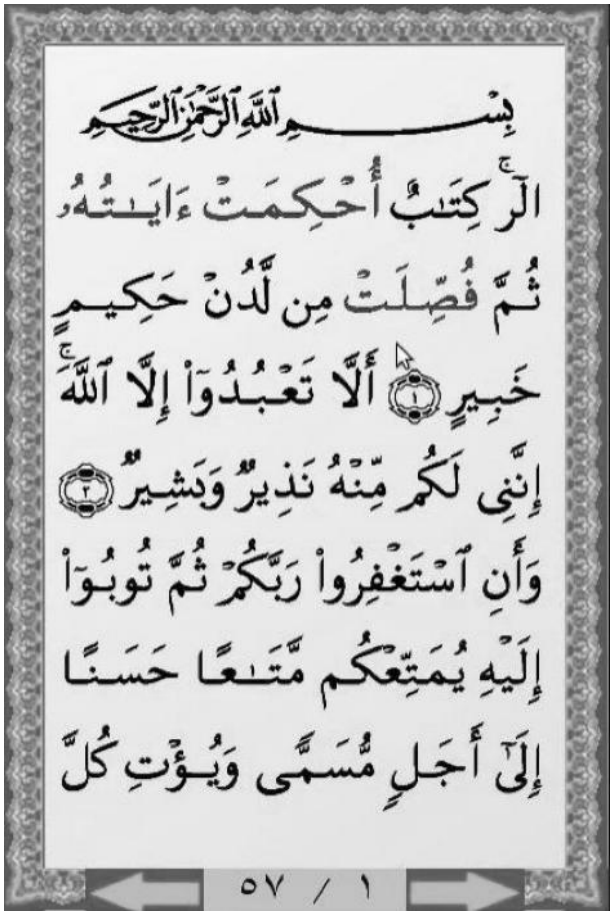

Fig. 7 *Sheet of Al Quran*

4. Conclusion

Based on experimental results, we can conclude that the process of choosing activity menu by eye gaze tracking can be applied using haar cascade method, moment and contour. All of those methods has weakness and advantages. For haar cascade method, it can detect object especially for face in quick time, but it has weakness if the user make some movement or didn't look straight ahead to the screen.

For moment method, its easy to use because its has provided in the OpenCV library. Despite, the centre mass of object can be founded easily if the countour of object can be obtained well.

From the experimental result, it has conclusion that this system can help users to give information in people around about activity they want to do with activity by blinking for more than 250ms. The percentage success rate left eye gaze tracking is 80 %, straight gaze is 90 % and right eye gaze tracking is 80 %.

References

[1] Yiu-ming, Qinmu Peng. 2015. *Eye Tracking With a Web Camera in a Desktop Environment.* IEEE Transactions in Human Machine Systems, Hongkong.
[2] Akshay G, Swapnil S.K. 2014. *The Eye Gaze Communication System.* International Journal of Research Studies in Science Engineering and Technology, India
[3] V. I. Saraswati, R. Sigit and T. Harsono, "Eye gaze system to operate virtual keyboard," *2016 International Electronics Symposium (IES)*, Denpasar, 2016, pp. 175-179. doi: 10.1109/ELECSYM.2016.7860997
[4] Fengyi Zhou, Wenjie Chen and Hao Fang, "Robust eye tracking and location method based on Particle filtering algorithm," *2014 IEEE 3rd International Conference on Cloud Computing and Intelligence Systems*, Shenzhen, 2014, pp. 247-252.
[5] C. C. Lai, Y. T. Chen, K. W. Chen, S. C. Chen, S. W. Shih and Y. P. Hung, "Appearance-Based Gaze Tracking with Free Head Movement," *2014 22nd International Conference on Pattern Recognition*, Stockholm, 2014, pp. 1869-1873. doi: 10.1109/ICPR.2014.327
[6] N. Steinhausen, R. Prance and H. Prance, "A three sensor eye tracking system based on electrooculography," *IEEE SENSORS 2014 Proceedings*, Valencia, 2014, pp. 1084-1087. doi: 10.1109/ICSENS.2014.6985193
[7] S Natasha, P Robert, P Helen. 2014. A Three Sensor Eye Tracking System based on Electrooculography. IEEE. Inggris.
[8] Arif M, M Hariadi, Mauridhi H. 2009. *Pengembangan Active Shape Model untuk Ekstraksi Multipel Fitur Sketsa Wajah*. Seminar Nasional Electrical, Informatics, and IT's Education. Indonesia
[9] Konstantinos G. 2010. Overview of the RANSAC Algorithm.
[10] Ibrahim Sidik N, Muljono. *Aplikasi Android Deteksi Mata Menggunakan Metode Viola-Jones*. Universitas Dian Nuswantoro. Semarang

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