International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

# EYE-BLINK DETECTION ASSISTIVE SYSTEM FOR PARALYZED PATIENT

**Boomika K[1], Kavya S[2], Lakshmi Narayan[3], Keerthi Sagar M[4], Chaithrashree R[5]**

[1]Boomika K, department of EEE & Vidya Vikas institute of engineering and technology
[2]Kavya S, department of EEE & Vidya Vikas institute of engineering and technology
[3]Lakshmi Narayan, department of EEE & Vidya Vikas institute of engineering and technology
[4]Keerthi Sagar M, department of EEE & Vidya Vikas institute of engineering and technology
[5]Chaitrashree, Assistance Professor, department of EEE & Vidya Vikas institute of engineering and technology

---

## Abstract

Paralysis is defined as the complete loss of muscle function in any part of the body. It occurs when there is a problem with the passage of messages between the muscles and the brain. Some paralyzed people cannotmove even a single part of the body other than their eyes. Hence, the main aim of this project is to design a real time interactive system that can assist the paralyzed to control appliances such as lights, fans or by playing pre-recorded audio messages, through a predefined number of eye blinks. Image processing techniques have been implemented in order to detect the eye blinks. In our system, the face tracking is accomplished by using a set of trained Haar cascade classifier, and a template matching technique is employed to track the eye. Initially, the involuntary blinks of the paralyzed person are used to locate the patients eyes by finding the number of connected components in a frame.

Interface could interface could benefit individuals with disabilities or mobility limitations by providing a more accessible means of interacting with their surroundings. Implementation of an eye blink and mouth-based control system is detailing the methodologies used for facial landmark detection, gesture recognition and wireless communication with an ESP32 microcontroller. Additionally, applications of this technology in smart home automation and potential avenues for future research and development. This project provides an overview of related work in gesture-based interfaces and facial landmark detection and describes the methodology and implementation details of our system. It also presents experimental results and performance evaluation. Finally, concludes with a discussion of findings, limitations, and future directions for this project.

## 1. INTRODUCTION

The field of human-computer interaction (HCI) has seen significant advancements in recent years, particularly in the real time of gesture-based control systems. These systems aim to provide intuitive and hands-free interfaces for controlling electronic devices, particularly in smart home environments and assistive technologies. One promising approach involves utilizing facial landmark detection to recognize eye blinks and mouth movements as input signals for appliance control. Eye blink detection and mouth opening recognition presents unique opportunities for seamless interaction without physical touch or voice commands. These gestures can be captured using computer vision techniques, leveraging facial landmark models to track key points on the face in real time video streams. By analyzing changes in eye closure and mouth shape, we can interpret these gestures as commands to trigger specific actions. The motivation behind this project is to explore the feasibility and effectiveness of using eye blinks and mouth opening as natural, non -intrusive control mechanisms for electronic appliances such an

## 2. PROBLEM STATEMENT:

The patients lose the ability to speak and write they can only contact the outside world through human computer interaction ;e.g. controlling brain wave controlling need to be worn by users, so they are not convenient for people to use. There exists eye mouth motion based software which enables the Paralyzed patients to write in the computer by using their eye mouth functions. When patient is away from brainwave controlling devices and lie on the bed, they cannot communicate with care providers. With the goal of helping Paralyzed patients on the bed to call for other people with a simple and easy approach, this research aims to develop a real time video processing system using laptop camera with some hardware use which can be controlled wirelessly by connecting the laptop with esp32 micro controller hardware.

## 3. OBJECTIVES OF THE PROJECT:

The main objective of the proposed system is

- The Objectives of this project is to develop an eye blink based electronics control system using facial landmark analysis for detecting eye blinks and mouth open events. The system will utilize computer visiontechniques to detect facial landmarks,monitor changes in eye states to count blinks, and recognize mouth opening.
- This project addresses the challenges of reliable and real time gesture recognition for electronics control, integrating facial feature detection with embedded systems communication to enable int

## 4. OVERVIEW OF THE PROJECT:

1. Facial landmark Detection Model:

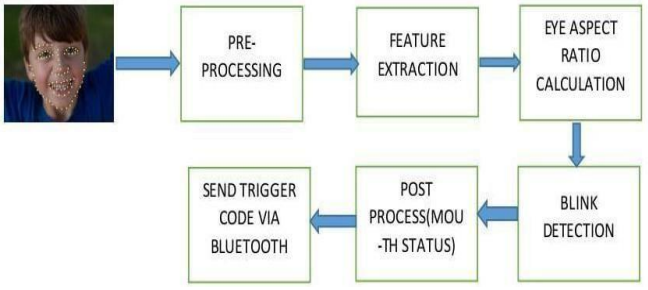
Choose a facial landmark detection model or library. Popular choice includes Dlib, OpenCV, or specialized facial landmark detection models trained using deep learning techniques

2. Preprocessing:

Preprocess the facial images by normalizing pixel values and, if necessary , resizing or cropping to focus on the region around the eyes. Extract facial landmarks from the images using the selected facial landmark detection model.

3. Feature Extraction:

Identify the specific facial landmarks corresponding to the eyes. Typically, landmarks around the corners and center of the eyes are crucial for blink detection.



4. Eye Aspect Ratio(EAR) Calculation:

Compute the eye Aspect Ratio using the detected facial landmarks. EAR is a metric that quantifies the eyes openness and closure based on the relative positions of key points.

EAR =(|| EAR can be calculated as EAR = (||p2 - p6|| + ||p3 - p5||) / (2 * ||p1 - p4||), where p1 to p6 are specific eye landmarks

5. Blink Detection Threshold:

Set a threshold for the EAR to determine when a blink occurs. Experimentally determine a suitable threshold based on the characteristics of your dataset and the application requirements

6. Post Processing:

Implement post-processing techniques to refine blink detections. For example, ignore blinks that are too short in duration to avoid false positives.

7. Temporal Analysis:

Consider temporal information by analyzing consecutive frames to distinguish between blinks and momentary closures. Implement a simple state machines or time series analysis to smooth and filter blink detection.

8. Integration:

Integrate the blink detection algorithm into the target application or system. Compatibility with the platform and consider real time constraints.

**Working:**

1. Facial Landmark Detection:

- Implement a facial landmark detection algorithm to identify key points on the face, particularly focusing on the eyes and mouth.

2. Eye Blink Detection:

Develop a reliable method to detect eye blinks based on changes in the state of the eyes over consecutive frames.

3. Blink counting and Encoding

Count and encode the number of eye blinks within a defined period to represent a unique value.

4. Mouth Open Detection:

Implement a mechanism to detect mouth opening using facial landmarks positions, triggering actions based on this event.

5. Serial Communication Setup:

Establish serial communication between a python program running on a computer and an ESP32 microcontroller to enable data transmission.

6. Data Transmission to ESP32:

Develop a protocol to transmit the encoded blink count or command data from the Python program to the ESP32 via serial communication.

## 5. CONCLUSIONS

The Eye-Blink Detection is a promising and rapidly advancing field that has the potential to transform the way we interact with computers and other devices. The proposed project brings out a solution for the paralyzed people without any harm to their body externally or internally. It overweighs the previously developed prototypes in this field because none of the components are in direct contact with the patient's body hence it definitely will prove to be safer. It is the family's or the care takers responsibility to train the paralyzed patient regarding the different combination of eye blinks required for different type of outputs at the speaker.

## REFERENCES

1. Joshua D. Fischer, Dawie J. van den Heever, "Portable Video-Oculography Device for Implementation in Sideline Concussion Assessments: A Prototype", 2016 IEEE conference.

2. Sudhir Rao Rupanagudi, Vikas N S, Vivek C Bharadwaj, Manju Dhruva Sowmya K S "Novel methodology for blinks recognization usingvideo oculography for communicating", IEEE Conference Publications,2014,ICAEE.

3. Masaru Kiyama, Hitoshi Iyatomi and Koichi Ogawa, "Development of robust video oculography system for non invasive automatic nerve quantifications', IEEE Conference Publications, 2012 IEEE-EMBS Conferences on Biomedical Engineering and Sciences.

4. S.M. H Jansen, H.Kingma, R L M Peeters and R L Westra," A torsional eye movement calculation algorithum for low constant images in video oculography", IEEE Conferences Publications,2010 Annual International Conference of the IEEE Engineering in Medicine and Biology

A Nar