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Eye Mouse Controlled Using Electroculogram

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Abstract

Paralysis is one amongst the major neural disorder that causes loss of motion of one or more muscles of the body, where in depending on the cause, it may affect a specific muscle group or region of the body. Eye movement can be used by the paralysis patients and armless persons to perform simple tasks.

This paper presents an implementation of a low-cost aid for severely disabled persons to communicate with computer directly by physical means. The communication is done through Electro Occulo Gram (EOG) signals

generated by the movement of eyes. The blink, left & right commands are used to communicate with computer. The retinal resting potential causes an electric field Around the eyeball, centred on the optical axis, which can be Measured by placing electrodes near to the eye. An acquisition System and a lab view application were implemented for Measuring these bio potentials in order to detect the movement of the eyes.

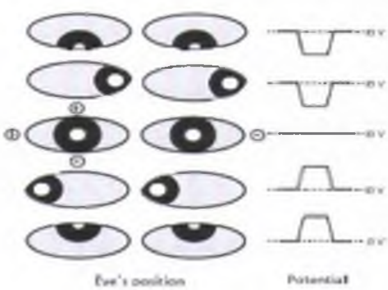
I Introduction

Severely disabled people are sometimes only able to move their eyes. That is one of the main reasons for looking for interfaces relying on eye movements. Among those interfaces, a common example is a mouse control, which allows the patient to interact with the environment without any limb movement. To measure eye movements, Electro Oculo Graphic (EOG) signal is one of the most preferred solution for a daily use. Indeed, although different techniques exist such as special contact lenses, infra-red light reflections measured with a video camera, EOG signal has a double advantage.

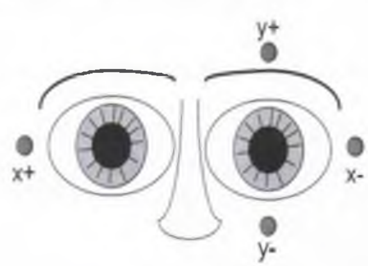
First,it is a portable technology, which is well appreciated for various applications. EOG signal is a very cheap way to measure eye activity as far as only some electrodes are required. In this paper, we propose to give a first step for comparing EOG-based eye movement recognition techniques, which is quite impossible in the literature given the variety of the used performance measures and frameworks. design and development of a novel EOG signal system is described to acquire and condition the signal. Then, using an application developed in LabVIEW, the signal is processed and analyzed to identify characteristics and problems with interpreting the EOG signal, comparing different signal processing techniques for denoising the signal.

II EOG CHARACTERISTICS

The eye has a standing electrical potential or charge across it, like a weak battery and acts as a dipole, with the front of the eye (cornea) electrically positive with reference to the electrically negative back of the eye (retina),



This shows the horizontal and vertical channel electrodes placement to the eye



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The EOG signal is sensed by Ag-AgCl electrodes and ranges from 0.05 to 3.5 mV in humans, with a typical bandwidth of DC to 50 Hz. the main signal bandwidth of eye movement is located in the range of 0.1 Hz to 40 Hz. In this frequency range, the EOG signal is influenced by other bioelectrical signals.

IIIBLOCK DIAGRAM

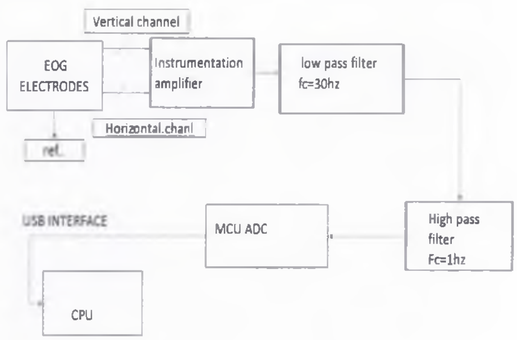

Fig.1 Block Diagram of the System

a) **Electrodes**: Is to interface to body is we are using reusable electrodes to connect with human body and these electrodes will pickup signals which corresponds to eye movements signals mixed with some others signals which are noise for us. We are going to use Ag-AgCl electrodes as they are low cost and easily available.

b) **Instrumentation Amplifier**: Signals from electrodes are received and sent to InstrumentationAmplifier. An instrumentation amplifier is a type of differential amplifier that has been outfitted with input buffers, which eliminate the need for input impedance matching and thus make the amplifier particularly suitable for use in measurement and test equipment. characteristics include very low DC offset, low drift, low noise, very high open loop gain, very high common-mode rejection ratio, and very high input impedances.

c) Filter: low pass filter used to boost the gain and reduced the noise. It operates on frequency 30hz.Movement one direction would correspond to a positive voltage and movement in the opposite direction would output a negative voltage. A simple RC high pass filter with a very high time constant was used. The high pass filter used had a cutoff frequency of 1 Hz. Rejecting any DC values in the signal but maintaining the desired content from the eyes.

d)ACQUISITION & PROCESSING SYSTEM:

Electrodes capture the biopotentials from the body but these signals are very weak and very noisy so there isinvariable need of advance acquisition system which comprises of precision instrumentation amplifier, active filters, multiple gain block and for interfacing to ADC we have to do dc shifting (or clamping) of signal.

Acquisition system will interface to the body get the EOG signal, amplify it, filter it and pre process it to ADC. ADC is interfaced with the ADRUINO BOARD. This reads the data from ADC.

IVSYSTEM DESIGN

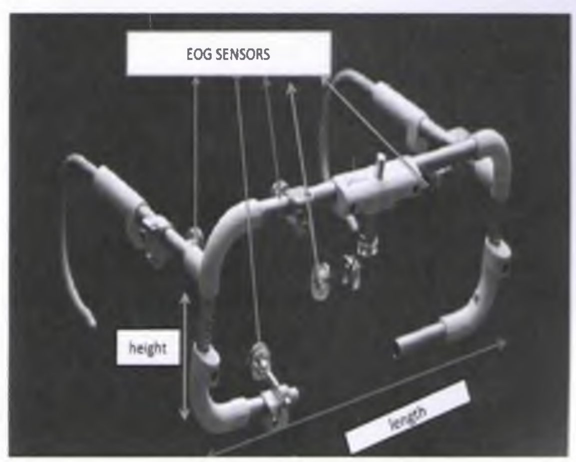

Fig.2 System Design

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V RESULT

The current result is that change in waveforms for eye movements in straight, right, left directions and also for single blink and double blink has been taken. All this signals are been taken using just three electrodes. If five electrodes are taken then the readings will be more clear and accurate.

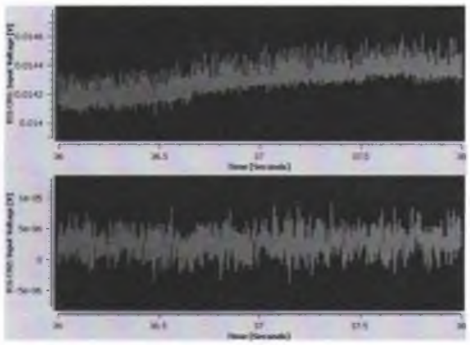

Fig.3 Waveform for Eye looking Straight Forward

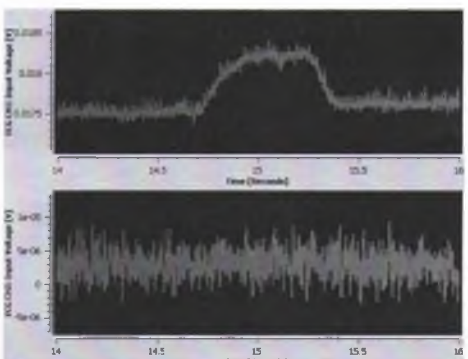

Fig.4 Waveform for Eye looking to the Right

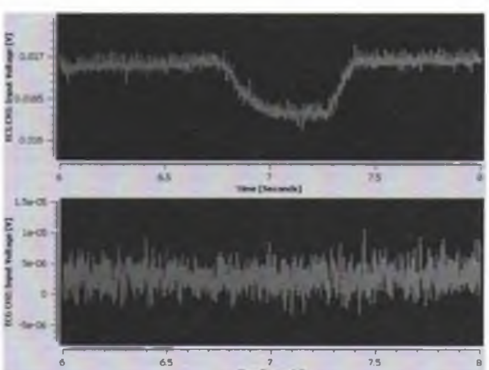

Fig.5 Waform for Eye looking to the Left

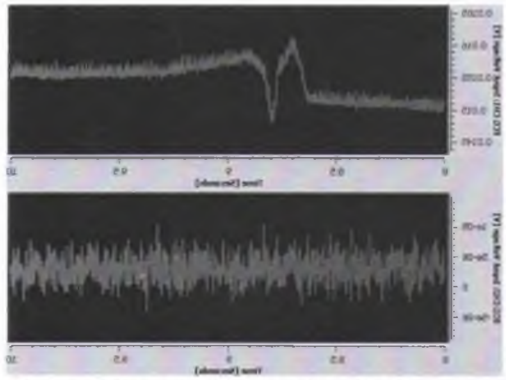

Fig.6 waveform for Single Click of Eye

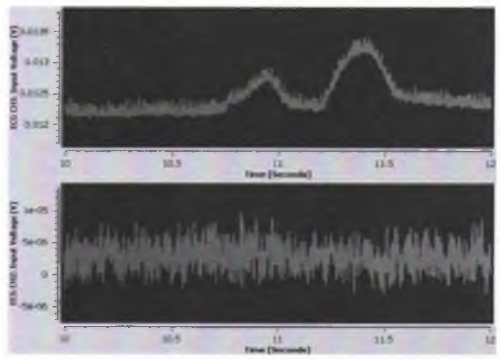

Fig.7 Waveform for Double Click of Eye

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