Eyewriter

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Abstract: *This paper discusses a novel technology which helps the paralysed people to communicate using their eyes. With the aid of this device, the user is able to control the entire computer using their eyes. It uses a modified PS3 eye camera and IR illuminators along with specified software's to track the position of user's pupil .It will also be locally maintainable. We introduce a technology that not only help them to communicate but also is cost effective.*

***Keywords*:** *Communicate, Control, Eye camera, Illuminators, Pupil.*

I.   Introduction

We aimed at developing a device which can be controlled by eyes for those people whose brain is active but body isn't .Our concern is to make such people more lively with their activities without the help of others. With the help of an eye camera, IR illuminators and specified software the proposed system can be better implemented. While the current eye tracking technologies available in the market cost more than 1000 dollars this can be afford at a rate of 200 dollar.

II. Problems

In 2009, the Christopher and Dana Reeve foundation unveiled staggering statistics based on research into the prevalence of paralysis across the US. According to the study, there are 1 in 50 people living with paralysis-approximately 5.6 million people. That's the same number of people as the combined population of Los Angeles, Philadelphia and Washington D.C. In India on a rough extrapolation 1 in 111 or 9.5 million people are paralysed. And the number is nearly 40% higher than previous estimates shown.

III. Existing Solutions And Limitations

Bionic technologies
Technologies to help paralysed people move again have come a long way.
3.1Spine Stimulation: A technology called epidural Spine stimulation which involves implanting a device that sends electrical signals to the spine has proven effective at restoring movement to paralysed people. But it's not the technology showing real promise for treating paralysis.
3.2Brain computer interface: Devices called brain computer interfaces which link the brain to a computer or external device such as a prosthetic limb have also used in treating paralysis. The cost of such devices is not affordable.
3.2Exoskeleton: Attempts are being made to make wearable robotic suits yet it is not completed.

IV Practical Solution

Eye Tracking Technology
It is the process of measuring either the point of gaze or the motion of an eye relative to the head. An eye tracker is a device for measuring eye positions and eye movement. Eye trackers are used in research on the visual system, in psychology, in cognitive linguistics and in product design.

The most widely used current designs are video-based eye trackers. A camera focuses on one or both eyes and records their movement as the viewer looks at some kind of stimulus. Most modern eye-trackers use contrast to locate the centre of the pupil and use infrared and near-infrared non-collimated light to create a corneal reflection. The vector between these two features can be used to compute gaze intersection with a surface after a simple calibration for an individual. Two types of eye tracking techniques are used:

- Bright pupil
- Dark pupil

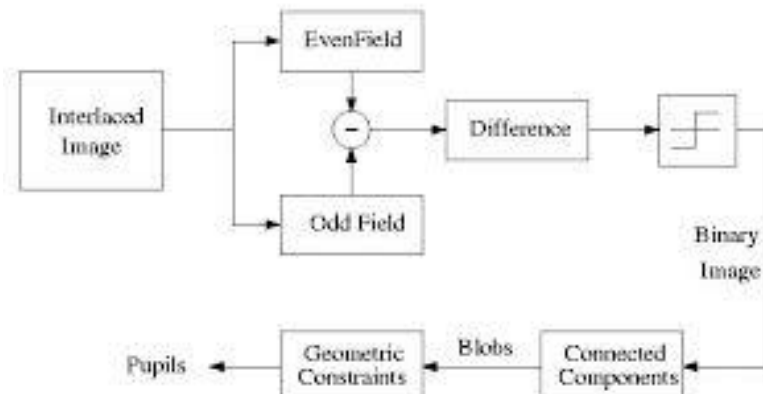**Architecture of the Proposed System**

Fig 1. Architecture

V. Hardware Description

The proposed system's hardware mainly consists of:

- PS3 eye camera
- IR illuminators
- Micro controller
- Transistor
- MOSFET

A model of EYEWRITER

PS3 Eye Camera: The play station eye camera is a digital device similar to web camera. The technology uses computer vision and gesture recognization to process images taken by the camera. The PS camera is capable of capturing standard video with frame rates of 60Hz at 640x480 pixel resolution and 120Hz at 320x240 pixels. While there is no official support or drivers by Sony to run the play station eye camera to run the play station on other platforms such as PC through getting V-sync(vertical sync of the camera). The v-sync is an electrical signal that comes from the camera which communicates refresh rate. Getting the camera's V-sync is crucial for this application to work because it is only way can match the camera's refresh rate to LED'S.

IR Illuminators: Infrared IR Illuminators are widely used to improve the capturing quality of cameras. Just like a human eye cameras are also not capable of recording movements in dark places but unlike our eyes, most modern camera's can capture infrared light. Many IR LEDs grouped together to throw good amount of IR light are called IR Illuminator. So these IR Illuminators serve one and only function to flash a bunch of infrared lights into the face. When properly connected to camera the circuit board will alternatively flash LEDs on the to outer circuit board in sync with the frame rate of the camera.

Microcontroller: The ATMEGA328 is a single chip micro controller. When the signal from the V-sync appeared on the base of npn transistor it will be amplified and fed to pin 3 of an arduino as an interrupt. Arduino checks for the interrupt and give appropriate signal to the pin 11 and 12 of arduino which triggers the FETs.

Transistor: A transistor is a semiconductor device used to amplify and switch electronic signalsand electrical power. It is used here to amplify the electrical signal coming from the vertical sync of the camera (V-sync has small voltage insufficient to drive the illuminators).

MOSFET: MOSEET is used to control the brightness of the IR illuminators.

VI. Software Description

The eyewriter requires a few pieces of software for building and running.

Integrated Development Environment (IDE): Integrated development environment (IDE) is a software application that provides comprehensive facilities to computer programmers for software development.

Open Frame works: open framework is a c++ library designed to assist the creative process by providing simple and intuitive framework for experimentation.

EyeWriter GitHub: Github is a web based hosting service for projects that use the Git revesion control system. It is a platform that allows people to exchange and share code.

VII. Conclusion

The Eye Writer is a low-cost eye-tracking apparatus + custom software that allows paralysed people to write and draw using only their eyes. This eye writer system is cheap and completely open source. At the moment, it costs about 200$ in parts. Traditional commercial eye trackers costs between $9000-$20,000, so this is a magnitude of order cheaper, and is designed to help anyone who wants or needs an eye tracker.

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