Eye Blink Controlled Virtual Interface Using Opencv And Dlib

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Abstract-

The basic non verbal interaction that is now evolving in the upcoming generation is Eye gaze. This eye blink system builds a bridge for communication of people affected with disabilities. The operation is so simple that with the eyes blinking at the control keys that are built in the screen . This type of system can synthesize speech, control his environment, and give a major development of confidence in the individual . Our paper mainly enforces the virtual keyboard that not only has the built in phrases but also can provide the voice notification/ Speech assistance for the people who are speech disabled . To achieve this we have used our Pc/laptop camera which is built in and it recognizes the face and parts of the face . This makes the process of detecting the face much easier than anything. The eye blink serves as the alternative for a mouse click on the virtual interface . As already mentioned, our ultimate achievement is to provide a nonverbal communication and hence the physically disabled people should get a mode of communication along with a voice assistant . This type of innovation is a golden fortune for the people who lost their voice and affected to paralytic disorders . We have further explained with the respective flowcharts and with each juncture .

Keywords - Eye blink, facial landmarks, dlib, Open Cv

I.   INTRODUCTION

This system is a vision controlled communication system. This can be prevailed by the people who are lacking in the use of their hands and voice (physically disabled). It can be used by both adults and children with cerebral palsy and brainstem strokes. Already in the overtaken period of time the eyes are used for many biometric systems. For example our Aadhar cards are also scanned with our biometrics since these are the unique features that a human being has . There was a huge demand when the brain computer interaction that was introduced earlier and was popularly used by the great scientist Stephen Hawking , but our project is an interaction between an eye and the computer , it builds a interface that can build a system of communication with eyes with the help of computers . The human eye blink detection is widely used for many other purposes also like the drowsiness checking for the drivers who drive long routes and it's also widely used in protection ones information likewise how we use fingerprint biometrics. The advancement in this field can easily make the disabled people more livable . To use this system, only thing that is needed is good control of eye , vision . As the user is positioned in front of the monitor, a webcam is mounted on the monitor that observes the user's eyes . This is operated by blinking at the box shaped rectangular buttons that are used to display the phrases. This system can be mounted on a wheel chair in front of the user , so whenever the user wants to click on a desired word , a blink is enough for the word to be clicked automatically . Once clicked, the voice assistant gives the output , but the major doubt is how can we sense the user is blinking in purpose or not ? That can be measured with the time frame or the frame rate that is provided by the program in which after a particular time of frame the key gets pressed or else it won't be considered as a blink .
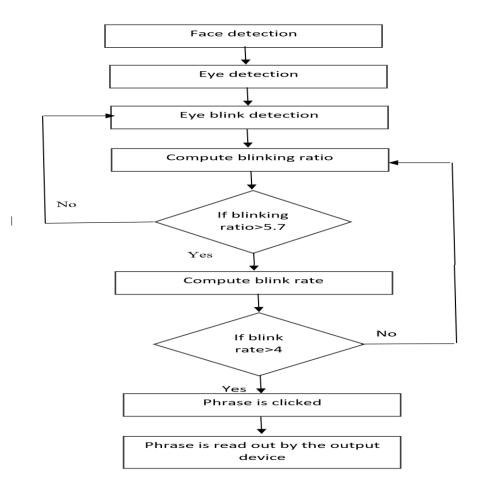
II.   RELATED WORK

There are several studies have been conducted on eye blinking techniques and eye monitoring techniques. In recent years the eye blinking technology have become the rising field of science. Behrooz Ashtiani and Scott Mackenzie used an eye blinking technology to provide a text entry system that consists of scanning ambiguous keyboard. The system detecting the eye blinks and further analyzes the duration and pattern of the eye blink that was presented by Margrit Betke and Michael Chau. It will be more useful if one looks at the paper created by Anjana Sharma to briefly know about various eye blinking techniques, algorithms. Different eye detection works are described by Grauman and Mageeetal. There are two types of vision based eye blink detection namely active and passive eye blink detection. Active eye blink detection uses retro-reflective property of eye . It depends on special illumination and gives more accurate results and also quick. Passive eye blink detection techniques require a camera to track eye movements and this technique doesn't use additional light source.

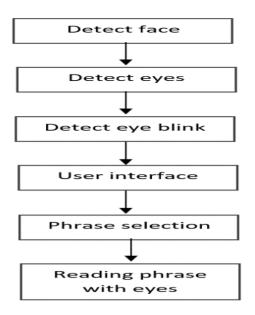## III.   PROPOSED METHOD

1)   Methodology:

Firstly the working of this system is recognizing the face followed by the eye and then the eye blink that enables the user to select the needed phrase in the keyboard that appears in the screen . So in general, the system is set to propose a protocol when the blink is ratio is said to be greater than 5.7 then the blink rate is computed , else if the ratio is lesser than 5.7 it is said to be a non blink and it is not computed further . This is totally dependent on the ratio in which the blink is made and checking whether it's a blink or not . Secondly, on to the rate of the blink , if the blink rate is greater than 4 then the pointer clicks the desired phrase set and hence finally the audio assistance is also delivered , but whereas when the rate is lesser than 4, it has to be again computed and checked to get the output . The working is so simple that any

physically disabled people can follow this , and the main feature is the blink detection that happens. To detect the face , facial landmarks feature is implemented with the help of dlib.
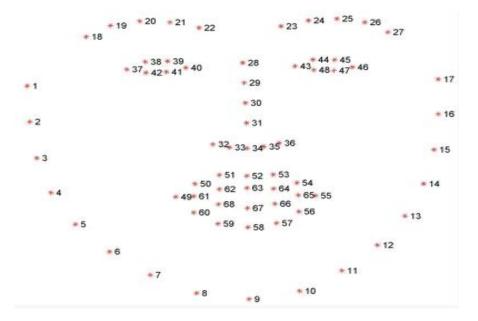

1) SYSTEM ARCHITECTURE:

In this paper, we have designed a system which can be easily controlled by the paralysed people. This system provides the speaking power without using mouth. Users can able to speak what they want through their eye blink. The user interface is very easy to use for all age groups from children to eldery person. The constructed system takes live video taken using webcam as input. From the input, the system will detect face and eye using facial landmark structure. The system will be built on several parts as deting face, eyes, eye blinks, virtual interface on screen, select the phrase button and finally read the phrase using eye blinking with the help of a speaker. The system architecture is as follows:

2) FACE DETECTION:

It is a technology of recognizing human faces from any image or video . Mostly, OpenCv and dlib are used to detect face by using various methods .The detector used here is made up of classic Histogram of Oriented Gradients (HOG) feature along with a linear classifier. Facial landmarks detector is implemented inside dlib to detect facial features like eyes, ear, nose, etc.

3) EYE DETECTION:

After detecting the face, eye region is detected with the help of facial landmark features. Using the face landmarks dataset, we can point out 68 landmarks on the face. each landmark is

assigned with an index. Using these indices, the desired region of the face is detected, . Point index for two eyes:

- left eye :- (37, 38, 39, 40, 41, 42)
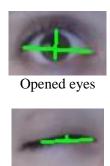- right eye :- (43, 44, 45, 46, 47, 48)

After extracting eye region, it is processed for detecting eye blinks. The eye region detection is done at the initial stage of the system.

4) EYE BLINK DETECTION:

With the exact eye region, we can detect the blinks with the help of two lines. One drawn horizontally and other drawn vertically splitting the eyes.Temporary closure of eyes along with the movement of eyelids is known as blink. It is a rapid natural process. We have to find out what happens when eye is blinked. We can conclude that the eye is closed/blinked when:

- Eyeball is not visible
- Eye lid is closed
- Upper and lower eyelids are connected together

If these actions are occured for a period of (approximately 0.3 seconds to 0.4 seconds) time ,we can assume it as a blink if it is longer than that then it can be taken as closed eyes. For a opened eye, both vertical and horizontal lines are almost identical while for a closed eye, vertical line becomes very smaller or almost vanished. Keeping the horizontal line as point of reference, a ratio is computed with respect to vertical line. We have to set a threshold value here and if the ratio is greater than the value then we can assume the eye is closed otherwise open.

Opened eyes

Closed eyes

5) USER INTERFACE:

In our system, user interface consists of list of phrases and the mouse pointer scrolling across the phrases top to bottom and vice versa.

i)   Buttons:

Each phrase is written on a button. buttons are created using python's Tkinter module. Tkinter is a interface to the GUI toolkit. This module is mostly used to create GUI applications easily.

ii)   Controlling the mouse pointer:

Pyautogui is a GUI automation module. This module is used to   control the mouse and keyboard events programmatically. In our system, scrolling of the mouse pointer across the phrases is achieved through moveTo() and moveRel() methods by giving the relevant x, y location of the screen as arguments.

6) PHRASE SELECTION AND READING:

While the mouse pointer is scrolling across the phrases, user has make voluntary blink (little longer than normal blink) when the mouse pointer reaches the desired button. And if the blink is captured in more than four frames, that button will be clicked and speaker will read the phrase which is already converted from text to speech and loaded into the system.

IV.   EXPERIMENTAL

RESULTS
Our program was tested in real rime and the results were recorded. Here we represent how our system behaves in real time.

1) DETECTING FACE AND EYES:

On running the program, the user interface appears and mouse pointer starts scrolling across the phrases. Within few seconds, webcam starts and starts the giving the live feed to the program with the help of OpenCv. By keeping the video as the source, the face is detected using the Haar based Histogram of Oriented Gradients(HOG) and linear SVM classifier. After detecting the face, eye region is detected by implementing shape 68 facial landmarks feature detector using dlib.

2) DETECTING EYE BLINK:

The main purpose of the system is to speak through eye blinking. After the eye region is recognized, we apply threshold to the eyeball to capture more accurately. Then the blinking ratio is computed. To differentiate the normal and the voluntary eye blinks we use a variable called blink rate. If the observed ratio is greater than the certain value for more than certain frames(blink rate),it is considered as a voluntary blink by the system. We set the blink rate to 4 for our system but it may vary depending on the quality of the webcam and environment it works.

3) SPEAKING WITH EYES:

As the mouse pointer is scrolling across the phrases, by making a voluntary blink when the mouse pointer is on a desired phrase makes a click on the desired phrase button by pyautogui.click() method. Finally that phrase will be read out as speech through the speaker.

4) RESULTS:

We have tested out system in real time for several times and analysed the results. Our system is not 100% accurate

Though clicking the phrases with eye blinks are more accurate, Sometimes normal blink also gets detected instead of voluntary blink. However these limitations can be minimized by using high resolution camera.

V.   CONCLUSION

In this paper we have widely described about the functions, working of the system. This system helps the paralyzed people to communicate their ideas and thoughts and needs for them. To differentiate voluntary and normal eye blinks, the eye blink frame rate is used. This algorithm helps the paralyzed people to communicate efficiently. This system doesn't require a person to operate and maintenance is very less. This complete project consists of proposed system, pc or laptop and web cam.The system can be used in many places like hospitals, homes, nursing homes etc. This system provides a new possibility in the life of paralyzed people with eye movement. It helps the paralyzed people to communicate their thoughts through the given phrases in the system. The aim of this system is to reduce the efforts of paralyzed people to communicate their thoughts by using eye movement algorithm. Surely this system will provide a solution for people with severe paralysis.

VI.   REFERENCES

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