Review On Human-Machine Interface based on EOG

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***Abstract*— Electroocculography is the process of recording eye movement present in electroretino standing potential exist between the front and back of the eye. Eye play vital role for the recording of the eye movement in the form of potentials. It is a new eye-motor coordination communication assistive system in which any user it may be paralyzed or disabled person or normal person can effectively used EOG system with the help of EOG electrode which can be fix near the eyes in horizontal direction and in vertical direction for the recoding of the human eye. The eye movement signals goes to the data acquisition system and data acquisition system differentiate the actions and various applications can be designed. It is very interactive system between computer and human communications.**

***Index Terms*— Assistive devices, Electrooculography (EOG), Human computer interaction (HCI),biopottential, ALS**

I.INTRODUCTION

HCI systems eye movement based is a communication platform for patients with amyotrophic lateral sclerosis (ALS), paralyzed person and disabled person. People of all age group suffer from neurological disorders such as cerebral palsy, ALS,paralyzed diesease and age related disabilities. They have only eye as a communicating organ as eye gives different movement easily. Those person who lost their hands in accidents and willing to do some activities that are basically do with the help of eyes can take the benefit of EOG. Amyotrophic lateral sclerosis (ALS), disease also known by the name of Lou Gehrig's disease has possible applications in eye based HCI supporter as a contact stage. ALS described as a neurodegenerative disease considered by the progressive loss of motor neurons in the brain. Patients who suffer from ALS which is a progressive paralysis of the muscles of the limbs and trunk, as well as those used for speech. ALS patients unable to use their hands or voices to communicate with other people The oculomotor nuclei are believed to be resistant to the neuro degenerative effects of ALS due to the increased gabaergic transmission muscles associated with eye movements are less affected than the other part of the body muscles. So eye movement as an alternative communication way for patients with ALS.

The technique of EOG is include the voltage or signals coming from the cornea and retina of the eye,the resultant EOG signal is generated has a vital role in system. It's crucial role in ophthalmological identification and in measuring eye movements.The EOG unable to record individual stimulas contrasting the electroretinogram.
There are several methods of sensing eye movements some are more accurate than EOG (Electroocculography) but most of them are far more expensive and bring much inconvenient and discomfort to user to use. The EOG method is non invasive low cost and easy to use.EOG technique are used for measuring biopottentials signals.

The eye acts as dipole in which front of the eye act as positive dipole i.e. cornea and back of the eye act as negative i.e. retina as shown in fig.1

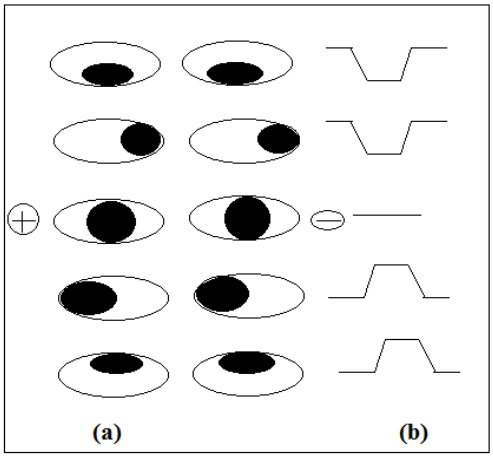

Fig.1 a)EOG signal deviation using by eye movement visual location (b) potential developed across eyes

This paper involves a proposal of EOG based writing system movement pattern. By detecting eye movement and extracting features the pattern can be recognized. Electrooculogram (EOG)-based eye tracking is an alternative to video-based eye tracking. EOG refers to the electric potentials recorded around the eyes, and reflects changes in eye positions. In contrast to the video-based eye trackers, EOG-based eye trackers require relatively lower computational power, and they are not influenced by ambient lighting conditions.Consequently, EOG can be used to develop relatively low-cost and low-power. embedded eye-tracking systems for various purposes such as robotic arm controllers [3], communication systems.

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II. EOG SIGNAL CHARACTERISTICS

In order to acquire EOG signal several electrode are placed on the distal ends of the two eyes in horizontal directions and in vertical directions above the two eyes and one reference for the common mode signal reduction.

Electrooculography (EOG) is the corneal–retinal potential produced due to depolarization and hyper polarization existing between the retina and cornea. The higher metabolic rate at the retina compared to the cornea causes the eye to maintain the voltage of about +0.40 to +1.0 millivolts with respect to the retina and with a frequency range of about DC to 50 Hz. At resting state, when user is looking straight, a zero potential signal is obtained. When the direction of gaze is changed, the corneal-retinal potential will also be changed at the same time.

III. RELATED WORK

The objective of the above paper is to provide a solution to the drift issue[1]. In this paper not only eye signals but also other signals like noise, electrodes voltage get amplified. To solve this problem author use the nonlinearity property. They calculate the definite eye angle with respect to the reference state of eye. For this author has to analyze the different eye position before and after eye activities to obtain the angle for the steady state of eye or movement of eye. Author of this paper introduces design idea for enhance the writing speed or work ability by the help of robotic arm[2].They designed the EOG for the eye movement it goes to the data acquisition system and by following various algorithm command goes to the robot or robot arm and robot or robot arm act accordingly. With the help of desktop interface they set the robot or robotic arm in motion. Various strategies they used for the set to robot in motion and it act like a real hand. In this paper author recognise the reading ability[3] to students and different people for make the reading activity interesting. They gathered the data of the various professional people and students.In some part of the reading the students and various professionals give favourable eyes signal as that is very interesting but some part of reading they found that reader get strain on reading by the analyzing of signals of eyes which was very in discontinue manner. They also fond various eyes movement accordingly they differ data of the reading matter.In the paper above they develop a graphical user interface to act like mouse on the desktop[4] screen of the computer.The various eye position eye upward, downward, left rolling right, up-left, up-right, down-left, down-right, blink and blink string on continuing on three time the enable the mouse by the icon present on the screen. They use mentioned algorithm as above as mouse movement require number of hidden objects.This paper give the according to paper the objective is for vigilance estimation [5] to discover a better practical position for obtaining EOG signals. As in convenient method for placement of the EOG signals near the eyes system uses placement of electrode on the forehead. The different data observed for the horizonatal eye movement and vertical eye movement they differentiate this data by the different head movement, cheek movement, eyebrows movement.

IV. METHODOLOGY

The proposed system consist of the EOG electrode attached to the surrounding of the eyes i.e. two electrode to the horizontal direction around the eye and two electrode to the vertical direction around the eyes by the help of adhesive tape and one electrode present at the forehead i.e ground electrode for common mode signal.Fig.2 shows the overall block diagram of the process. The activity of interest in this part of the work is movement of the eye i.e. upward, downward, right, left for writing purpose on the designed matrix.

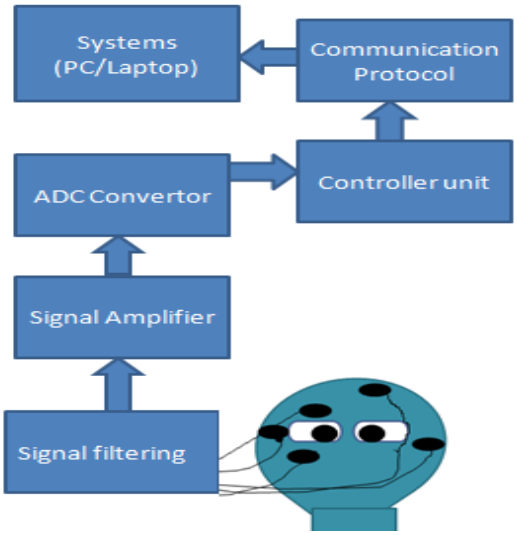

Fig.2 Proposed Block Diagram

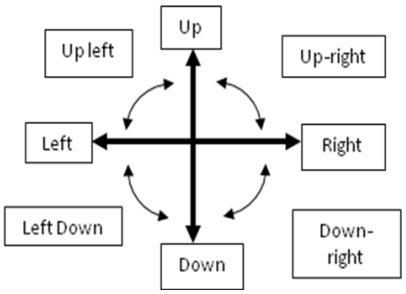

Fig.3 Direction of the eye movement

The channel 1 and channel 2 which comprises of filter, amplifier and adc convertor which come from the horizontal and vertical placement of the electrode are given as input to the data acquisition system used in system. The eye movement gives the direction to the system for recording eye movement for the system. Signal get filtered to allow only filtered signal by removing noise signal, passes through amplifier and followed by analog to digital convertor to the data acquisition system. A grahical user interface display on the system in which we can write letters with the help of dot matrix designed.

1) EOG Signal attainment: Two EOG components (horizontal and vertical) were obtained from four electrodes attached around the eyes; these were located at the outer edges of both eyes as well as above and below the right eye

.To reduce the computational cost of the system, four-channel EOG signals were down-sampled to a rate of 128 Hz without highpass filtering. The horizontal EOG component was derived by subtracting the left eye signal from the right eye signal. The vertical EOG component was obtained by subtracting the signal at the lower edge of the eye from the signal at the upper edge of the eye. EOGh and EOGv are notations indicating the horizontal and vertical components of EOG, respectively.

2) Noise Removal: An EOG signal contains various noise components such as thermal noise, conductance fluctuation, and power noise, as well as signal fluctuations resulting from electroencephalogram (EEG), electromyography (EMG), and electrocardiography (ECG). To minimize noise, a filter was applied to the raw EOG signal.

V. CONCLUSION

In this paper, EOG characteristics based upon method of recognisation of eye motions. According to the recognisation results, we use GUI (graphical user interface) for eye writing purpose.With numbers of training to the system, we can achieve higher recognition accuracy. Therefore we can inference that the system give the mode of communication between patient suffering from disability and their caretaker. In the future, we can develop goggle like model as conventional method is little uncomfortable to the patient.

VI. REFERENCES

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