A REVIEW PAPER ON ASSISTED ROBOTICS (WHEELCHAIR) FOR MOBILITY USING EYE GAZE DETECTION BASED ON ELECTROOCULOGRAPHY FOR DISABLED PEOPLE

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Abstract :In our daily life robots play a key role in advancing the quality of life for people with disabilities. There is a wide range of systems that allow managing independent mobile robots. The main purpose of our control system is to guide an independent mobile robot by using Electrooculography (EOG). The EOG signals can developed using Ag/Agcl electrodes and developed EOG signals are managed by the microcontroller for the calculation of eye gaze. Then according to the control approach, the command is sent to the wheelchair. The cataloguing of different eye movements permits us to create simple code for monitoring the wheelchair. This work was designed towards developing a functioning and low-cost assistive robotic wheel chair system for disable peoples. To live more self-regulating life, the system can be used by the disabled people especially with the eye-motor coordination.

***IndexTerms* - Electrooculography (EOG), Microcontroller, Electrodes, Motors, Wheelchair**.

I. INTRODUCTION

Now a day's disable population, In India as per census (2016) and National Sample Survey Organization's wide survey in India out of 121 Cr populations, 2.68 Cr are disabled. Between the disable population 56% (1.5 Cr) are males and 44% (1.18 Cr) are females. There are different types of disability, distinctions due to gender, class, place of residence (rural / urban) etc. Disable population occupy in rural areas (1.86 Cr disabled persons in rural areas and 0.81 Cr in urban areas).According to census and NSS disabilities is increasing rapidly every single year [1].

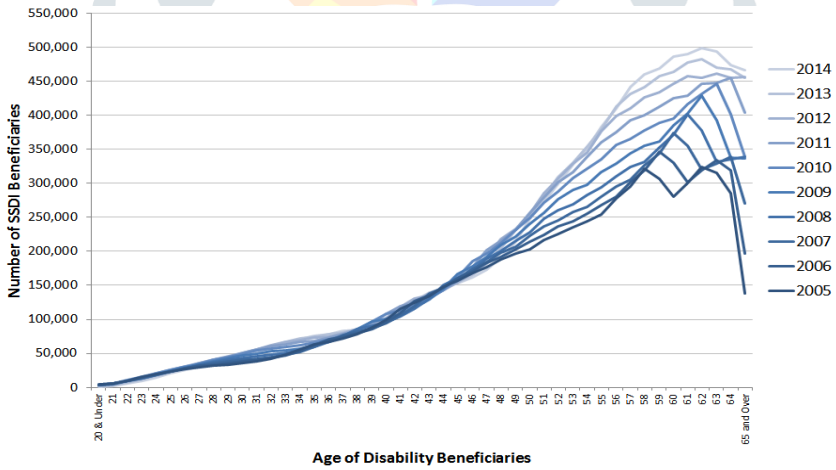


Fig 1: Growth rate of disabled Person in India[2]

Today, a smart system needs to be developed to serve humanity in life. People with physical disabilities need to deal with many dynamic issues and need new tools with the latest technology to help with comfortable mobility. Several types of examination groups at a world level have begun to set up cooperation projects, projects to aid communication and mobility of disabled persons with the purpose of increasing their quality of life and approving them a more self-sufficient lifestyle and better chances of social incorporation[3][4].

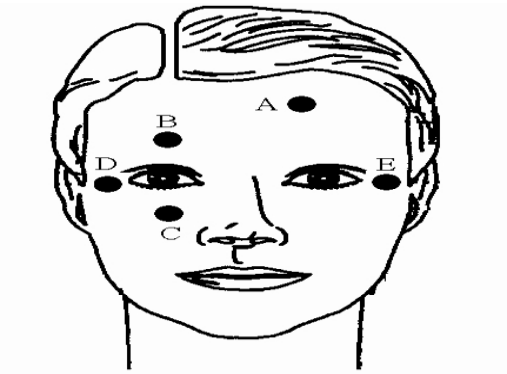
This paper is for work development of a robotic wheelchair system based on an Electroocculography (EOG).This wheelchair system is used for the navigational purpose in environment which required some desired ramps and doorway with sufficient width to pass the wheelchair. Robotic wheelchair must cooperate with user and make the robotic system semiautonomous relatively completely autonomous [5]**.**

This paper includes several sections in which section 2 Section II defines electrooculography (EOG) as a technique for recording the electrical activity of the eyeball and its rationality for detecting eye movements. Section III suggests an Electrooculographic model of the eye for determining the eye position in terms of the recorded EOG. Section IV is for different wheelchair guidance strategies by electrooculography and shows the Electrooculographic system actually set up to describe the test platform (wheelchair)**.**

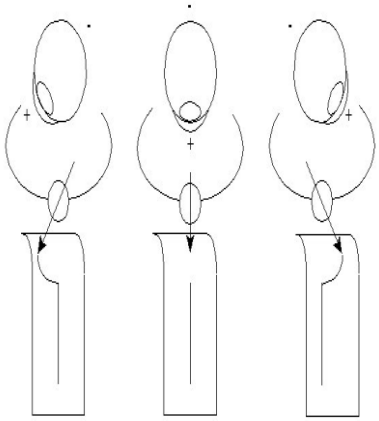
II. Electrooculography (EOG)

Electrooculography is a method for detection of eye movement and it is recording of the corneal-retinal potential rising from polarizations and depolarization occur in between cornea and retina, it is known as an Electrooculogram [6]. The retinal potential can be measured as a steady electrical dipole with negative pole at fundus and positive pole at cornea. The potential in eye can be estimated by measuring the voltage across two electrodes, which is placed around the eyes as eye gaze changes, by this we get EOG (measurement of electrical signals of dipole).

EOG potential value varies from 50 to3500 micro volt with frequency range of 100 Hz. Its waveform is practically linear for gaze angles of plus +30degree or -30degree. It is captured by five electrodes placed around the eyes. The positioning of the electrode, skin electrode contacts, lighting conditions, head movement, blinking, etc. The signals are sampled 10 times per second, the EOG signal is a result of a number of factor, including eyeball rotation and movement, eyelid movement, different sources of artifact, electrode placement, head movement, influence of the illumination, etc. [7]**.**



(a)Electrode placement



(b)Ocular dipole

III. Survey of different techniques for detection of eye movement

1. In october 1999 S. H. Kwon and H.C. Kim share their thoughts at BMES conference serving huminity advancing technology on topic of "EOG based glasses type wireless mouse for the disabled people"[8]
2. In 2009 Zheng, Xiao-xiang X share their thoughts at ICME international conference on complex medical engineering on topic of "A portable wireless eye movement control computer interface for disabled people" by using zigbee wireless module.[9]
3. In August 2011, Ali bulentusakli and Serkangurkan published one paper on topic of "Design of novel efficient human computer interface: an electrooculogram based virtual keyboard."[10]
4. In October 2011, Andres ubeda and Jose M. Azorin share their thoughts in ieee press on topic of "Wireless and portable EOG based interface foe assisting disabled people."[11]
5. In 2012, Piyush swami, Tapan Gandhi, Ramandeep singh and Snehanand share their thought on the topic of "Novel embedded approach for the development of wireless Electrooculogram based human computer interface."[12]

IV. DATABASES FOR EYE MOVEMENT

1. **STARE (Structured analysis of retina):** STARE database is created with the aim to develop research related to the automatic diagnosis of the human eye.
2. **DRIVE(Digital retina images for vessel extraction):**
   DRIVE is a retinal fundus image database created to develop research on the segmentation of blood vessels in retinal image**.**
3. **HRF(High-Resolution fundus image database):**
   This database is created to support studies on automatic segmentation algorithms on retinal fundus images**.**
4. **Eye-Tracking datasets**

1) **3D image Eye-Tracking datasets:** There are only a few 3D eye-tracking datasets publically available. The NUS3D dataset collected human eye fixation from 600 stereo pairs viewed by 80 subjects**.**

2) **3D video Eye-Tracking datasets:** There are only a few 3D eye-tracking datasets publically available. The NUS3D to the best of our knowledge, to this date, the only publicly available 3D video eye-tracking datasets are the EyeC3D and the IRCCyN datasets, which contain 8 and 47 stereoscopic videos, respectively.

V. Conclusion

We concluded that, by this work we successfully developed the assisted control system (Wheelchair) using eye movement for disabled people. The main characteristic of electrooculography is acquisition and processing of the EOG signal from the connected electrodes for controlling of system. In this paper work we offered control system that allows disabled people especially for the eye motor coordination to control the wheelchair. It is used economically. EOG guidance has been verified on a controlling prototype & also the results are acceptable in the present time.

There are different types of Electrooculographic guidance has been mentioned, but the main thing is to set threshold for the detection of eye movements to record EOG from various person to get exact threshold value. Main factors in this process are electrodes positioning. If electrodes position is varying in position it will change the output voltage so to overcome this problem we follow standard position. In real time applications we considered the changes between involumetry or volumetry blink. For real application various activity of disable patient should increase the eye movement detection using recorded EOG signals [13].

VI. Acknowledgment

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