Eye Blink Detection for Paralyzed Patients using Haar Cascade Classifier

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Abstract

The purpose of this project is to build a real time interactive system that allows paralyzed people to easily express themselves, via eye blinks. We represent a real time method based on Haar-Cascade Classifier for eye blink detection. The motivation of this research is the need of disabling who cannot communicate with human. A Haar Cascade Classifier is applied for face and eye detection for getting eye and facial axis information. In addition, the same classifier is used based on Haar like features to find out the relationship between the eyes and the facial axis for positioning the eyes. An efficient eye tracking method is proposed which uses the position of detected face.

I. INTRODUCTION:

Motor neuron disease (MND) is a medical condition where the motor neurons of the patient are paralyzed and is it incurable. It also leads to weakness of muscles with respect to hand, feet or voice. Because of this, the patient cannot perform his voluntary actions and it is very difficult for patients to express is needs. Tetraplegia is also one such condition where people cannot move parts below their neck. In this electronic era, solutions for patients with above mentioned diseases are found, one such innovation is the proposed system explained throughout. The proposed system can be used to control and communicate with other people through eye blinks. In the recent years due to the rapid advancement in the technology there has been a great demand of human-computer or human- mobile interaction (HCI or HMI). Eye blink is a quick action of closing and opening of the eyelids. Blink detection is an important enabling component in various domains such as human-computer interaction, mobile interaction, health care, and driving safety. For example, blink has been used as an input modality for people with disabilities to interact with computers and mobile phones.

System uses an inbuilt camera to capture the video of the patient and with the help of facial landmark algorithm it identifies the face and eyes of the patient. The system then slides a bunch of images one after the other on the screen and the patient can choose to blink over the image he wants ,just to convey message of his desires. The system identifies the blink with help of eye aspect ratio and then identify the need of patient.

In these days electronic devices are improving day by day and their demand is also improving. Smart phones, tablets are example of this. The system detects the eye blink and differentiates between an intentional long blink and a normal eye blink. Tetraplegia is a condition where people cannot move parts below neck. The proposed system can be used to control and Communicate with other people. In the recent years due to the rapid advancement in the technology there has been a great demand of human computer or mobile interaction (HCI or HMI). Eye blink is a quick action of closing and opening of the eyelids. Blink detection is an important enabling component in various domains such as human computer interaction, mobile interaction, health care, and driving safety. For example, blink has been used as an input modality for people with disabilities to interact with computers and mobile phones.

In Viola the chain of single-feature filters, Haar Cascade Classifier for identifying sub-region image is used. With the fast calculation of integral image technique, it can work in real time. Eye tracking provides an almost seamless form of interaction with the modern graphical user interface, representing the fastest non-invasive method of measuring user interest and attention. While the mouse, keyboard, and other touch-based interfaces have long reigned as the primary mediums associated with the field of human computer interaction, as advances continue to improve the cost and accuracy of eye tracking systems, they stand poised to contend for this role. An open and close eye template for blink pattern decisions based on correlation measurement is used. The method was specifically useful for people with severely paralyzed. A real-time eye blinking detection was proposed based on SIFT feature tracking with GPU based implementation.

The image analysis techniques have been greatly accepted and applied. In the proposed method, A Web camera is for taking consecutive facial images of the driver. It then uses program which is writtenin python code to detect the position of eyes based on the images taken.

The methodolgy for this system is as shown below:

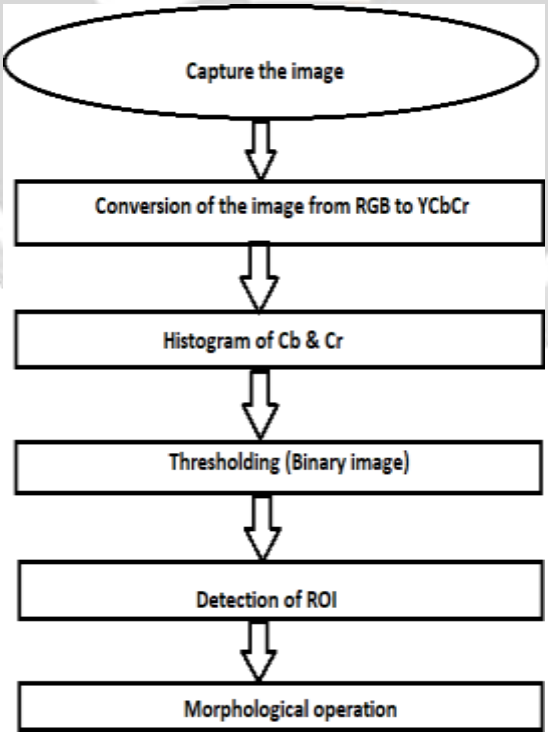


Fig 1 Methodology

II. Data Flow Diagram of the System

A data-flow diagram (DFD) is a graphical representation of the "flow" of data through an informationsystem. DFDs can also be used for the visualization of data processing (structured design). On a DFD,data items flow from an external data source or an internal data store to an internal data store or an external data sink, via an internal process.

Level 0 data flow diagram

A context-level or level 0 data flow diagram shows the interaction between the system and external agents which act as data sources and data sinks. On the context diagram (also known as the Level 0 DFD) the system's interactions with the outside world are modeled purely in terms of data flows across the system boundary. The context diagram shows the entire system as a single process, and gives no clues as to its internal organization.

Level 1 data flow diagram

The Level 1 DFD shows how the system is divided into sub-systems (processes), each of which dealswith one or more of the data flows to or from an external agent, and which together provide all of thefunctionality of the system as a whole. It also identifies internal data stores that must be present in order for the system to do its job, and shows the flow of data between the various parts of the system.

Figure 2 Level 0 data flow diagram

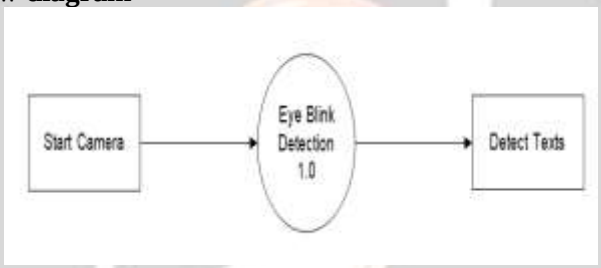
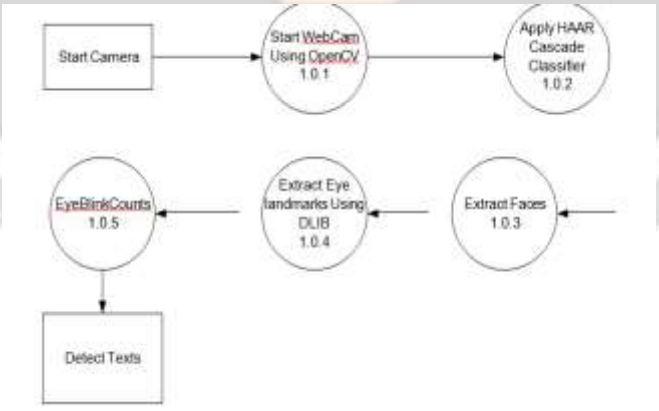


Figure 3 Level 1 data flow diagram



III. Description of Project Modules

[1]Camera and frame capturing

The first step of the proposed system is the initialization. After taking a short video of the participant's face using the front camera of the device used which is more likely a laptop. A process Frame methodwill be used to create the frames from the captured video. Afterwards the coloured frames will be converted to gray scale frames by extracting only the luminance component. The luminosity methodis a more sophisticated version of the average method. It also averages the values, but it forms a weighted average to account for human perception. We're more sensitive to green than other colours,so green is weighted most heavily. The formula for luminosity is 0.21 R + 0.72 G + 0.07 B. The luminosity method works best

overall.

[2]Eye Detection

To detect the eye, first, the Haar cascade classifier should be trained, in order to train the classifiers, the AdaBoost algorithm and Haar feature algorithms must be implemented, two set of images are needed. One set contains an image or scene that does not contain the object. The EBCM used all detected elements of Haar Cascade Classifier, and the result show the detected eye in rectangle box. AdaBoost algorithm is used to train node classifiers on a Haar-like feature set to improve the generalization ability of the node classifier. Consequently, the face detection performance of the facedetector is improved. Experimental results have proved that the proposed algorithm can significantly reduce the number of weak classifiers, increase the detection speed, and slightly raise the detection accuracy as well.

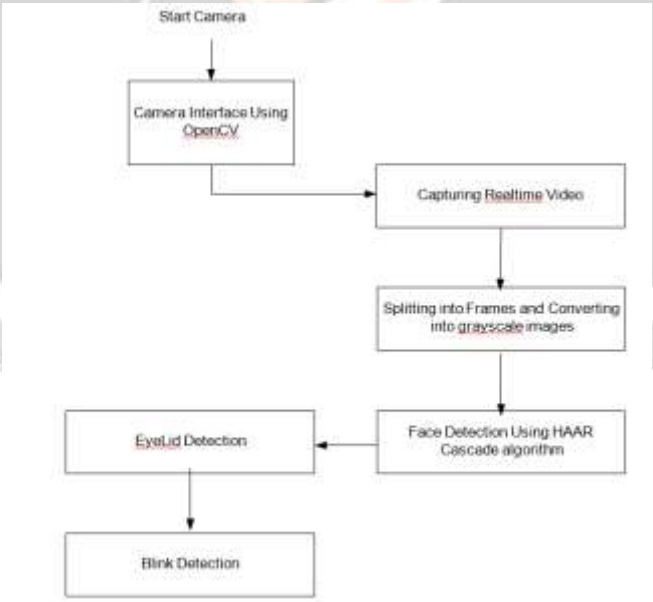
[3]Eye Tracking

The corneal-reflection and pupil-centre are the two eye's parts that are the most important parts to extract the features that will be used in EBCM method. These features help us in tracking the eyes movement. By identifying the center of the pupil and the location of the corneal reflection, the vector between them is measured. Besides, with further trigonometric calculations, point-of-regard can be found. The EBCM method succeeded in making the face and the eye's pupil moved together in the same direction synchronously and with the same direction. Let suppose that X is the human face which has been detected , P1 and P2 are two points related to the left eye, and they are moving synchronously with the movement of X.

[4]Eye Blinking

Eye blinking and movement can be detected with relatively high reliability by unobtrusive techniques.Though, there are few techniques discovered for the active scene where the face and the camera device move independently, and the eye moves freely in every direction independently of the face. Although

IV. System Architecture:



Brief about System Architecture:

1. Capturing the frame from the video using the system's camera initializes the execution of theproposed system.
2. The frames are converted into gray scale image and we are making zero and ones combination ofwhite and black pixels.
3. We are considering 68 point pixel for face and 6 point pixel for eye lids.
4. The Face Detection is done using haar cascade Algorithm processes on the captured video frames which is converted as

gray scale image to give out the rectangular boxed face.

5. The output from Face Detection Algorithm then gets processed using AdaBoost Classifier to detectthe eye region in the face.
6. Eye detected will be sent to check whether the eye is closed or open.
7. When the eyes are open the virtual keyboard numbers are being played sequence until the eyes areclosed.
8. Once eye is closed then the particular need of the patient in that number is given as a output forcare takers.
9. The outputs are in the form of image display, text alerting, audio played etc.

V. LITERATURE SURVEY :

[1] An Image Based Eye Controlled Assistive System for Paralytic Patients"

Authors: Michelle Alva, Neil Castellino.

Communication is an essential part of human life which paralytic patients with locked-in syndrome are deprived of. In locked-in syndrome, the patient cannot move any of his voluntary muscles exceptthe eyes . Taking this into consideration, the proposed system is designed to detect the face and pupilof the patient through a standard webcam using Haar cascade classifiers and Circular Hough Transform algorithm respectively.

[2]"Eye-Motion Detection for MND Patients"

Authors: ChyiYeu Lin, Chu-Lian Xu.

This paper aims to develop an eye-motion based communication system for motor neuron disease (MND) patients to contact with care providers any time they want when they lie on the bed. This eye- motion detection system involves technical modules of eye-blink detection, gaze estimation and headpose estimation on MND patients.

[3] "Face detection and tracking: Using Open CV"

Authors: K. Goyal, K. Agarwal and R. Kumar.

An application for tracking and detecting faces in videos and in cameras which can be used for multipurpose activities. The intention of the paper is deep study of face detection using open CV. A tabular comparison is performed in order to under-stand the algorithms in an easier manner. It talks about various algorithms like Adaboost , Haar cascades. This paper aims to help in understanding thebest prerequisites for face detection.

[4] "Blink detection for real-time eye tracking"

Authors: Tim Morris, Paul Blenkhorn, Farhan Zaidi.

This work is motivated by our goal of providing non-contact head and eye based control of computersystems for people with motor difficulties. The system described here uses spatio-temporal filtering and variance maps to locate the head and find the eye-feature points, respectively. These feature points are accurately tracked in the succeeding frames by using a modified version of the Lucas Kanade tracking algorithm with pyramidal implementation.

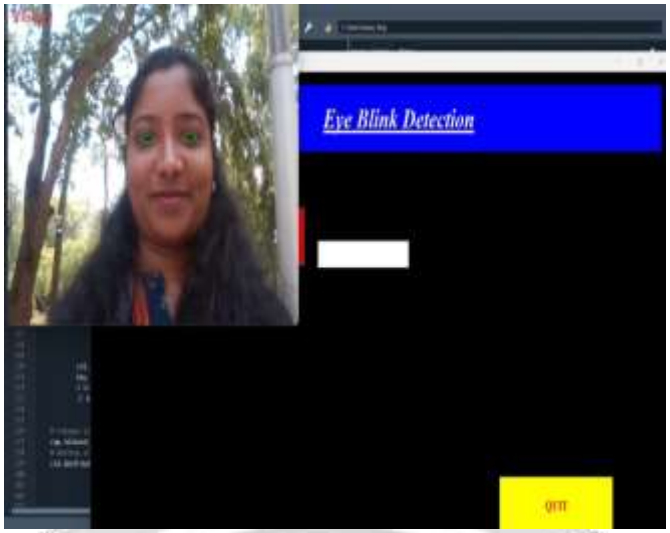
[5] "Assistance for paralyzed patient using eye motion detection"

Authors: Milan Pandey, Kushal Chaudhari, Rajnish Kumar, Anoop Shinde, Divyanshu Tola.

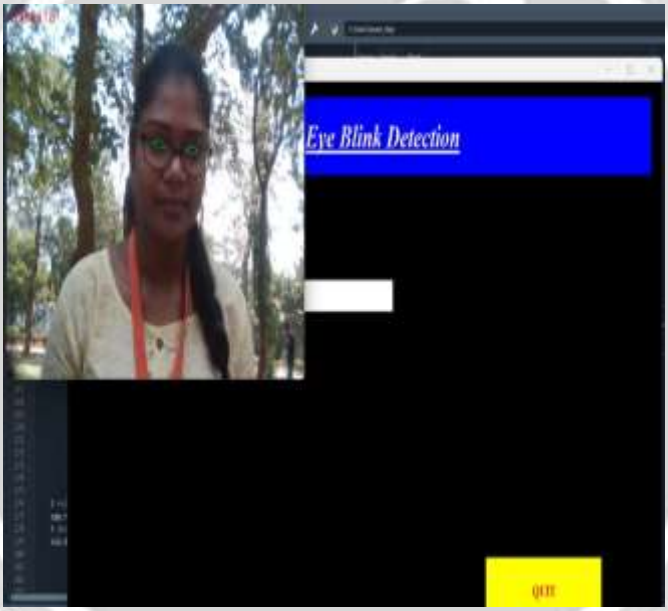
The objective of this paper is to propose a human computer interface for a completely paralyzed patient using eye motion and eye blink detection. A nonintrusive communication interface which was developed and runs on a consumer grade computer which takes input in the form of video frames from an inexpensive webcam without special lightning conditions.

VI. PROJECT OUTCOMES:

The following snapshots define the results or outputs that we will get after step by step execution ofall the modules of the system.



Detecting without Spectacles



Detecting with Spectacles

VII. CONCLUSION:

The main aim of the proposed system is that it aims to bring about a change to ease the life of paralyzed people without causing any harm to their bodies, and be a promising tool to those who cannot use the keyboards physically. It proves to be better than the recently developed models developed in this field as none of the components of this method are in direct contact with the patient'sbody.

Blink To Text provides a viable option for LIS patients to communicate. The software's accessibility first design allow's LIS patients to express themselves independently. The software being open source and requiring no high end hardware ensures that it is widely availible across financial classes.

Of course, their is still room for improvement in future iterations of the software. In short term development, the blink detection algorithm should be made more robust. After doing more research,it seems that the Facial Landmarks technique may be more accurate than the Hough Transform technique. The software should migrate to this system. In long term

development, more activities should be made within the reach of an eye blink. If a person cannot transverse physical space, she/heshould still be able to explore cyberspace.

VIII. REFERENCES

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