

# ***Eye Blink and Hand Gesture detection For Aid of Paralyzed Patients***

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***Abstract— Paralysis is the Absolute loss of muscle function in any part of the body. It usually happens when there is Issue with the passage of messages among the muscles and the brain. Some paralyzed people aren't able to move their single part of the body except eyes. Hence, the main aim of this project is to make a real time interactive system that can assist the paralyzed by giving commands to control appliances such as lights, fans etc. Various Image processing approaches have been performed in order to detect the eye blinks. In this system, the face tracking is accomplished by using a set of trained Haar cascade classifiers, and . In this system hand gesture is also given for patient convenience in which a flex sensor is used which works on the principle of change in the internal resistance and to detect the angle made by the user's hand at any given time. The flexes made by hand in different combinations amount to a gesture and this gesture can be converted into a text display to aid paralyzed patients.***

***Keywords: Computer Vision, Internet of Thing, Hand Gesture***

## ***I..INTRODUCTION***

Paralysis can be defined as complete loss of muscle functionality for either 1 or more muscle groups. Paralysis Could cause loss of feeling or Function in the affected areas. Paralysis Could be localized and generalised based on type, or it could follow a specific Pattern in Patients. Most paralysis is caused due to damage in nervous system are Constantly Occurring in nature; however Various forms in periodic paralysis are there, Paralysis is most often caused by damage to the nervous system, especially the spinal cord. Major causes of paralysis are stroke, trauma along with nerve injury. According to the survey by Christopher and Dana Reeve foundation, Almost one in every fifty people are paralyzed . Fully paralyzed patients may need 24-hour support. But in the present day and age, it is not possible for anyone to be available at all times. So, in those situations where the patient is alone in a room, he/she could use help if required Such as switch on/off a light, a fan or any other appliance.

Hence, our Project Paral-Eye will help the patient to be self-sufficient to a certain Level. There are Various applications which can be Done Using from eye blink detection and these aren't limited for usage by only paralyzed Patients. An efficient, real time blink detection algorithm can be used for Various purpose. Paral-eye can be used for Operating on/off appliances such as a television or a microwave oven.. All this can be accomplished with just a very less eye blinks. Various Ways have been devised for face tracking.CamShift Facial tracking

Haar face Cascade algorithm and face tracking using Eigenface are some of these. There are techniques Used for blink detection as well. Some of them are software based i.e by using image processing, and a few are hardware-oriented using sensors. Various image processing techniques includes blink detection using the contour extractions, Gabor filter, and eye blink detection using Median blur filtering.

The Aim of this paper is to propose a system that will assist the paralyzed patient along with other types. It does so by tracking the person's eye and counting the blinks and also using hand gestures,which employs this count to control various appliances and play pre-recorded audio messages. Although a number of studies have been implemented for eye blink detection, there are no applications which are Created to actually use the blink detection to practical Use.The principal contribution of this paper is the conceptualization of a system which will help the paralyzed and disabled to achieve some level of Functionality . Moreover, the algorithm provided by has been improved by implementing face tracking, so as to reduce the effect caused by movements in the background.

## ***II. LITERATURE SURVEY***

Eye Blinking Detection To Perform Selection For An Eye Tracking Program Used In Assistive Technology was originally anticipated by Alex and ru Pasarica, Radu Gabriel Bozomitu, Vlad Cehan, Cristian Rotariu. The study describes how the review strategies used by people with neuro-motor disorders to incorporate eyes movement collection in an eye monitoring device which is used in assistive technologies. The program uses various keyword techniques or ideo grams being displayed on the device screen for choosing. Approach utilize to detect eye blinking is based on segmentation of the image utilizing local threshold calculated either by basic image sum or process of Bradley. The Found results demonstrate the approach applied for the wink identification which could be used successfully for an assistive technology in existent time tracking device for eye.

Modern Method for Eyes Tracking and Blink Detection in Real Time video frames was Originally proposed by Dr. Leo Pauly, Deepa Sankar This study introduces a new approach to track eye as well as identify blinks from frames in video stream collected through web camera that have weak resolution customer grade. which utilizes a system using a Haar centred eye tracking cascade process with mixture consisting functionalities of HOG and an eye twitch recognition classifier. The approach presented is nonintrusive and there after offers comfortable contact between user. The eyes blink monitoring system accurateness is 92.9%

whereas wink recognition system accurateness is 92.1% which was validated utilizing regular databanks as well as cumulative accurateness is 86.6% as measured in a typical environment in real world conditions.

Design Of various switch controller For the aid of Paralytic Patient Using EEG was Originally suggested by Prof. Arunsrinivas.P, Deepak.N, Ganeshkumar.K, Navathej.G, Mrs.B. Geetanjali, Dr.V. Mahesh This Given study explains how the EEG centred alteration method utilize volunteer eye flicks derived through EEG Enablement signal. For the motive of collecting EEG waves from the patients, 2 electrodes on the surface are mounted on top the skull frontal area

It has been observed that the EEG waves produced to volunteer blinks of eye generate stronger waves with greater magnitudes, frequentness that varies normal EEG in the system. CPU ARM were designed successfully for eye twitchiness identification. The two modes of device control – audio method that sufferer utilize for communicating their needs whereas control method that lets sufferer turn in/out of separate computers. Such method aid in significantly raising the stress levels of the paralytic subject.

Assistance for the help of Paralysis Using Eye Blink Detection was Originally Stated by Dr. Atish Udayashankar, Amit R Kowshik, Chandramouli S, H S Prashanth the research describe Paralysis as the total lack of muscles in any part of the Human body. It usually happens when the flow of signal between the muscle and the brain. Any Patient who is paralyzed can't lift common body component than eyes of theirs. The Primary objective of This study develops an immersive actual plan, which will support disabled in manipulating Various equipment like lighting/ replay previously recorded voice signals via previously defined count of eye blink . Recognitions of image method were introduced to detect blinks in the pupils.

Eye Monitored Device for disable People was Designed by Asfand Ateem, Mairaj Ali, Zeeshan Ali Akbar, Muhammad AsadBashir this study aims for helping people. Turning people tech needed when the period clicks. Technologists want to crack the barriers; it's what they do to make homo sapiens life simple. Although, they have also lodged with technologies with Various blueprint for engineering modish stuff. The Statistics suggest several instances of disabled individual identified worldwide, particularly individuals with syndrome locked in; is a therapeutic style in which most muscles of the body is paralyzed except eye control. The research aims to transform the lives of these people effortless, painless and achievable to restore these people's joy, fulfilment, cheerfulness and self-possession. The Given research supported the implementation of assistance for people with less functionalities and the manufacturing of eye-controlled systems

Assistance for Paralytic Patients Using Eye Motion Detection was originally suggested by Divyanshu Totla, Prof.Milan PandeyKushal Chaudhari,Anoop Shinde, Rajnish Kumar, Prof. N.D. Mali the analysis purpose introduces real device systems of eye contact and visual blinks recognitions to a fully paralyzed patient. The power to paralysis most of the time regulates muscle activity restriction to brawn in Human body, otherwise the patient's individual means of connection happens through blink. Intrusive interfaces require different hardware otherwise focus on Infrared measuring devices. Technology that won't intrude was built on a consumer-friendly basis is a device that extracts feedback from an webcam by video frame type with no particular lighting conditions. The system continuously monitors eye blinks and then calculates both pupil activity by means of control instructions. Orientation of eyes observed could be supportive by programs for instance emergency aid, simple usefulness, S.O.S.

### III. MODULES AND FUNCTIONS IN PROPOSED SYSTEM

#### A) RELAY MODULE

Relay module: The Relay Module Which is used in our system is 5v 4 channel relay module which is used for operating appliances such as Lights ,Fans ,Buzzer , we have used 2 Lights , one Fan And A Small Buzzer which are connected to the relay module where input to them are provided by the Flex Sensors to The System.

For Connecting the Relay Module to the Computer We have implemented and used esp12e wifi module for wifi based connection which provides Excellent range which helps to work in real time for patients with flexibility of location

#### B) Glove MODULE

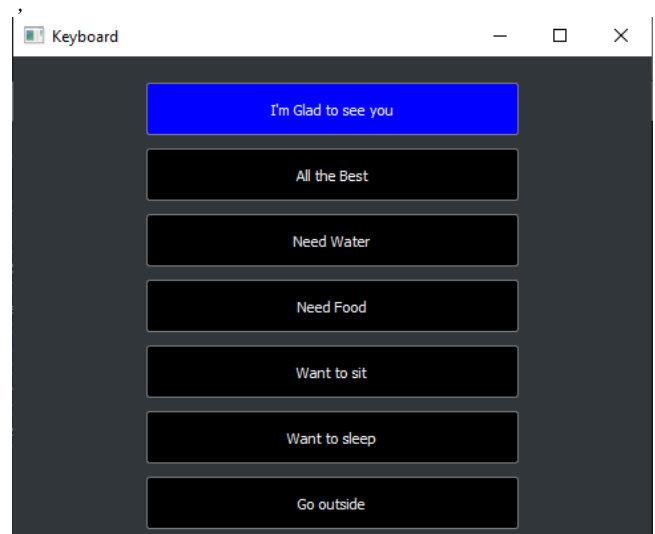
the Glove is an essential part of the project which focuses on getting accurate inputs from the user and provide them to the system fast and accurately

The Glove Module Mainly Consist of an ESP32-WROOM-32D Espressif which provides better wifi control for the program and help in better ping for the program to run smoothly and efficiently .the Glove is Designed to work in all natures according to user's Requirements ,

The Glove Part Mainly Contains a mpu6050 triple axis gyro it's a 5v Device We used for getting rotations of the gloves , the Tri-Axis angular rate sensor (gyro) with a sensitivity up to 131 LSBs/dps is used in a such a way that it could be used in a combination with the flex sensors



**C) Blink To Speak:** The Blink To Speak Module is implemented for the purpose of communication of patient with nearby guardian or caretaker the blink to speak allows user to select a message which then converts into a sound to alert the caretaker or family member what the patient requires , this may include messages as i require water etc.



### IV. Algorithms

### A) Haar Cascade Algorithm :

Haar Cascade is a popular Object Detection Algorithm which is being implemented to successfully identify faces in real time video streaming. Haar Cascade algorithm uses edge or the line detection feature proposed by prof. In Viola Jones research paper which was published in 2001. The haar cascade algorithm is given many positive images consisting of various faces, and a lot of negative images not consisting of face to train on them and achieve better results.

### B) EAR Algorithm

The Eye Aspect Ratio (EAR) formula, which was proposed in [10] is capable of detecting the eye blink using the scalar value derived from eye openness. For instance, it is needed to detect the eye's shape accurately in order to calculate the eye blink. From the landmarks detected in the image with the face. For each image frame derived from real time video, the eye landmarks are constantly detected between height and width of the eye that had been computed. The eye aspect ratio can be defined by the Equation

$$EAR = \frac{|p2 - p6| + |p3 - p5|}{2|p1 - p4|} \quad -- (4)$$

Equation (4) shows the eye aspect ratio formula where p1 till p6 are 2D landmark locations of eye. The p2, p3, p5 and p6 are used to measure the heights of eye whereas p1 and p4 are used to measure the width of the eyes. The eye aspect ratio is a constant value when the eye is open, while it rapidly falls approximately to 0 when the eye is closed as shown in the Figure.

## V. SOFTWARE SOLVENCY

### A) CALCULATING Eye Blinks and Hand Inputs

Eye Blink Contains 2 Input Sources Left Blink And Right Blink While The Glove Contains 3 Input Sources 2 Flex Sensors and And Gyro Sensor For Readability of the movement of sides Further This Data is sent to the system for performing operations on given data

The System Mainly Accepts these input and convert them into Functions Such As :

Move Left : This Function gets Invoked When A Person Blinks Left Eye or Flex Finger1 And move the Gyro To the Left it will invoke Move Left And Focus Will Change to The Left Button.

Move Right: It gets Invoked When Finger 1 is flexed and gyro is Rotated to Right and another invocation is from blinking right eye.

Selection: When Both Eyes Are Closed Or Both Fingers Are Flexed And The Gyro is moved to the left Then the Focused Option is Selected

Move Row Wise : When Finger 2 is Selected and gyro is Moved to left or right the Focus Will Change Row Wise Either Up Or Down

### B) CONTROLLING HOME APPLIANCES

The Glove Connected to the Main System and eye Blink Continuously provide Serial inputs to the system Which Provides Control to the relay board , the relay board Consist of:

- Led Lights
- and A fan
- a buzzer

the input coming to the system invokes the relay board through the esp12e wifi module present in the Relay Board then the Required Component is Provided with the Connection through relay Board , the Relay Board which is being used here is a 4 relay circuit board which provides enough connections for our fan Lights and buzzers

### 5.3 SMS SENDING THROUGH TWILIO

One of the Prime Functionality was to provide a communication channel for the patient to provide emergency signals to CareTakers Twilio Provide Backbone Functionality of telephone services to the Patient. through twilio patient can send Messages saying that he/she Need assistance/ help or not feeling well.

## VI. EXPERIMENT

### A) Opencv Based Finger Detection:

in early stages of paral-eye , we have tried to implement hand detection and finger flex detection We Tried Implementing Opencv Along with mediapipe to achieve better results through the visual application , but due to the fact that patient has many medical instruments attached in it's hand it will be hard for Detecting the hand movement with all the devices , it was a good concept but it wasn't practical for the end user as patients etc.

### B) Flex Sensors Combinations:

The Handglove Consist of 2 Flex Sensors for the input which is studied to create combinations for the input and to be precise with the user needs .

the flex sensors works along with the Gyro sensor to provide various combinations to work on the system as inputs , with ease of Flex Sensors user can perform various tasks with simple inputs

## VII. Results:

The Glove we created consists of 2.2 Flex Sensor which is capable of providing good flex input to the ESP32-WROOM-32D , we have tested it with different wifi modules and got the best result in the current version .

the ESP32-WROOM-32D provides good ping to the project overall the range of the module is dependent on the wifi module being implemented , thus with the current version the project works smooth in different ranges when Connected to the wifi it provides good coverage area in normal house which is essential for the patient which can help if position of patient is changed from one room to another,

Opencv provides good visuals along with the haar cascade algorithm which computes the eye blinks in real time with low to minimal delay which is essential for the system , To improve the blink detector, Soukupová and the Čech algorithm is recommend and constructing the 13-dim feature vector of the eye aspect ratio (Nth frame, N-6 frame & N+6 frame), which then followed by feeding the feature vector into the Linear SVM for classifications.

## VIII. DISCUSSION AND CONCLUSION

The field of computer vision and the internet of things has enhanced the great interaction between humans and machines. By using this we have developed a system for paralyzed people which makes it easier to communicate between doctor and patient.

Paralysis is dramatically spreading more than previously thought. Approximately 1.7 percent of the U.S. populations, or 5,357,972 people have reported that they were living their life with some form of paralysis, as per the study as a central nervous system the disorder resulting in difficulty or inability of a person to move the upper or lower extremities.

People who are living with paralysis have households with very poor incomes. Roughly 28% of households in the world with a person who is paralyzed make less than \$14,000 per year.

Thus the main purpose of this project was to make it as cheaper as possible for the paralyzed patients throughout the world, if these are created in mass then it would solve a lot of problems faced by paralysis patients, the project has very less hardware components which allows it to be more efficient and easy for the patients to have

Thus, to sum up everything that has been stated so far, the paralyzed person problem in World is a major setback. The government of India has set up various actions that prioritize helping paralyzed people. Not everyone can stay 24x7 with their close one that's why we need to perform actions in the section of aid of paralyzed people

Thus Paral-Eye is very accurate and efficient for paralyzed patients, we were able to solve the common problems faced by the through with basic inputs taken from the user the paral-eye works in real time video streaming makes it better in performance with users, the input are taken and calculated in real time, the EAR calculated with the eye inputs and used to get the perfect eye blinks, all the modules are connected to the same Wifi connection which provides less ping difference in the system which makes it faster to implement all the functions the delay is less thus making the project efficient and high performance for the patients

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