Communication System for Incapacitated using Eye Blink

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Abstract:* We describe a real-time technique for eye blink recognition that is based on various video and image processing algorithms. The necessity to disable those who are unable to communicate with humans is the driving force behind this research. The position of the identified face is used to propose an effective eye tracking technique. For managing Android mobile phones, an eye blinking detection based on eyelid status (closed or open) is used. The procedure is applied both with and without a smoothing filter to demonstrate how the accuracy of detection has improved. This project's primary goal is to create a real-time interactive system that can help the paralysed operate household items like lights and fans or play pre-recorded audio messages with a certain amount of eye blinks.

***Keywords:* MATLAB; Simulink; Biometrics; Erosion; Dilation**

I. INTRODUCTION

Image processing methods based on eye biometrics are used by eye tracking systems. To conduct jobs like recognition or authentication, image processing converts the input data into digital form and applies various mathematical operations to the data to produce a more enhanced image. These tasks are carried out by humans using digital computers. Picture processing is another name for the procedure. In image processing, the picture is examined to find shades, colors, contrasts, and shapes that the human eye cannot see.

The suggested system recognizes the patient's voluntary blinks and responds by alerting the caregiver to the need. It also calls the caregiver and plays a voice output. The system employs a built-in camera to record a video of the patient, and with the aid of a facial landmark algorithm, it is able to recognize the patient's face and eyes. The patient can select to blink over the image he wants to indicate his desires as the system then slides a number of images on the screen one after another.

II. LITERATURE SURVEY

The goal of this paper is to suggest an eye development and eye squint area-based human computer interface for a patient who is entirely paralyzed. People who are severely disabled or who are unable to govern human interactions without the use of their hands are the inspiration behind this assessment. Here The first advancement was in face detection, where the eye region was located using MATLAB's picture handling and SIFT calculation. The patient can select here with the aid of eye developments because various predetermined images will be displayed on the screen (e.g., water, food, juice, music, films and so forth.). The essentials will be selected in this way and presented to the guardian based on eye squints.

In this examination, the patient's eye squint is detected using a visual distinguishing structure that uses a CCD camera to continuously deduce a picture. The mobile phones in this instance are controlled by eye flash ID. It doesn't offer a reliable method to do the task. It is not necessary to have any wonderful lighting or prior knowledge of facial territory or skin concealing. An elective specific method that is appropriate for people with severe disabilities is included in the estimating and programming demonstrated in this study. Results demonstrate the Flicker Connection's capacity to accurately detect planned and unshakeable squints, which is a major advance for a system dependent on facial cues or movements.

III. PROPOSED SYSTEM

The proposed project intends to provide an answer for those who are incapacitated without causing any harm to their physical structure either internally or outwardly. Since none of the components come into close contact with the patient's body, it outweighs the earlier prototypes in this field and will undoubtedly prove to be safer. Effective in terms of cost: The primary goal of creating an algorithm for a real-time video oculography system is to make it affordable for those who cannot afford it. The current method of communication for these patients is too expensive. As a result, it's essential to create a system that the average person can buy and that uses low-cost design components. Quick: A small number of algorithms have been developed for video Oculography systems.

IV. METHODOLOGY

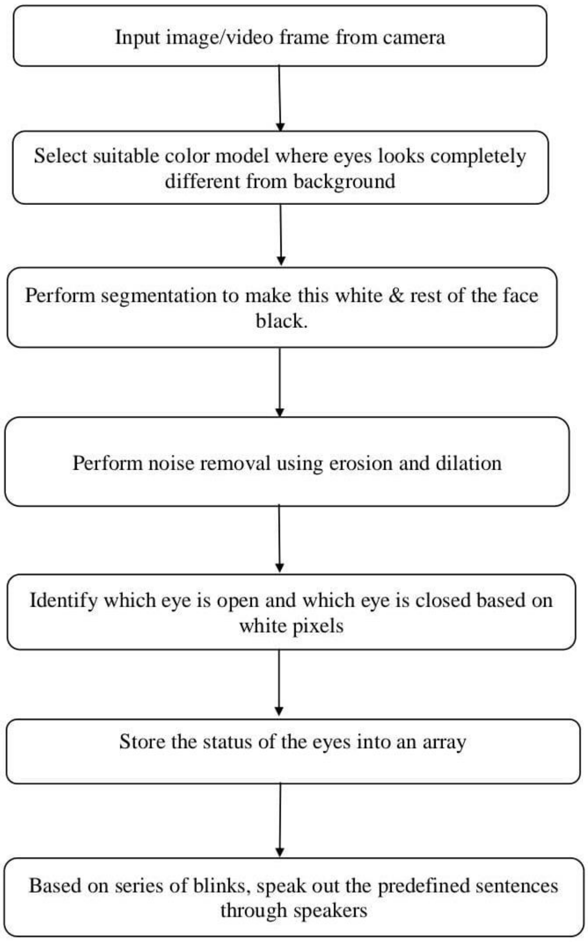

Fig 1. Algorithm flowchart

The device setup consists of a HD web camera which records live video, and this recorded video is transferred to our application which is built using MATLAB. Basically, this setup represents a small-scale representation of the main idea. In the first process, the recorded image or video frame will be sent as input to the algorithm as shown in Fig. 1. At the next step we must select a suitable color model where eyes look completely different from background. Further we have to perform segmentation to make eyeball white and rest of the region black and here only focus is made on pupils of the eye. Noise removal is done using erosion and dilation methods of MATLAB. Based on white pixels, identify which eye is open and which is closed. Store the status of the eye into an array. Based on the series of blinks the speaker speaks out the predefined sentences. The setup when implemented cap connected with a web camera is to be worn by a person and focus it such that eye movements are to be observed. And the results are spoken out. The pre-defined instructions are based on eye blinks and these instructions will help the caretaker to fulfill the needs of the person. Image preprocessing flow is shown in Fig. 2.

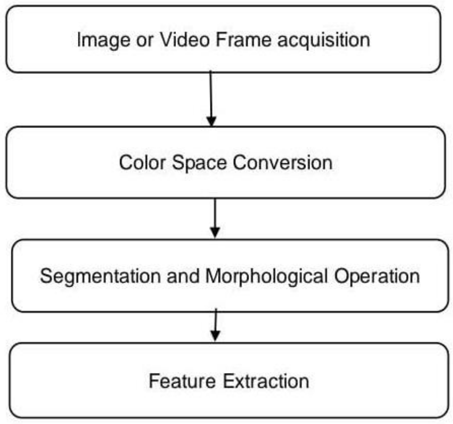

Fig 2. Image processing algorithm flow

A. Acquisition of images

This is the first of the essential phases in the processing of digital images. If the output of the camera or sensor is not already in digital form, the image is taken by a sensor (such as a camera) and digitalized using an analogue-to-digital converter. Obtaining an image could be as simple as receiving one that has already been converted to digital form.

B. Colour image processing

Colour image processing is an area that has been gaining its importance because of the significant increase in the use of digital images over the Internet. Use the colour of the image to extract features of interest in an image. This may include colour modelling and processing in a digital domain as seen in Fig. 3.

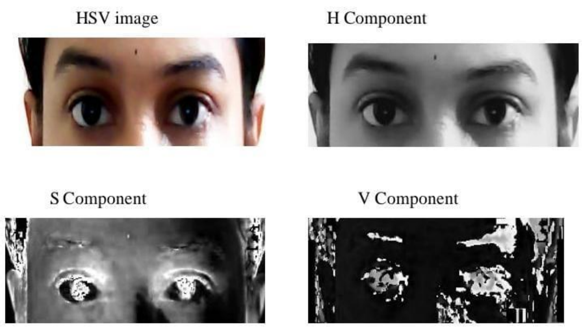

Fig 3. Image pre-processing

C. Segmentation and Morphological Operation

Segmentation techniques separate an image into its individual elements or objects. The S Component image's objects are segmented using the Threshold Technique.

After subtracting this picture from the original image, it is crucial to calculate the image backdrop using morphological operators in order to identify the eye from the photographs. The backdrop will have pixel values 0, while the final image will only contain objects with pixel values 1. This approach produces superior outcomes. Watershed segmentation and Gaussian mixture models are common approaches eye detection.

D. Video Processing

Whatever image processing work is done, it is only for one particular image. Go to the video after that. Simulink is a better option for working with video than MATLAB since it has more advanced features for processing video. Implement any algorithm that has been created for image processing in Simulink utilising the blocks that Simulink offers.

V. RESULTS

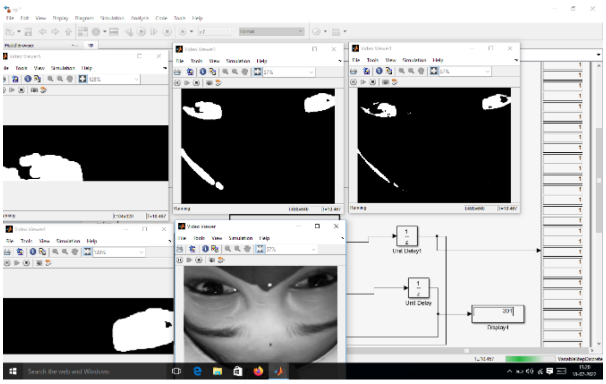

Fig 4. Windows showing pre-processed eye movements

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Command Window
arr1 =
     0     0     0

i am feeling boared
arr1 =
     0     0     0

i am feeling boared
>>
```

Fig 5. Command Window displaying results

The application shows different windows consists of preprocessed eye movements in Fig. 4. In the first window the left eye movement is tracked, and it detects whether the eye is opened or closed. The second window represents both eyes and as it can be seen only eyes are in white pixels and the rest in black pixels. The eye status is recorded and stored in an array and based on this the output is spoken. As seen in Fig 5. the output is displayed in the command window, and it is spoken out.

VI. CONCLUSION

For real-time mobile phone control, the problem of eye blink recognition is quite difficult. This is a result of how eyes move and how light changes depending on how far the mobile camera is. The improved eye and blinking detection accuracy offered by the suggested approach is 98%. For a distance of 35 cm, the overall and detection accuracy are 98 percent and 100 percent, respectively, when artificial light is utilized. The average execution time for each frame is 71 ms, which is very quick for real-time applications. When the caregiver doesn't answer the phone or doesn't see the message, an alarm can be set in the system's future.

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