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EYE PUPIL MOVEMENT BASED ON CURSOR CONTROL MECHANISM USING IMAGE PROCESSING

Ms. K.E. ESWARI MCA., M.E.,[1] , M. SEDHU[2]

[1]Associate Professor, Department of Computer Applications, Nandha Engineering College(Autonomous), Erode, Tamilnadu, India.

[2]Final MCA, Department of Computer Applications, Nandha Engineering College(Autonomous),Erode, Tamilnadu, India.
Email: [1]eswari.eswaramoorthy@nandhaengg.org, [2] sedhudhana5@gmail.com

Abstract. The project introduces a technique for human computer interface with the help of pupils of eye. Normally, keyboard and mouse are used to make the interaction between the system and the user for input devices. The project presents a hand free interaction device for the people who have certain medical issue or kind of disability. This technique is planned to change the conventional computer screen pointing devices for the people who have certain disability. The application controls the computer's cursor with the users' eye movement. The users are allowed to use the application with the help of users' eyesight and control the cursor movement as per the users'direction. Aim of this application is to introduce a low cost based system for the people who have the disability and connect them with the real world. The project involves finding pupil location from the given source image. In addition it finds whether blink activity is occurred in successive images. The project also improves the robustness against the lighting conditions in the input images.

Keywords: Image Processing, Amyotrophic Lateral Sclerosis, Electrooculographic Potential, Pupil Detection.

I. INTRODUCTION

As we know that the advances in the computer system increases day by day veritably fleetly and extensively. Every day a new technology is introduced in the request. There are so numerous technology and operations are available in the request for the accessible life style of the stoner, but the person with the physical disabilities aren't suitable to pierce these operations same as the other stoner.

For that purpose then we're trying to introduce a fashion that's available for the stoner who has certain disability or some medical issue. As we know that currently there's tremendous proliferation in the road accident and the people lost their body corridor in those accidents in similar cases the people aren't suitable to pierce the device like computer or laptops. This may creates a hedge between the stoner and the system. To lower down the hedge or the disturbance is a demanding task currently. There are so numerous ways available in the request to make the interface with the system similar as voice controlled device; facial recognition fashion, Head movement fashion but every fashion has its own advantages and disadvantages.

Piecemeal from the entire eye shadowing system is the stylish volition to make the communication between the system and the stoner. In eye shadowing system druggies are allowed to use their pupil of eye to move the cursor on the screen where the direction of the eye indicates.

Then we're trying to introduce a low cost grounded operation for the hindered people to use their certain body corridor and make the interface with the system and the stoner and connect them to the real world. There are five modules to apply the eye tracking system. The following are the objects of the study

- To find eye area in the given images.
- To find white pixels area (left, right, over and down of pupil) in the given image.
- To make the eye tracking system one of the stylish operation for hindered persons.
- To check for blink exertion in consecutive images.
- To make the cursor move automatically or run an operation grounded on pupil movement or blink action.

II. LITERATURE REVIEW

In this paper [1], the authors developed a system that used a camera to visually track the tip of the nose or the tip of a finger or some other selected feature of the body and moves the mouse pointer on the screen accordingly. People without disabilities quickly learn to use the system to spell out messages or play games. People with severe cerebral palsy have tried the system with some

initial success. Their goal was to provide computer access to people who are quadriplegic and cannot speak by developing computer vision systems.

People who are quadriplegic and nonverbal, for example from cerebral palsy or traumatic brain injury or stroke, have limited motions they can make voluntarily. Some people can move their heads. Some can blink or wink voluntarily. Some can move the eyes or tongue. Family, friends, and other care providers usually detect these motions visually. Many computer access methods have been developed to help people who are quadriplegic and nonverbal: external switches, devices to detect small muscle movements or eye blinks, head pointers, infrared or near infrared camera based systems to detect eye movements, electrode based systems to measure the angle of the eye in the head, even systems to detect features in EEG.

These have helped many people access the computer and have made tremendous improvements in their lives. Still, there are many people with no reliable means to access the computer. They are interested in developing computer vision systems that work under normal lighting to provide computer access to people who are quadriplegic and nonverbal.

Their current system does not use the tracking history. The subimages in the new frame are compared only to the selected subimage in the previous frame and not, for example, to the original subimage. We plan to investigate methods that would compare the current subimages with past selected subimages, for example using recursive least squares filters or Kalman filters. They are just beginning clinical work with the tracking system. They would invite more people with severe disabilities to try the system. People for whom the system seems appropriate will continue working with it so that we can help them better accesses the computer and also so we can try to optimize the performance of the system. They would work with Rick Hoyt so he can use the tracking system to spell out messages on the computer using his own spelling method.

Their larger plan is to develop systems to visually recognize the facial movements – head movements, blinks and winks, tongue movements, eye movements– that people with quadriplegia can make so we can provide computer access to as many people as possible. They hope the visual tracker is interesting and useful in itself and a first step in this larger project.

They said that their tracking program works extremely well. The program tracks a person's nose for many minutes without adjustment or intervention. No lighting changes were made in the lab, which has standard overhead fluorescent bulbs. Occasionally the selected subimage creeps along the user's face, for example up and down the nose as the user moves his head. This is hardly noticeable by the user as the movement of the mouse pointer still corresponds closely to the movement of the head. A person without disabilities has good control very quickly.

A person can sit down and spell out a message on an onscreen keyboard after just a minute of practice. Using 0.5 seconds dwell time spelling proceeds at approximately 2 seconds per character, 1.5 seconds to move the pointer to the square with the character and 0.5 seconds to dwell there to select it. People spell out entire messages without intervention by the operator. They have tried the system with three teenagers with severe disabilities. Two of the teenagers used to have no head control but have had a baclofen pump implanted in the past year to reduce muscle spasticity. They now have some head control and are able to move the cursor around but not yet reliably. One teenager is able to move the cursor at will by moving her head.

They have been working with Rick Hoyt, who was born with severe cerebral palsy. Rick has some voluntary head movement, especially to the left. He and his brother developed an easy to use and increasingly popular spelling system based on just a "yes" movement. They have implemented the spelling system in a computer program. When combined with this tracker, messages can be spelled out just by small head movements to the left or right using the Hoyt spelling method.

In this paper [2], the authors presented an implementation of a lowcost vision-based computer interface which allows people with severe disabilities to use eye blinks to access computers and communicate with other persons. Their communication aid requires only one low-cost web camera and a personal computer. Several experiments were conducted to test the performance of the proposed eye-blink-based communication aid.

Computers have been dramatically changing our lifestyles, livelihoods, and even the whole society. These kinds of changes benefit some groups in our society but unavoidably create new barriers to a disadvantage minority such as people with physical disabilities who cannot manually access computers with dexterity as able-bodies people do. Therefore, in recent years, there has been an effort to design alternative interfaces for people with disabilities to replace traditional computer input devices such as keyboard and mouse.

Assistive technology systems of every variety have been proposed and even commercialized to allow people with disabilities to use their limited voluntary motions to communicate with family and friends, access computers, and control TVs and air conditioners, etc [11]-[18]. For some people with severe disabilities, an extreme disability such as amyotrophic lateral sclerosis (ALS) or severe cerebral palsy deprives them of the use of their limbs and even facial muscles. Owing to this kind of extreme disability, many available popular assistive technology systems are not helpful to them. Under this circumstance, eye motion -based systems may provide an alternative option for people with severe disabilities who only retain the ability to move their eyes. There are several

different ways to track the eye movements, such as refection of light [19]-[23] and electrooculographic potential (EOG) [20], etc.

Among so many useful assistive technology systems, the "camera mouse" system [20] and the "Blink Link" [21] deserve to be particularly mentioned. The camera mouse system tracks some small section of a user's facial features (e.g., nose, lip, and the whole eye, etc) with a video camera and translates them into the movements of the mouse pointer on the screen. By dwelling in the desired screen area for a certain amount of time, the user may make a selection or issue a mouse click. The experiences with the camera mouse system were very encouraging. They showed that the system could successfully provide computer access for people with severe disabilities. However, the eye feature has not been used effectively with the camera mouse system in their reported work at that time.

Grauman et al. proposed the Blink Link system which enables communication using eye blink patterns to provide an alternate input modality to allow people with severe disabilities to access a computer. A very high success rate in almost real-time was reported; however, the system was imposed by some restrictions. Once the open eye template becomes out of date for some reasons, the system may give faulty outputs. In [24], Bhaskar et al. even pointed out that the Blink Link system suffers from several disadvantages. For example, it requires offline training for different depths from the camera for the computation of the distance. Furthermore, changing camera positions requires the whole system to be retrained.

In their previous work, a vision-based "Head Mouse" system and an "eye mouse" have been proposed to allow people with disabilities to use their head movements or eye movements to manipulate computers. The goal of this paper is to present an implementation of a non-instructive eye-blink-based communication aid for the severe disabilities such as ALS.

With the communication aid, ALS people are able to use their limited voluntary motions such as eye blinks for communications, manipulating computers, and controlling home appliances (e.g., TV and air conditioner, etc). In this communication aid, the pattern matching technique and optical flow are integrated to detect eye blinks.

III. PROPOSED METHODOLOGY

The existing system is an eye tracking application. To develop this application various algorithm methods and techniques of the image processing are used. These methods and techniques of image processing give a well designed model for eye tracking system.

This application is also useful for the face detection, features detection, template generation and cursor movement. In any handicapped scenario 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.

In this system, 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.

Finally, eye tracking system handles the cursor movement. The direction of the cursor is found out by comparing the template with the previously stored template.

1. Only up and down movement of face/eye is considered.
2. Images with more Brightness are taken as input.
3. Blink action by adjoining two image data and cursor movement for that is not considered.
4. Continuous closed eye patterns in successive images are not detected (to stop the current running application).

In addition with all the existing system approach, proposed system also considers the right and left movement of the pupil and the system actions are controlled. The pupil's location inside the eye is measured and actions are carried out such as home key and end key pressing are made.
Also, blink action of the eye is tracked and system actions are carried out. This is being checked by closed eye in one image and opened eye in next(successive) image. Moreover, continuous closed eye in various successive images are captured and the current running application is closed.

1. Along with up and down movement, left and right movement of face/eye is also considered.
2. Images with less Brightness are also taken as input.
3. Blink action by adjoining two image data and cursor movement for that is also considered.
4. Continuous closed eye in various successive images are detected for closing the application.

IV. FINDINGS

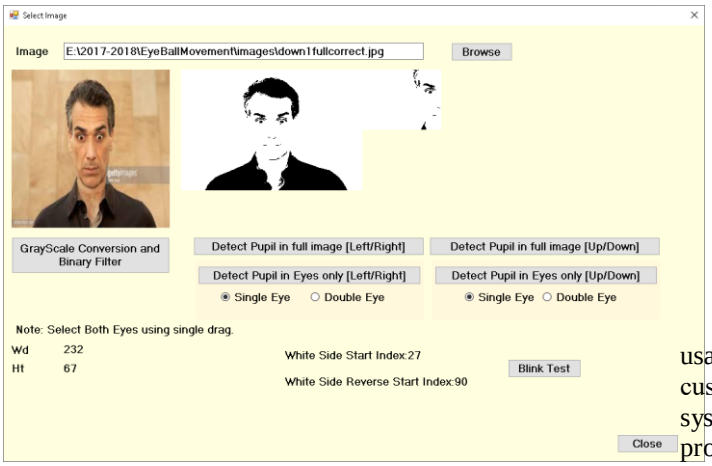
As we know that nowadays there is tremendous increment in the road accident and the people lost their body parts in that accidents in such cases the people are not able to access the device like computer or laptops. This may creates a barrier between the user and the system. To lower down the barrier or the disturbance is a demanding task nowadays.

A low cost based application for the handicapped people is required to use their certain body parts and make the interface with the system and the user and connect them to the real world. So this application detects the pupil position in the given human face image and controls the cursor movement in the application.

The main problem is to find eye area in the given images and then to find white pixels area (left, right, up and

down of pupil) in the given image. The system must be capable to make the eye tracking system one of the best applications for handicapped persons , to check for blink activity in successive images and to make the cursor move automatically or run an application based on pupil movement or blink action.

- In this module, two successive images are taken, eye area selected.
- Then if first image contains black pixels in the particular area and the white pixels in same area in second image, then it is treated as blinking.
- Likewise if first image contains white pixels in the particular area and the black pixels in same area in second image, then it is treated as blinking.
- Then an application is invoked such as ‘Notepad’. The process may be any like opening Notepad and ‘Double Clicking or closing the current application.



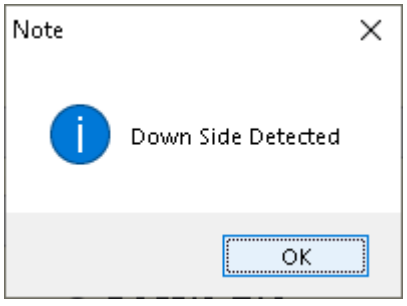
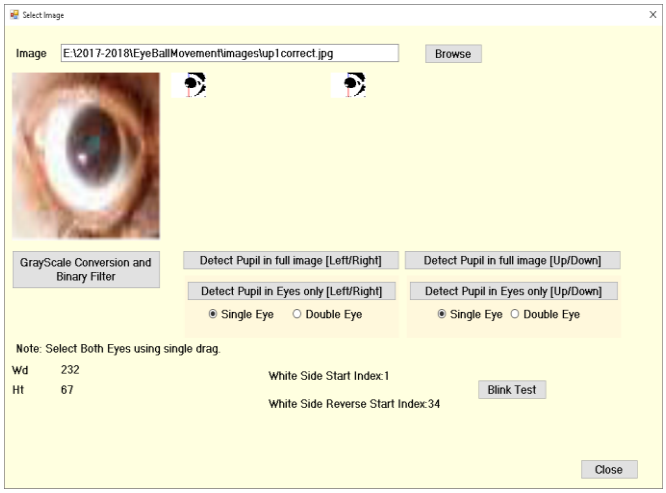


FIGURE 4.1 PUPIL DETECTION DOWNSIDE



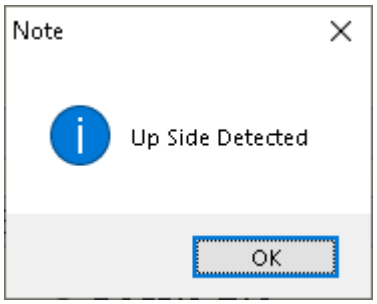


FIGURE 4.1 PUPIL DETECTION UPSIDE

V. CONCLUSION

The project 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. This system provides the support or platform to the disable person to access the device like a normal human being. This system is one of the best methods 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 person with the several disabilities 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. 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 is given by the user. This application introduces a low cost based system for the people who have the disability and connect them with the real world. 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.

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