Detection Of Saccadic Eye Movements to Switch the Devices For Disables

Sampan N. Shah[1] Prof. K. C. Dave[2]
[1]M.E. (Applied Instrumentation) [2]Assistant Professor
[1, 2] Department of Instrumentation & Control Engineering
[1, 2] L. D. College of Engineering, Ahmedabad, Gujarat, India

Abstract—The paper presents the alternate means of communication to the person with severely disable. Here, the work aimed to detection of fast eye movement and switching the devices for disable person for satisfaction of basic their needs with the help of their care takers.

Keywords: Saccadic,HCI,GUI,Labview,Virtual Instrument.

I. INTRODUCTION

As we know that there is different kinds of assisting devices are available for paralyzed patients and more than available under research. Here is an novel attempt to study natural eye movements and its application for design such kind of device that act more assisting role for paralyzed patients.[1]
Recent research attention for the development of assistive technology incorporates direct interfacing of human Physiology and computer technology i.e., human-computer interfacing (HCI). The primary function of the HCIs is to engender control signals for external devices based on the real time scrutiny of measured biological signals. Since this task can be accomplished while bypassing the spinal cord, an apparent potential of the HCI machinery lies in providing aid to the individuals with severe motor disabilities, such as amyotrophic lateral sclerosis (ALS) and Guillain-Barre Syndrome. While these patients have little or no voluntary muscle control, their cognitive functions might still be intact.
Hence, the goal of HCIs is to supplement the individuals' residual ability with the surviving functions. With the advancements in sensor technology and embedded technology, various portable and affordable assistive devices have been developed for physically challenged people. Applications utilizing HCI technology includes viz. functional muscle stimulation, virtual reality environments, virtual keyboard, etc. Likewise several research works have been developed for the control of external devices using different physiological signals viz. Photoplethysmography (PPG) and electroencephalography (EEG) based brain computer interface
(BCI), electrooculography (EOG) based eye-gaze tracking, voice control technology, electromyography (EMG) based cybernetics, etc. However, in addition to the advantages that these systems offer there have been a lot of complications associated with the usage of various bio potential signals. Electrooculography (EOG)

A. Anatomy of Eye

Here, In Fig 1 the anatomy of eye is shown here, the Cornea potential is higher than retina potential In fig 2 Dipole model of Eye is shown.

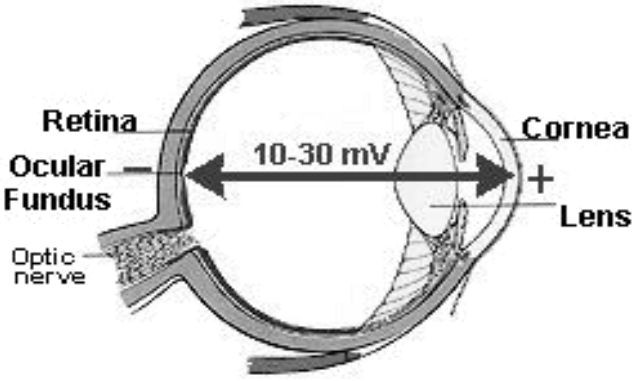

Fig (1): Anatomy of Eye

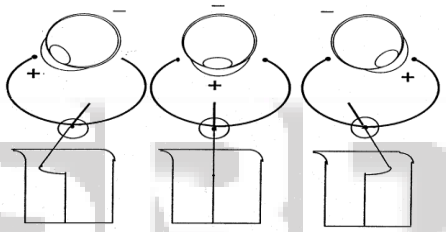

Fig (2): Dipole Model of Eye

B. Parameter to Consider for EOG [3]

1) Age of Person
2) Height from ground (Where he/she Stands)
3) Head Movement

C. Signal Conditioning Circuit of EOG Signals

The circuit diagram for EOG signal acquisition is as per below block diagram. The first block is the electrodes for EOG. The position of electrodes is as per below figure. The second block is instrumentation amplifier then third block is filter and last block is CRO or DSO.

Fig (3) Block diagram of Signal Conditioning of EOG Signals

For Instrumentation Amplifier INA 128 IC is used. First Stage of gain=10 for detection of Low amplitude EOG signal. The 2nd stage of gain=100.So,overall gain of the System is 1000.For filter 2nd order Butterworth Low pass filter of cutoff frequency 1000 Hz is used. The position of Electrode for detection of Horizontal eye movement the position of Electrode is as per fig -4.

Fig (4): Electrode position for Detection of Horizontal Eye Movement

For Human computer interfacing and for the purpose of A/D Conversion NI made PCI-6221 DAQ Card is used. The VI for acquisition and Signal Processing is shown in fig 6.The fist block is for DAQ assistant.

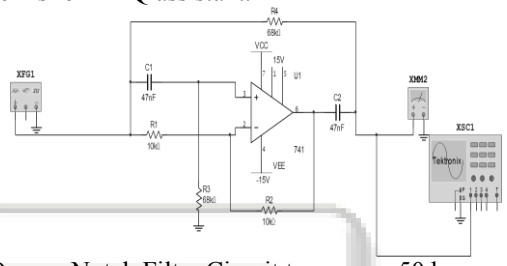

Fig 5 Opamp Notch Filter Cicruit to remove 50 hz power line Interference

1) Calculation of the value for the circuit is very straightforward.
2) The formula to calculate the resistor and capacitor values for the notch filter circuit is:
3) fnotch = 1 / (2 pi R C)
4) R3 = R4 = 68KΩ, R1=R2=10KΩ
5) C=C1=C2=47 nf, fnotch = centre frequency of the notch in Hertz
6) R and C are the values of the resistors and capacitors in Ohms and Farads

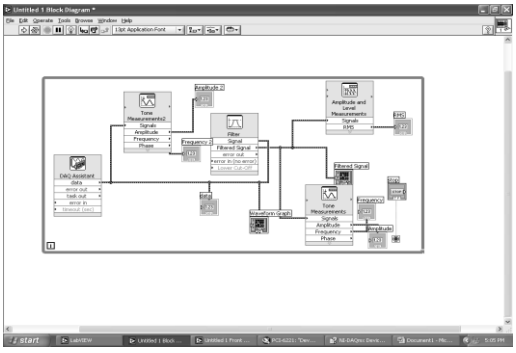

Fig (5): VI for Signal Processing and Acquisition

ACKNOWLEDGEMENT

First of all I am thankful to God, for their always support, Then my parents and my Guide Prof K. C. Dave for their Constant support and guidance whenever I required.

REFERENCES

[1] R. Barae , L. Boquete and M. Mazo "System for assisted mobility using eye movements based on electrooculography", IEEE Trans. Neural Syst. Rehabil. Eng., vol. 10, no. 4, pp.209 -218 2002
[2] A. Bulling , D. Roggen and G. Tröster "Wearable EOG goggles: Eye-based interaction in everyday environments", Proc. 27th Int. Conf. Human Factors Comput. Syst., pp.3259 -3264 2009
[3] A. Bulling , J. A. Ward , H. Gellersen and G. Tröster "Robust recognition of reading activity in transit using wearable electrooculography", Proc. 6th Int. Conf. Pervasive Comput., vol. 5013, pp.19 -37 2009 .
[4] J. Hori , K. Sakano , M. Miyakawa and J. Saitoh "Eye movement communication control system based on EOG and voluntary eye blink", Proc.ICCHP, pp.950-953,2006
[5] D. Borghetti , A. Bruni , M. Fabbrini , L. Murri and F. Sartucci "A low-cost interface for control of computer functions by means of eye movements", Comput. Biol. Med., vol. 37, no. 12, pp.1765 -1770 2007
[6] www.ni.com
[7] Y. Chen and W. S. Newman "A human–robot interface based on electrooculography", Proc. IEEE ICRA, vol. 1, pp.243 -248 2004
[8] A. R. Teixeira , A. M. Tome , K. Stadlthanner and E. W. Lang "Nonlinear projective techniques to extract artifacts in biomedical signals", Proc. EUSIPCO, pp.486 -495 2006
[9] J. Wolpaw , N. Birbaumer , D. McFarland , G. Pfurtscheller and T. Vaughan "Brain-computer interfaces for communication and control", Electroencephalogr. Clin. Neurophysiol., vol. 113, no. 6, pp.767 -791 2002
[10] F. Cincotti , D. Mattia , F. Aloise , S. Bufalari , G. Schalk , G. Oriolo , A. Cherubini , M. G. Marciani and F. Babiloni "Non-invasive brain-computer interface system: Towards its application as assistive technology", Brain Res. Bull., vol. 75, no. 6, pp.796 -803 2008

