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Converting Intent of Physically Impaired into Text using Eye Blink Detection

Veena N, Anitha N

Abstract*: Many people around the world are affected by motor function disabilities. These people cannot communicate with others as they have met with accidents or they are under some trauma. It is nearly impossible for such paralyzed people to communicate with others. This system permits various physically handicapped patients to convert their intent to text using their eye-blink in order to use a computing system motor capability. However, people under paralysis can use their eyes. A natural motion of the eye is an eye-blink. This eye-blink can be efficiently used to communicate information.

Keywords: AJAX, Anaconda, Dlib, Flask, JavaScript, OpenCV.

I. INTRODUCTION

HCI (Human–Computer-Interface) is a communication process between human and a computer which occurs in real time. There are a number of input channels required such as a screen, track ball etc., but as this paper deals with the human deficiency to type will be using a screen [1][2]. Almost all the devices require the human intervention these input devices cannot be used for the physically impaired persons. So there is a requirement to come out with an alternative strategy for communication between computer and a physically impaired person which helps them to become as part of society which has become hot topic of discussion in the field of research. The interface that is provided is based on a laptop with web camera which basically requires some sort of light source as in Figure 1 and 2. This interface is open source and available on-line.

II. HUMAN COMPUTER INTERFACE

HCI for physically challenged impaired people with respect to movement need to satisfy certain conditions such as HCI should not be in connection, avoid dedicated apparatus, it should offer better performance, and it should get processed on customer computer. The main reasons for these conditions are not because the research could gather lesser capital but because the end user might not be able to afford highly expensive commodities and hence a system working on one of the most common of infrastructure is of great use to the user [1].

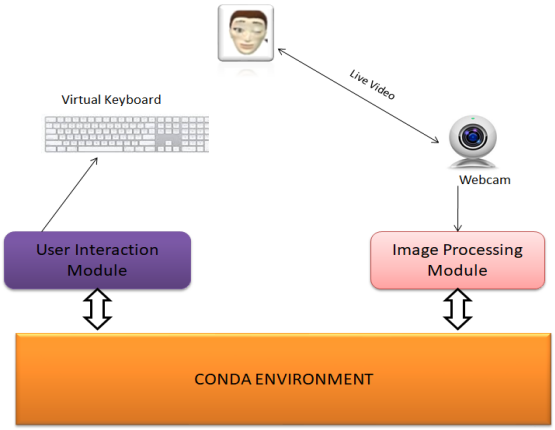

Figure 1: Overall architecture

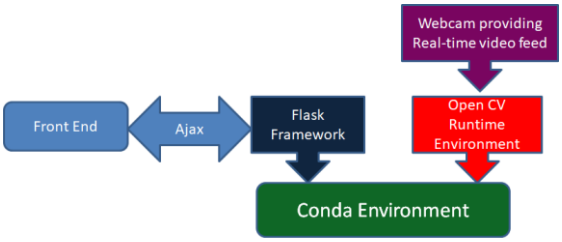

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Figure 2: Detailed architecture

III. PROPOSED SYSTEM

A computer system which is vision based is used for recognition of volunteer eye-blinks, along with the application as an HCI for people with physical incapacities. A computer system, which is skilled of handling linear set of images of the face with minor resolution with speed of handling certain frames per second is been constructed from off the shelf components namely laptop with webcam of good quality. The proposed method will allow detection of the eye blink and classification of set of blinks in the current real-time environment. The identified eye blink is considered as the response. Interface first moves the cursor/lightened characters in a horizontal fashion once the first blink is detected the cursor then moves vertical in accordance with the response waiting for a second blink which then selects the appropriate character. It requires different software's such as Anaconda, Flask, OpenCV, Dlib and JavaScript and AJAX as in Figure 2. The eye-blink vision-based detection system is categorized into two types i) active, ii) passive.

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* Correspondence Author
Veena N*, Asst. Professor, Department of Information Science & Engineering, BMSIT&M, Bangalore, India.
Anitha N, Professor, Department of Information Science & Engineering, EPCET, Bangalore, India.

The active method gives correct result from eye to eye blink detection and it is robust.
It cannot be offered by a common man because of its high cost due to Infrared Radiation (IR) and a dedicated hardware, however they are not effective in out-air surroundings because of direct sunlight on IR brightness. Another limitation of this approach is the safety concern about the exposure of retina to IR illumination basically causes damage as in Figure 3 and 4. the flowchart of the same is shown in Figure 5. Therefore, the better approach is to use a gaze controlled passive vision-based control system [3]. Passive approach does not make use of extra source of light. The eye blinks are noticed from the set of images in the visible spectrum. Most of the eye blink detection methods are in fact detect eye regions in images [3] [4].

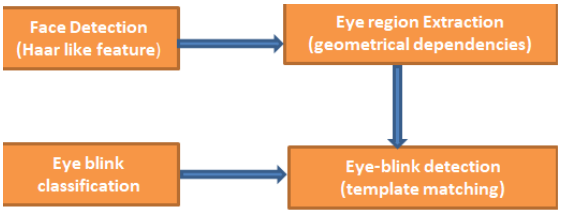

Figure 3: Eye blink classification

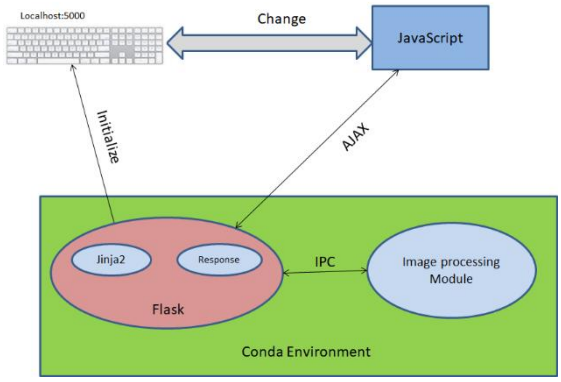

Figure 4: User interaction module

Face recognition is an integral part of eye-blink detection system. Face detection is one of the crucial phases of the eye blink detection system. However, face localization is expensive and time consuming because of this fact the face localization phase is run only during the start-up process. Hence the system chosen to work in real time system should work at a faster rate. The upside of this technique is the open source software enabling us to achieve this feature but there are a number of disadvantages as well, first the problem with disturbance, any other face in the scheme of reference will also be caught and this will jeopardise the system and the detection will not be efficient [5][6]. The rectangular mask can be employed instead as in Figure 6. The design consists of the dual hull, in case of the dual hull, the CG (Centre of Gravity) is maintained in between the two hulls which make it more efficient in counteracting the wave. Using single hull Centre of Gravity and Centre of Pressure vary continuously due to random motion of currents, so we have preferred dual hull design.

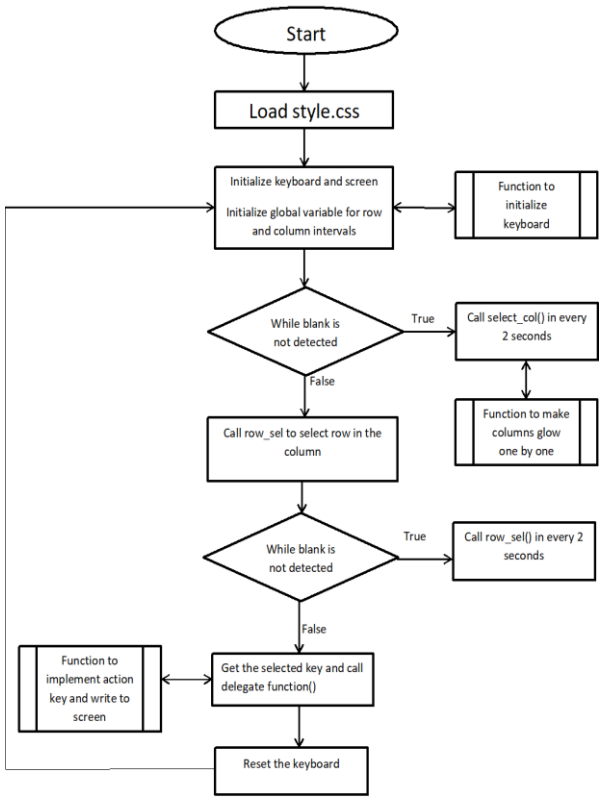

Figure 5: Flowchart for user interaction module

Buoyancy theorem states that the height of the object floating should be less than the circumference of it. The ship designs using balsa wood which is flexible and has lightweight. The ship remains stable even in the presence of waves of height one foot. Once the ship is designed as per the required dimensions it is coated with wall. The method that is chosen should work in all the environments with varying facial expression, hair, head pose and other varying styles etc. there are number of procedures available for face recognition which can be classified as follows:
1)Knowledge based procedure that specifies rules to define the possessions of the face regularity and the geometrical associations between features of the face
2) feature based methods that works on the identification of skin colour, eyes and mouth
3) template-matching procedures which are based on calculating the connection between the input and stored patterns of the face
4)Methods based on models where we train methods on models by using different neural networks [5][7].

A. *Face Detection*

Feature value for a mask is calculated as the sum of intensity of pixels covered by black rectangle to the sum of the intensity pixels covered over the entire mask. Entire feature values are not required to identify the faces correctly we can build an efficient algorithm that works only on part of the feature with a small error rate. To find those features we use a boosting algorithm where the process is carried repeatedly in order to build a cascade of classifiers. Every phase of the cascade is the sum of weak classifier which increases the complexity as number of phases increases.

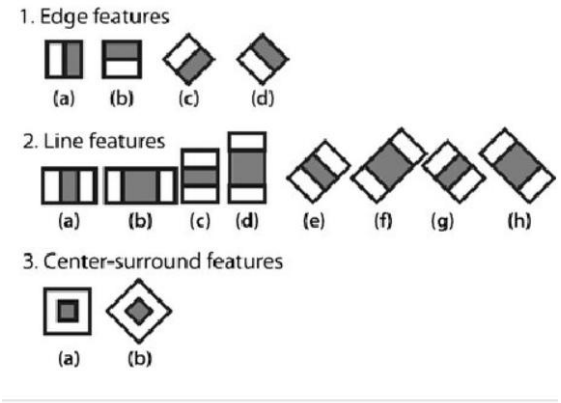

Figure 6: Rectangular mask used for object detection

B. *Detection of Eyes*

The next phase is the localization of eye region in the input. Location of the eyes on the curtain is identified from the geometrical requirements which are prearranged at any given point of time. The conventional method tells that the face is usually divided into 6 squares 2/3, accordingly eyes will be situated at 0.4 away from head top. This in turn is pre-processed in order to perform eye blink identification.

C. *Eye Blink Classification*

To distinguish the eye-blink duration greater the 250 ms the variation of the association constant in period is taken into consideration and analysed. If this value analysed is less than the predefined value for 2 successive frames, then the eye blink onset is identified. The eye blink off-set is identified if the value of the connection coefficient is greater than the analysed value. If the time period of an eye-blink detection is more than 250 ms and less than 2 s, then such a blink is said to be voluntary one.

D. *Performance*

The system developed for eye-blink recognition and monitoring was analyzed in i5 intel processor on the sequences from the inbuilt Realtek Pro webcam. The image categorization which will be equal to 320 by 240 pixels. System testing is done in a room illumined by ten LED spotlights and four windows with daylight. The person will be seated in visible of a monitor. The correctly noticed eye blinks are represented as (TP) True Positives, false detections are represented as (FP) False Positives (FP), and missed eye blinks are represented as (FN) False Negatives.

E. *Eye Blink Detection*

The method for involuntary identifying of eye blinks were used by predetermined actions. The applications are written using python (PyCharm) and with the help of a library OpenCV as in Figure 7. This system is built from the products where we have an easy access. Such as, a camera and a personal computer which provides basic infrastructure. To ensure the performance better we have to make sure that the distance between the user and the webcam should be less than or equal to 100 cm.

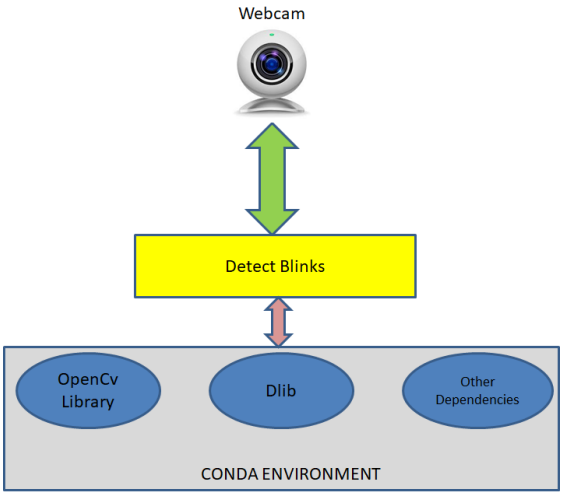

Figure 7: Eye blink detection module

The user first visualising his vision into the screen at approximately 50 cm when the user application blinker moves through sequential sets of horizontal matrix, when the user blinks the motion shifts and the blinker moves vertically with a time delay to make the user aware of his selection if the provided in out is wrong the user goes through the entire scenario without another subject to input, causing the sequence to begin from the start. Once the correct input is provided or selection is made the computer immediately puts the entry on a display above the selection matrix [10][6]. Figure 8 shows the overall flowchart for eye detection module. We can also provide solutions to the paralysed people by collecting the EEG signals and we can predict the disease [11] [12] [13] .

IV. RESULTS AND DISCUSSIONS

Here it helps various physically handicapped patients to convert their intent to text using their eye-blink. Many people around the world are affected by motor function disabilities. In order to use a computing system motor capability are a must. Moreover, there are many people who cannot communicate as they have met with accidents or have been under some trauma. It is nearly impossible for a paralyzed person to communicate with others. However, people under paralysis can use their eyes. A natural motion of the eye is an eye-blink. This eye-blink can be efficiently used in order to communicate information as in Figure 9.

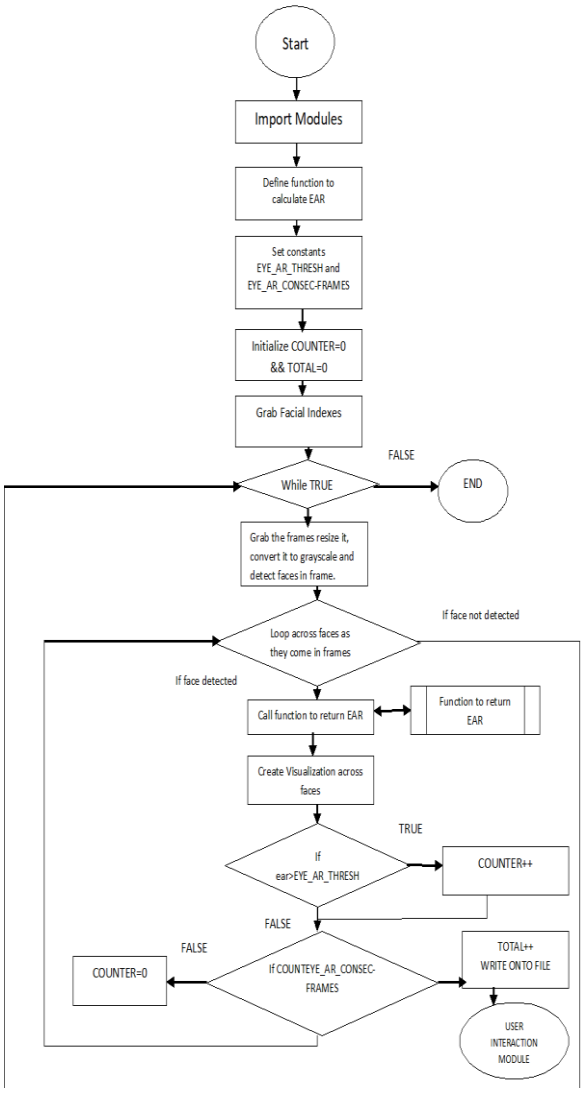

Figure 8: Flowchart for Eye detection module

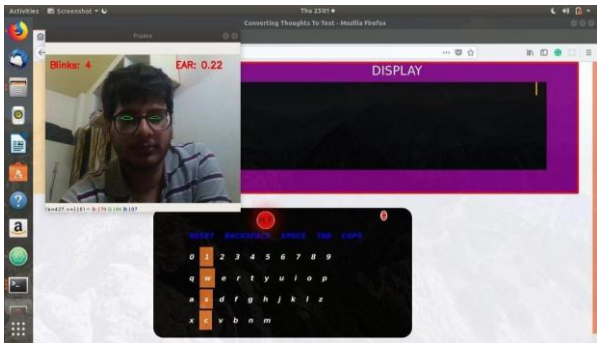

Figure 9: working model of the proposed system

There are various tools available to use eye-blinks. As we are aware that systems now a days have inbuilt webcams which can be used. A live video is read from the web camera and we use the received input to find out what the user intends to communicate. The interface distinguishes intended eye blinks and infers them as instructions which are used to select text for the user. Our system provides a different means for users to use as existing systems employ extra hardware and are also expensive [8][9].

V. CONCLUSION

The human computer interaction is important for every person who is physically impaired of this century. In today's era most of the work is done through computers. Blink-to-Text can be a helpful tool for those who cannot use the keyboard by their hands due to a number of reasons. It can be used by the paralyzed especially differently able persons to effectively interact with the outside environment through this application. The implementation of other systems that are available in market require hardware like EEG headsets which is costly to use in daily life. Thus, application provides efficient and cost-effective solution to the problem

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AUTHORS PROFILE

Veena N completed her B E is Computer Science and Engineering from Visvesvaraya Technological University, and M. Tech. in Software Engineering from Visvesvaraya Technological University. Presently she is pursuing her Ph. D in Brain Computer Interface under Visvesvaraya Technological University

Anitha N completed her B E is Computer Science and Engineering from Visvesvaraya Technological University, and M. Tech. in Computer Science and Engineering from Bangalore University. Completed her Ph. D from Visvesvaraya Technological University. Presently she is working as Professor in Information Science and Engineering from East Point College of Engineering & Technology, Bangalore.