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Assisting Software Solution for Paralyzed to Communicate

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***Abstract*— One of the major challenges faced by the paralyzed patients, especially those suffering from ALS or motor neuron disease, is that their motor neurons get degenerated, because of which none of the voluntary actions such as speaking & walking can be performed. In our project, we intend to develop a communication system for these patients, wherein a series of winks showcased by the patients can be decoded to commonly used sentences.**

Keywords: ALS; MND; Paralysis; Blinks; Occulography

I. INTRODUCTION

Amyotrophic Lateral Sclerosis (ALS) also known as Lou Gehrig's disease or motor neuron disease (MND) is a disease that weakens muscles and arrests voluntary functions. In this disease, nerve cells break down making the muscles weak. After a period of time, all muscles under voluntary control are damaged. Patients with ALS have slurred speech, hoarseness, excess saliva, find it difficult to swallow. As muscles weakens, the walls of diaphragm and chest collapse making it difficult to breathe. Most people with ALS die from respiratory disorders, usually within 3 to 6 years from the onset of symptoms. However, some patients survive for about 10 or more years. Patients with ALS currently communicate through swift keys or electrooculography (EOG). The problem faced by patients using EOG is that it is painful and incase of swift keys it is expensive. The method we use is far more accessible and less painful.

II. LITERATURE SURVEY

There are several techniques for available as assisting technology to paralyzed patients to communicate. S.S.Deepika and G.Murugesan introduced a technique to control cursor movements on screen using eyes only [1]. This method consists of consists of web camera attached to wearable glasses. The input images taken are converted to grayscale image and then binarized with a dynamic threshold. The iris is detected using Circular Hough Transform. If blinks are detected then mouse click is performed or else center point of iris is located and eye gaze is estimated. After estimating the eye gaze, the cursor movement is carried out. The limitation of this method is that Hough Transform is complicated and time consuming.

Controlling cursor movements using only eyes is again explained by Prashant Salunkhe and Ashwini R. Patil [2]. In this proposed method three eye tracking techniques have been used. They are limbus tracking, pupil tracking and third is electrooculography (EOG). Limbus tracking is technique is based on the position and shape of the limbus relative to the head, Pupil tracking uses Hough Transform. Electrooculography involves implanting electrodes near the eyes of patients to detect potential between iris and cornea. Limbus and pupil tracking are complicated and electrooculography can be very painful.

Prajna Suvarsha and Arunraj Jathanna have explained a method to detect eye movements in patients with nystagmus and other balance related problems using electrooculography (EOG), video-oculography (VOG) and electronystagmography (ENG) [3]. Gold plated electrodes were used to pick signals from the surface of skin and comparisons were drawn from EEG and ENG signals. Using electrodes on patient's face can be painful.

Joshua D. Fischer and Dawie J. van den Heever designed a portable video-oculography device to detect concussions [4]. The proposed method used a 3D printed head mount with Raspberry Pi PiNoIR camera as the sensor. The head mount was fitted with a screen. It displayed a nine point calibration grid to calibrate the system. Pupil gaze position was determined after the user gazed at different position on the screen. The limitation of this technique is that head mount is huge and the 3D printed parts are not easily accessible.

SwiftKey is an input method (software) for Android and iOS devices. It uses a blend of artificial intelligence technologies that enables it to predict the next word the user intends to type. This software is custom modified especially for Professor Stephen Hawking who suffers from ALS to help him communicate.

III. CONCLUSION

The methods mentioned in previous section apply EOG or VOG method to identify the eyes. In case of EOG, the electrodes are placed on the surface or the skin or sometimes pierced, which often results on patient being continuously conscious about the setup. Thus, it can be clearly stated VOG can be the best approach.

Instead of using complex and time consuming techniques as used in [1], it would always be better to apply faster algorithms.

IV. FUTURE SCOPE

Further, a video based oculographic approach can be implemented where simpler yet efficient techniques can be used for faster processing.

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