

An approach to control appliances using EOG signal for physically challenged persons

¹R.Srinath,²Divya.S , ³Supriya.S

¹Assistant professor,^{2,3}UG Scholar, Department of Electronics and communication Engineering,VEL TECH,Chennai-62

Email:¹Sribalaji24@gmail.com,²divyaprabasri.s916@gmail.com,
³agasty66@gmail.com

ABSTRACT-The eye can be regarded as one of the organs that can help a paralyzed person to communicate suitably. Eye movement can be used by the paralysis patients and armless persons to perform imple tasks. This paper describes the acquisition and analysis of EOG signals for activation of home appliances for paralysis patients. The proposed method here uses a minimum number of electrodes for signal acquisition thereby reducing the occurrence of artifacts, further following a simple circuitry for implementation of signal conditioning which is also cost effective from the user point of view. The standing potentials in the eye can be estimated by measuring the voltage induced across a system of electrodes placed around the eyes as the eye-gaze changes, thus obtaining the EOG. And this EOG signal can be used as an input for microcontroller in order to control home appliances.

KEYWORDS: Paralysis, Electrooculography (EOG), Electrodes, Microcontroller.

1. INTRODUCTION:

Paralysis has been commonly referred to the complete or partial impairment of the body function due to the loss of mobility of the muscles or nerves of the body. In the past few decades, various classes of bio signals have been used which have contributed a key role in the rehabilitation of the disabled. Here, the electrode may be used to measure eye movement by placing the electrodes around the eyes. This system outlines on the development and implementation of a low cost eye movement detection device for controlling appliances for paralyzed patients. Home automation involves the control and automation of lighting, heating, ventilation, air conditioning and security, as well as home appliances such as washer/dryers, ovens or refrigerators/freezers. To measure eye

movement, pairs of electrodes are typically placed either above and below the eye or to the left and right of the eye. One form of communication that is of particular interest here is the detection and following of the eyegaze or eye control systems. Many people with severe disabilities usually retain intact their control capacity over the oculomotor system, so eye movements could be used to develop new human machine communication systems. Furthermore, this type of interface would not be limited to severely disabled persons but could be extended to the whole group of persons with the capacity for controlling their eye movements.

2. LITERATURE SURVEY:

According to a study, there are 1 in 50 people living with paralysis that approximates to be around 6 million people.[1] It means that we all know someone a brother, sister, friend, neighbour or colleague, living with paralysis. In order to regain the function and independence following the disease, different mobility aids and medications have been brought into light in hands with the technology.

In paper [2] the author describes an eye-control method based on EOG to control an electric wheel chair for the disabled persons. It consists of sensors and GUI run by the computer. Eye control method can be applied to handle graphical interfaces

and eye is used as a mouse computer. Here a relevant control command has to be given for the patient. To move the wheelchair left, the patient has to rotate his eye to the left and to move the wheelchair right, the patient has to rotate his eye to the right. In this, a certain functions can only be performed like controlling the wheelchair.

A security system [3] is proposed based on human computer interface by using Electrooculography (EOG) signal keeping concentration on physically disabled people. Nowadays security is the main concern in every sector of our life. Most of the system requires a secret password to get access of the system under protection. In our work, a password based security system is proposed where password can be given by eye via EOG signal. The EOG interface detects the eye movement through electrodes placed on the face around the eyes. A unique pattern of EOG signal obtained by eye movement in certain directions can give the most secure password. An algorithm is proposed to detect the eye movement and extract the features of EOG signal. These features are further used to recognize the pattern for password using string matching technique. This system can be used as an added feature of EOG based assistive system. This is an offline approach which is highly accurate and reliable.

3. PROPOSED SYSTEM:

In this paper, the eye movement can be measured by a pair of electrodes that are typically placed either above or below the eye and to the left or right of the eye. These electrodes will pick the electrooculographic (EOG) signal. Here, the eye movement is monitored by using electrodes. Then the measured information is given to microcontroller as input. Further, the information is processed and data is transferred to load via microcontroller. According to the received data the load will be ON/ OFF condition.

4. SYSTEM ARCHITECTURE:

4.1. ELECTRODE PLACEMENT:

Here the EOG signal is acquired with the help of Ag/AgCl electrodes. These electrodes are comparatively inexpensive and help in reducing the drifts by careful application, also prevents the motion artifact and contact with the eye. The number of electrodes used here are three and the reference electrode is placed on the forehead. These electrodes will pick the EOG signal shown in fig1.

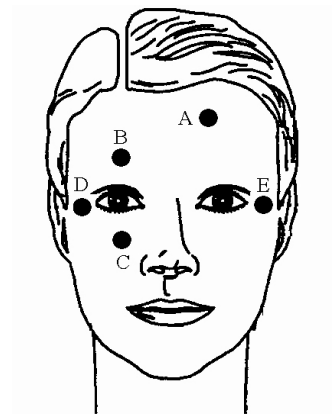


Fig 1: Electrode placement

4.2. PIC MICROCONTROLLER:

PIC16F877A is one amongst the popular form from the family of PICMicro family Microcontroller. The ease of use, flash memory technology that can write/erase until thousand times makes it more efficient for application purpose. The low cost, low power consumption, easy handling and flexibility make PIC applicable in areas where microcontroller were not previously considered. Other features that characteristics PIC16F877A are 10 bit upto 8 channel A/D Converter, data EEPROM retention greater than 40 years and single power supply (5V) in serial programming. The wide operating voltage range (2.0V - 5.5 V) is one of the contributing factors that has motivated us to implement PIC16F877A in our application.

4.3. PIEZO ELECTRIC PLATE:

The basic principle used in Piezoelectric plate is piezoelectricity. It is a

phenomenon of internal accumulation of charge in crystals in response to external mechanical force applied on it. The material used in piezoelectric element is lead zirconate crystal. These crystals generate measurable piezoelectricity when they are deformed about 0.1% of their pole between release the current when the orientation of crystal is disturbed by mechanical vibrations. These signals are in turn given to Op-Amp. The piezo element can detect slightest vibrations to make it useful to detect seismic waves shown in fig2.

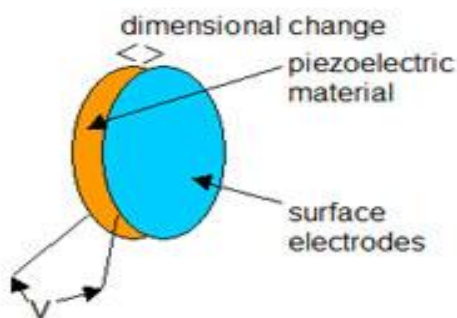


Fig 2: Piezoelectric plate

4.3.RELAY:

A relay is an electrically operated switch used to isolate one electrical circuit from another. In its simplest form, a relay consists of a coil used as an electromagnet to open and close switches contacts. Since the two circuits are isolated from one another, a lower voltage circuit can be used to trip a relay, which will control a separate circuit that requires a higher voltage or amperage.

4.4.RELAY DRIVER:

A relay is an electrically operated switch used to isolate one electrical circuit from another. In its simplest form, a relay consists of a coil used as an electromagnet to open and close switches contacts. Since the two circuits are isolated from one another, a lower voltage circuit can be used to trip a relay, which will control a separate circuit that requires a higher voltage or amperage.

BLOCK DIAGRAM:

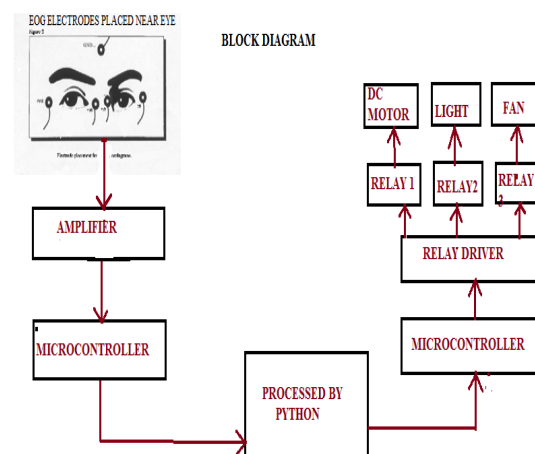


Fig 3. Block diagram of proposed system

5. IMPLEMENTATION:

The electrode placement in EOG system for medical applications. Here the eye acts as a dipole between cornea (positive potential) and the retina (negative potential) which causes the electric field around the eye ball. These signals can be measured by placing electrodes near the eye. The received EOG signal is then

amplified and given to the microcontroller. The PIC microcontroller uses a software called CCS compiler that compiles the signal output. And then given to relay driver. Thus the appliances can be controlled by the patient through their eye movements shown in fig3.

6.RESULT AND DISCUSSION:

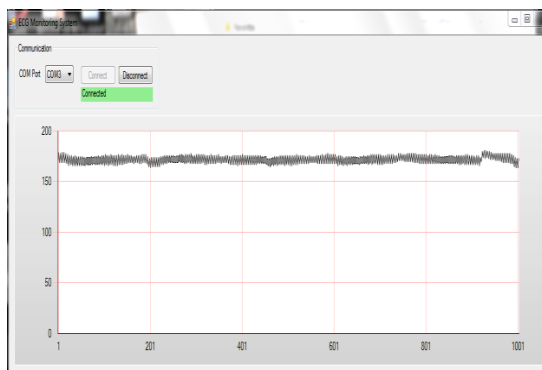


Fig 4: Waveform when the patient's eyes are stationary.

When the eyes of the patient are stationary or when the patient is looking ahead there is no considerable change in potential and the amplitude of the signal does not vary. It is a linear zero output. The above waveform shows (fig4) that the patient is stationary.

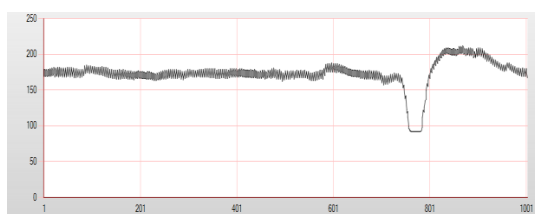


Fig 5: Waveform when patient rotates his eye to the right.

To switch on the first load (light), the patient rotates his eye to the right. Then the electrodes gather the signal and the load is switched on. This waveform shows that the first load is switched ON shown in fig5.

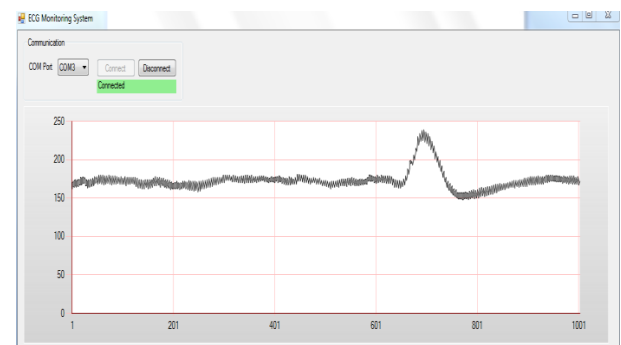


Fig 6: Waveform when the patient rotates his eye to the left.

To switch on the second load (fan) the patient rotates his eye to the left. Then the electrodes gather the signal and the load is switched on. This waveform shows that the second load is switched ON shown in fig6.

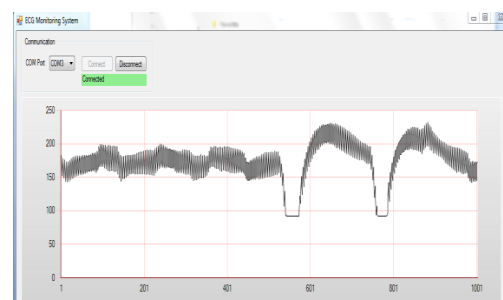


Fig 7: Waveform when patient moves his eyes upwards.

To switch on the third load (dc motor) the patient moves his eye upwards. The electrodes will pick the EOG signals and do the process for switch on the third load. This waveform shows (fig 7) that the third load is switched ON.

7. CONCLUSION:

A low cost eye movement based detection device for controlling home appliances has been proposed in this system. The device is developed mainly for the paralyzed people, for whom mobility is a point of concern. The device is based on the acquisition of EOG signal which is comparatively inexpensive, efficient in terms of linear relationship of the signal over the eye movements that makes it suitable for the application. The device here incorporates activation and deactivation of appliances such as fan, bulb and door control.

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