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Employing Eye Blink Detection to Provide Multimedia Assistance to Individuals with Paralysis

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ABSTRACT

The primary goal of this study is to alleviate the challenges faced by individuals with total paralysis due to Motor Neuron Disease (MND) and Locked-in Syndrome (LIS). The Paralysed Patients who are paralysed are unable to speak because of a speech impairment their eyes are the only body part that is unaffected, therefore they can only communicate by moving their eyes[2]. These sufferersParalysis patients typically have control over their eye movement. Therefore, the objective of this Research is being done to develop a real-time interactive system that enables paralyzed persons to communicate simply by making eye blinks. We demonstrate how to use video and image processing techniques to detect eye blinks in real time of a requirement to disable .The requirement for those who are unable to converse with humans to be disabled is the need to disable those who are unable to encourage this research [6]. A Haar Cascade Classifier is used to gather facial and eye data for face and Eye detectiondata on the axis. Additionally, the same features-based classifier based on Haar is used to determine the link between the face axis and the eyes' position. The recognized face's location is used to suggest a successful eye tracking strategy. Based on the eye blink Count Patients feelings will be know to the caretakers[8].

Keywords— Eye Tracking, Haar Cascade, Eye Blinks.

1.INTRODUCTION

Motor neurons in patients with motor neuron disease (MND) lose their ability to move. It may also result in voice, foot, or hand muscle weakness. The patient is consequently unable to engage in voluntary actions and finds it challenging to express his or her needs. Solutions for patients with the aforementioned diseases can be found in this technological age; one such innovation is the proposed system, which is detailed in full throughout. In the proposed system, eye blinks can be utilised to command and interact with other people[1]. Demand for humancomputer or human-mobile interaction has grown recently as a resultof substantial technical breakthroughs. The instantaneous blink When eyes blink, they quickly close and open. A facial landmark algorithm is used by the system to recognise the patient's face and eyes from video of the patient taken by an internal camera. The patient can choose to blink over the image he wants to convey his preferences as a sequence of images are then displayed on the screen one after another by the device. The eye aspect ratio is used by technology to first detect the patient's need and then the

blink[5]. The innovation andThe proposed technology can be used to communicate with and control other individuals since it recognises eye blinks and can tell the difference between an intentional extended blink and a regular eye blink. Technology can be used to control and communicate with other individuals[20].

2. LITERATURESURVEY

[1] Atish Uday Shankar, Amit R Kaushik—Assistance for the Paralyzed using Eye Blink Detection‖ IEEE Paper Fourth International Conference on Digital Home, 2012

[2]Assis.Prof. Are A. Mohammed, Suleiman, Shereen - Efficient Eye Blink Detection Method for disabled people domain‖ International Journal of computer science and Application, Vol.5, No.5, 2014

[3] Kishore Kumar G, Kemparaju N —Eye Waver Technology Based Assistive System for Disabled ‖ International Journal of Latest Technology in Engineering, Management & Research Article Volume 10 Issue No.3 IJESC, March 2020 24996 http:// ijesc.org/ Applied Science, Volume VIII, May
4]Tambe Sameen Mohammed, Rajeshwari P—Review on Smart Eye Blink Solution for and Patient Using Python, March 2019 |Volume 4, Issue 3 .

5] Aleksandra Krolak and Pawel Strumillo –Eye Blink Detection system for human computer interaction, universal access in the information society,2012. Królak, A., Strumiłło, P.:

6] Alex Poole, Linden J. Ball “Eye tracking in human Computer interaction and usability research: current status and future prospects”, Encyclopedia of human computer interaction 2006
7] Kristen Grauman, MargritBetke, James Gips, Gary R. Bradski “Communication via eye blinks detection and duration analysis in real time”, Proceedings IEEE conf. on computer vision and pattern recognition, Lihue, HI, vol.1, pp.1010, 2001

8] appearance for eye tracking and eye-blink detection and measurement IoanaBacivarov ; Mircea Ionita ; Peter Corcoran IEEE transaction on consumer electronics (Volume: 54, Issue:3 , August 2008)
9] Grauman, K., Betke, M., Lombardi, J., Gips, J., Bradski, G.R.: Communication via eye blinks and eyebrow raises: Video-based human–computer interfaces. Universal Access in the Information Society, 2(4), 359–373 (2002)

10]Bradski, G. R., “Computer Video Face Tracking for Use in a Perceptual User Interface,” Intel Technology J., Q. 2, 1998 Kim, C. and Turk, M., “Biased Discriminant Analysis Using Composite Vectors for Eye Detection, Proceedings of the 8th IEEE International Conference on Automatic Face and Gesture Recognition, September 17–19, 2008, Amsterdam, Netherlands **Table1:**The following table represents the Literature Survey Review of the System.

S.No	Author	Existing System	Proposed System
1	Youngwook Kim, Senior Member, IEEE_ Detection of Eye Blinking Using Doppler Sensor With Principal Component Analysis	Several measurements were performed with/without the noise caused by human movement when the sensor was placed near the eyes. We analyzed the Doppler signal in the joint time–frequency domain	Only Dlib's Algorithm can be used with that we can easily able track the eye and eyeblink count.
2	Atish Uday Shankar, Amit R Kaushik—Assistance for the Paralyzed using Eye Blink Detection‖ IEEE Paper Fourth International Conference on Digital Home, 2012	In this work, the system that uses patient signals and converts them into data in some form for communication. However, this method is highly pricey, therefore they have created a very affordable device that reads and converts a patient's blinking eyes into a mores code that is widely recognised. For those who are paralysed, it is beneficial.	In the Proposed system Har cascade algorithm is used so that it very less Price comparing when compared to the Existing.the code we used here is very less.

3	Assis.Prof. Are A. Mohammed, Suleiman, Shereen - Efficient Eye Blink Detection Method for disabled people domain‖ International Journal of computer science and Application, Vol.5, No.5, 2014	They've created a realtime interactive system in this study that allows paraplegic people to operate fans, lights, and other appliances using prerecorded eye blinking samples. The use of a video camera with a region of interest to detect eye blinking.	In the Proposed one there is no need of the Paraplegic People to operate the fans, lights, and other Appliances.

4	Kishore Kumar G, Kemparaju N ―Eye Waver Technology Based Assistive System for Disabled ‖ International Journal of Latest Technology in Engineering, Management & Research Article Volume 10 Issue No.3 IJESC, March 2020 24996 http:// ijesc.org/ Applied Science, Volume VIII, May 2019	In this research, they describe a novel eye waver-based assistive device for tetraplegic patients. Tetraplegia, sometimes known as quadriplegia, is a type of paralysis in which a patient is unable to move any of their body parts below the neck. The patient may potentially lose their mental capacity in such circumstances. Care must be taken of the patient who will be bedridden. The goal of the suggested assistive system is to make it possible for a tetraplegic patient and their caregiver or other individuals to communicate. Based on the patient's eye movement, the system operates.	The patient can able to give blink of eye for giving the signals and

5	Tambe Sameen Mohammed, Rajeshwari P—Review on Smart Eye Blink Solution for and Patient Using Python, March 2019 |Volume 4, Issue 3 .	The challenges faced by patients are greatly reduced by the advancement of technology in the medical industry. Motor Neuron Disease (MND) is a serious medical condition that can cause paralysis. Due to the weakening of muscles, MND patients are unable to do tasks like talk, walk, express their	The MND patients can move Easily move their eyes and the eye can tracked and give the eye blinks.
		feelings, and communicate. Only his eye blinks are under the patient's control, and the MND patient's difficulties are being solved day by day. This report describes a wide evaluation of the literature on various treatments for MND patients	
6	Alex Poole, Linden J. Ball "Eye tracking in human Computer interaction and usability research: current status and future prospects", Encyclopedia of human computer interaction 2006. pp.211 219	swiftly enough to be used in real time, abruptly detecting and monitoring the facial features The night vision camera may be used to capture the human face of people of various races because it accurately recognises facial features and transforms them into events that are then used to interact with the computer.	This also can be used to monitoring the facial features and Night vision Camera and frame capturing will be able to recognizes all facial features and that gives the signal to the care taker.

7	Kristen Grauman, MargritBetke, James Gips, Gary R. Bradski "Communication via eye blinks detection and duration analysis in real time", Proceedings IEEE conf. on computer vision and pattern recognition, Lihue, HI, vol.1, pp.1010, 2001	The cost of this system will be very high and for giving the blink of eye also it will take more time.	It is very less Expensive and for giving signals to the care taker also it is taking very less time.
8	Bradski, G. R., "Computer Video Face Tracking for Use in a Perceptual User Interface," Intel Technology J., Q. 2, 1998 Kim, C. and Turk, M., "Biased Discriminant Analysis Using Composite Vectors for Eye Detection, Proceedings of the 8th IEEE International Conference on Automatic Face and Gesture Recognition, September 17–19,	The most effective and consumes the The interface recognizes intentional eye blinks as control commands. The image processing techniques used include template matching- based eye tracking and	This system uses Harcascade and Dlib's algorithm with this it is comes as very good effective and more useful for paralyses
	2008, Amsterdam, Netherlands. A RealTime Eye Blink Detection Method and Its Use	eye-blink detection, as well as Haar-like features for automatic face detection.	Patients

3. PROPOSED METHOD

A Productive approach is suggested. A approach for identifying human eye blinks and calculating inter-eye-blink times is based on image processing techniques. To obtain the facial axis, face trackingmethods Dlibs and a Haar Cascade Classifier are used information for Boosted classifiers in a cascade provide the basis of the adaptive Haar Cascade ClassifierUsing the link between the eyes and the facial axis, Haar-like traits were sought after placing the eyes.The algorithm results demonstrate the effectiveness of the suggested approach applications that are real-time.

Benefits:

A)The project presents the acquisition and analysis of paralysed patients' eye movements.

B) To reduce the occurrence of artifacts, an eye blink sensor is employed to detect eye movement. A simple, low-cost circuitry is constructed to implement signal processing.

4. SYSTEM ARCHITECTURE

The proposed system is started by taking a frame from a video with the system's camera as its initial step.The frames are made into a grayscale image by combining white and black pixels with 0s and 1s. 68 point pixels for the face and 6 point pixels for the eyelids are under consideration[6].On the recorded video frames, which are transformed to grayscale images to produce the rectangle boxed face, the face detection is carried out utilising the Haar Cascade Algorithm processes.The AdaBoost Classifier is used to process the output of the FaceDetection Algorithm in order to identify the eye region in the face.The eye will be provided a detection signal to determine if it is open or closed [9].Thevirtual keyboard numbers are played sequentially from the time the eyes are open until they are closed.After the patient's eye is closed, the specific needs of the patient are output for caregivers. The outputs include the playing of audio, text alerts, and visual displays[10].The Proposed System architecture is explained in above and will be represented diagrammatically in Figure.1 as follows.

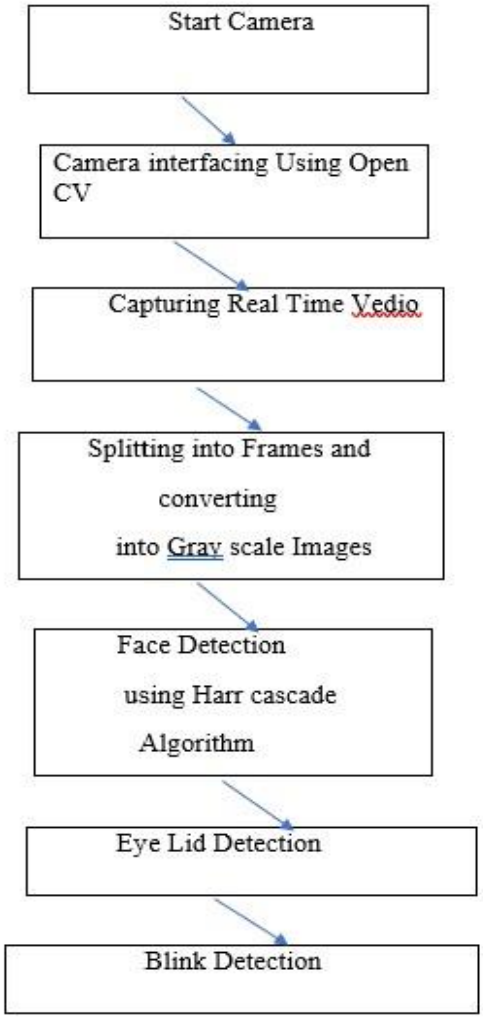

Figure 1: Proposed System Architecture diagram.

5.Implementation:

The methods of image analysis are widely used and approved. A webcam is used in the suggested method to take the driver's successive facial photographs. Based on the captured photos, a software built in Python is used to determine the position of the eyes. In the below flow diagram figure.2 completed data flow and system implementation process.

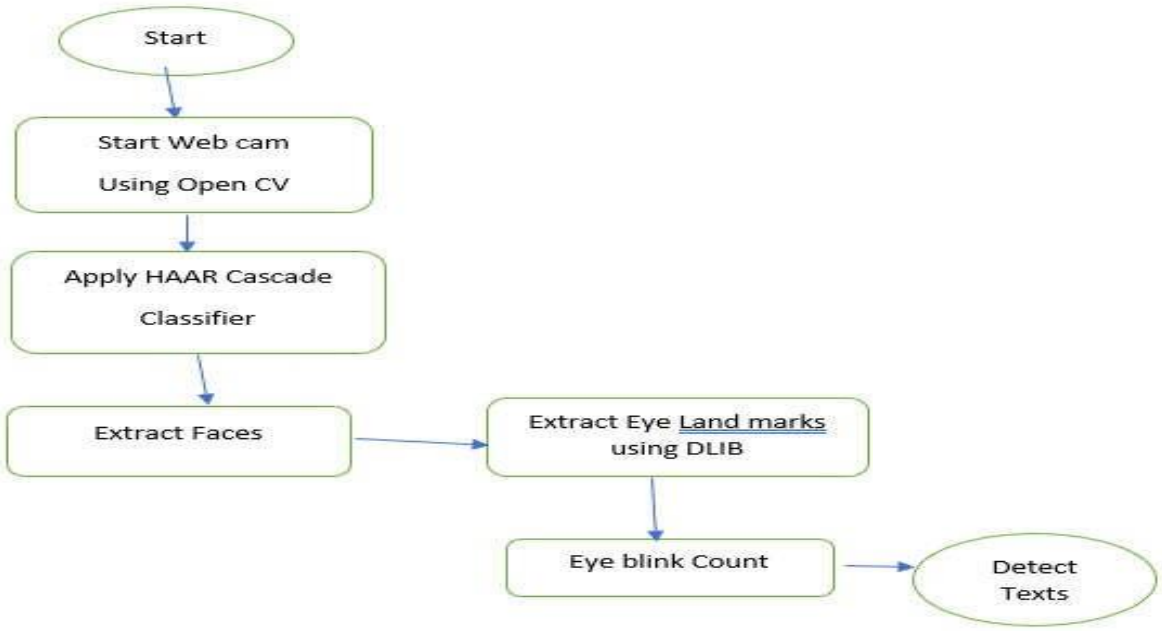

Figure 2:System Flow Diagram

5.1 Camera and frame Capturing: The initialization phase of the suggested system is the first stageAfter briefly recording the participant's face with the front camera of the used most likely laptopdevice. a procedure The acquired video will be utilised to build the frames using the frame approach[18]. The coloured frames will then be reduced to grayscale by removing all but the brightness component. The average approach has been upgraded with the luminosity method. The

values are also averaged, but to take into consideration human perception, the average is weighted Green is given the highest weight because it is the colour for moresensitive also .

The average approach has been upgraded with the luminosity method. As well as averaging the results, it also creates a weighted average to take into account human error perception[16]. We are more environmentally aware than other peopleGreen is given the most weight among the colours the equation is 0.21 R + for brightness 0.72 G + 0.07 B. The luminosity method is most effective overall The luminosity approach is amore complex variation of the typical approach. Additionally, it averages the data, although creates a weighted average to take human error intoperception. We are more environmentally aware than other people.Green is given the most weight among the colours. the equationis 0.21 R + for brightness0.72 G + 0.07 B. The luminosity method is most effectiveoverall[15]. The original image and Gray scale image are showed in figure 3 and figure 4 .

Figure 3: Original Image Figure 4: Gray Scale Image

5.2 Face Detection: The approach for face detection uses the Haar classifier. Based on recognised features rather than pixels, such as facial features, the Haar classifier quickly classifies any item. However, to find a face feature, the region of the image being examined must be regionalized to the area with the highestlikelihood of including the functionality. False positives are reduced by regionalizing the detection area.Eliminated[17]. As a result shown in the figure 5 face detection can be detected ,face is recognised, marked with a rectangle box, and used subsequentlyto roughly determine the eye's axis for the eye detection step.

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Figure 5: Face Detection

5.3 Eye Tracking:The two eye portions that are crucial for extracting the features needed for the EBCM approach are the corneal reflection and pupil centre. These characteristics enable us to

track the movement of the eyes. The distance between them can be calculated by locating the corneal reflection and the pupil's centre. Additionally, point-of-regard can be discovered using additional trigonometric calculations[14]. With the help of the EBCM technique, it was possible to synchronise and direct both the face and the pupil of the eye. Assume that X represents the identified human face, R1,R2,R3 and R4 represent two points associated with the left eye in the figure 6 and they are moving in unison with X.

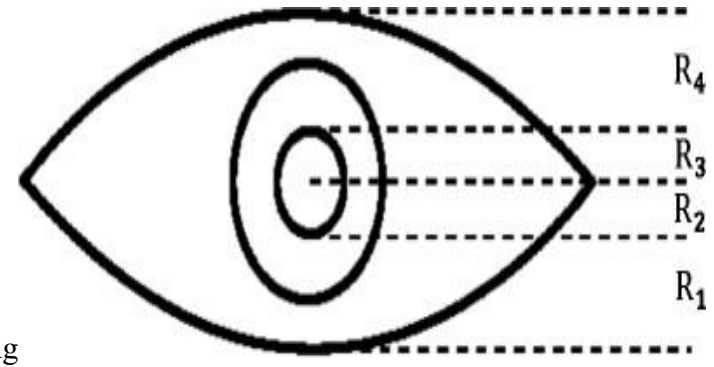

Figure 6:Eye Tracking

5.4 Eye Blinking:Blinking Eyes With minimal intrusion, eye blinking and movement can be observed with atechniques.However, just a few methods have been developed for active scenes involving the camera and the face.Gadget moves independently, and the eye is unrestricted in its movement in all directionsface. Although it must be carefully considered how eye-gaze tracking data is used, sinceHuman eye motions consist of a variety of deliberate and involuntary movementscognitive functions[2].

We are only interested in two sets of face structuresthe eyes for the purpose of blink detection. Six (x, y)-coordinates are used to represent each eye, beginning at the eye's left-corner (as though you were gazing at the working counterclockwise around the first (individua) the rest of the area. In light of this picture should focus on one main point. There is a link the distance between these's height and width where p1,..., and p6 are 2D facial landmark places in viewed figure 7 [7].

Equation 1:

$$EAR=(||p2-p6||+||p3-p5||) / 2(||p1-p4||)$$

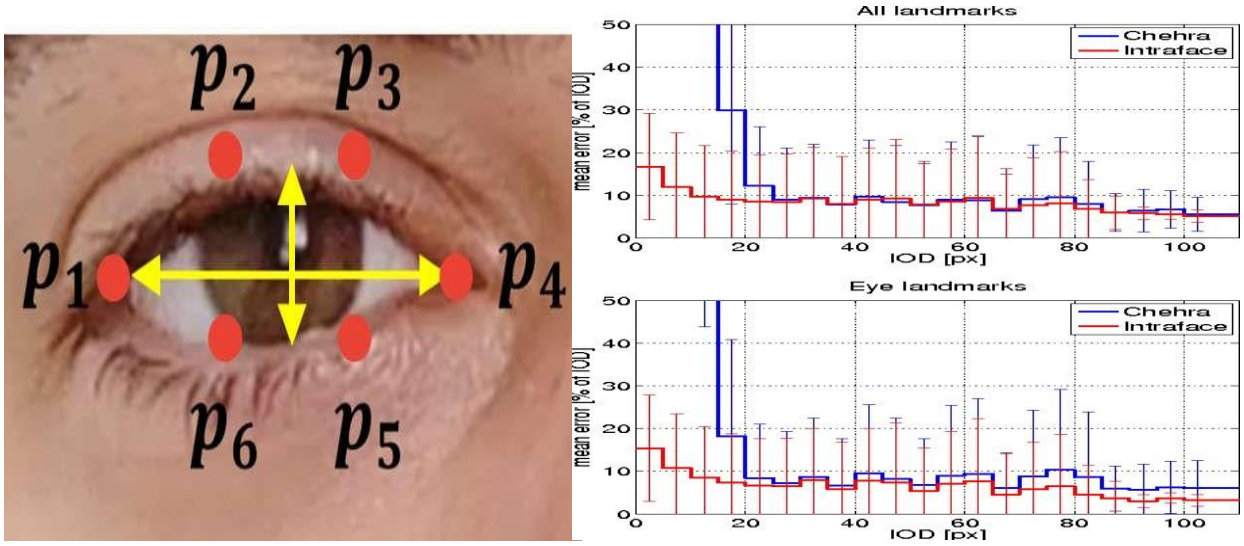

Figure 7: Facial Land Marks

6.METHODOLOGY:

The Methods of image analysis are widely used and approved. A webcam is used in the suggested method to take the driver's successive facial photographs. On the basis of the captured photos, a

software built in Python is used to determine the position of the eyes. The System Methodology can be explained in the below figure 8.

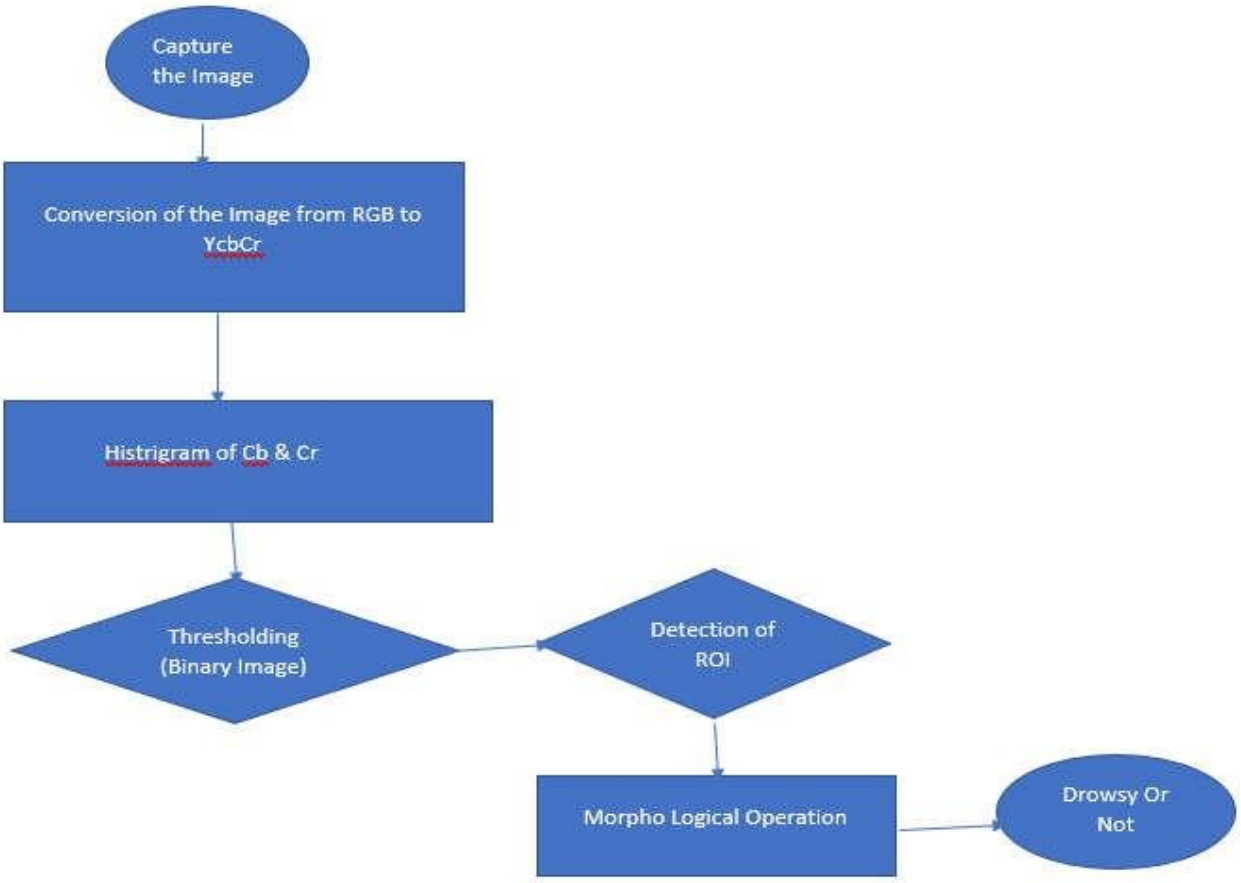

Figure 8: System Methodology

6.1 Eye Detection Image Processing:

The steps for implementing the image processing's detection of ROI are explained in this section.

Capturing the image:

The Man face is visible in a photo that was taken inside a Room. A camera typically captures images using the RGB model (Red, Green and Blue). The RGB model, however, also accounts for brightness in addition to colours. Distinct brightness for the same colour signifies different colour when it comes to human sight[13]. The RGB model is quite sensitive to image brightness when assessing a human face. As a result, the second STEP is to reduce the brightness of the photos. Due to its widespread use in video compression standards, we employ the YCbCr space. We nonlinearly alter the YCbCr colour space to make the skin cluster luma-independent because the skin-tone colour depends on brightness[14]. This allows for the reliable detection of both light and dark skin

tones. The key benefit of transferring the image to the YCbCr domain is that throughout our image processing, the influence of luminance may be eliminated. Each colour in the image—red, green, and blue—has a different brightness in the RGB domain[18]. Since the Cb (blue) and Cr (red) components are independent of luminosity, the Y component provides all information regarding brightness in the YCbCr domain. The RGB image is segmented using the following conversions:

Equation 2:

$$Cr=0.439 *R-0.368*G-0.071*B+ 128$$
$$Cb=0.148*R- 0.291*G- 0.439*B+128$$

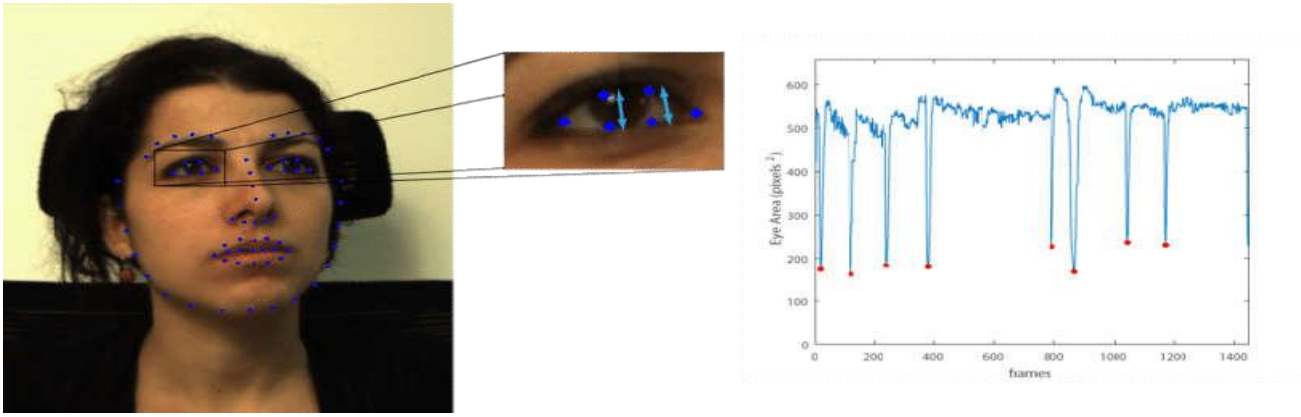

Figure 8: Eye Blink Detection

6.2 Eye Region Detection:

Since we are only using the face, we understand that the region of interest is the area around the eyes[13]. We divided the face into four quadrants, with the eye area occupying the highest two quadrants. The fact that eye blinking typically occurs simultaneously allows us to then Count on the right eye being situated in the top left corner of the face[19]. Therefore, One eye will serve as the basis for the calculation. These presumptions allow the eye's location to be determined.Using an opencv-based vision system, a motorist's tiredness can be automatically detected in a real-time video feed, and if the driver looks to be drowsy, an alarm can be played[12]**.**

7.Result:

Eye Aspect Ratio can be used to measure the patient's eye blink (EAR). Every single person has a different eye ratio. Every 0.4 seconds, the rate of eye closure is detected. If the value exceeds a certain threshold, the system counts the number of blinks and transmits an alert message through the speaker.

The speaker gadget produces the alert signal. Real-time eye blink detection for the patient is done using the OS and camera. The spoken messages such as "make a phone call," "require medicine," and "need drink" are then created from the detected blinks, allowing paralyzed people to connect with the outside world. LIS patients to communicate on their own. Being free and open source in the project. The Eye blink Detection of Right eye and Left Eye are as like in figure 9, figure10.

Figure 9:Eye Blink Detection of Right Eye

Figure 10: Eye Blink Detection with Left Eye

Table 2: DR, FAR, Success Rate

Test / Parameter	1	2	3	4	5
TP	43	62	35	51	60
TN	10	16	4	7	5
FP	0	2	4	1	2
FN	0	0	2	1	1
DR	100	100	94.59	98.07	98.36
FAR	0	3.125	10.25	1.92	3.22
Success Rate	100	96.97	96.49	98.07	96.83

8..TESTING

Testing is completed, and the programming is collected as a bundle. Interfacing errors are identified and fixed. There are various ways to categories approval testing. Here, the test results show that the product capability in a manner that meets the client's reasonable expectations.

Table 3.Tests in the Proposed Project Completed.

Functionality to be Tested	Input variable	Tests Completed	Remarks
Working of Front-End	Working of FrontEnd	Appropriate forms open when buttons are clicked	Succes
Working of Eye Blink Detection	User has to extract the face and eye region then detect the blinks	Blink detected and play the audio for respected blink count	Succes

9.CONCLUSION:

The proposed system's major goal is to improve paralyzed people's quality of life without harming their bodies and to be a promising tool for those who are physically unable to use keyboards. Since none of the components of this approach come into close contact with the patient's body, it outperforms recently established models in this area. Blink To Text offers LIS patients an effective means of communication. The independence of expression for LIS sufferers is made possible by the software's accessibility-first design. The programme is broadly accessible across all financial classes because it is open source and doesn't require expensive hardware.

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