EYEBALL MOVEMENT BASED WHEELCHAIR USING RASPBERRYPI

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***Abstract*— We have been seeing many people who are fighting against many diseases. One of the most painful disease is Paralysis. All of us think of supporting the people in need either financially or physically. But being an engineer we can design a new instrument or machine that helps needy. This project is one such attempt to contribute our part to the society. Paralysis is one of the biggest curse to mankind. The person can neither feel nor move himself. In extreme cases of paralysis the person needs the support of another guy even for moving his finger. Paralysis is of many types, the 4 main categories are , Monoplegia (one arm or leg), Hemiplegia(one arm & leg),Paraplegia(both legs),Quadriplegia(both legs & arms) In worst case paralysis(Quadriplegia)the person could move only his eyes. The head movement or voice based wheelchairs will not hold good in that situation. So an eyeball movement based wheelchair would help the best for those people. This would be more accurate when compared to other automated wheelchairs because in voice controlled wheelchair ,addition of noise due to outside environment leads to inaccuracy .For head movement based wheelchair human effort is required. So an iris controlled or eyeball detection wheelchair would be the best option. We implement this using Raspberrypi (with OpenCV Python),camera and driver motors**

***Index Terms*— Quadriplegia, RaspberryPi, Wheelchair, OpenCV**

I.INTRODUCTION

In this paper, a method for eyeball localization is proposed for controlling wheelchair.an algorithm is furnished with various processing steps and develops an efficient system to reduce both the cost and the computational complexity .Primary goal was to detect eyes in real-time and also to keep track on it, so a study of the physical properties of the pupil and eyes was done and also pixel values of the nearby locations were analyzed. Localization of eyeball is use form any applications and there are many algorithms developed which can easily provide the desired result. However all these algorithms can be executed on a controller with limited RAM speed and hence it became mandatory for us to develop an algorithm specific for this application and it is detailed in this paper. Secondary goal was to make hardware assembly which can take command outputted from detected eyeball location. This in turn leads us to a fully automated wheelchair for the physically challenged people mounted with gear box, motor and power supply. In the end, it was an integration of various modules and other add-on features assembled on the wheelchair which can make it more affordable and viable to the people. Conceptualization and implementation of this project was aimed keeping in mind the larger welfare of the human society. In our system we have used Harr Cascade classifier. In this system the eyeball is detected with reference to the coordinates of the face and the eyeball can be located accurately by using geometrical technique and statistical analysis which prevents the unwanted detection of resembling features of the face to the eyeball.

II. DEVICEDESIGNING

A. *Stage One – Eyeball Detection and image conversion*

Eyeball is basically black in color.So if we count the numbr of black pixels in the eye, based upon the number of black pixels in the eye we can decide in which direction, did the person move his eye. For this to be done, we need to give the image of the person's eye as an input to our code. Hence we use a camera that is compatible with raspberry pi which captures the person's image and send the eye image to the raspberrypi. The image which is captured, is color image. Computing a color image is a bit difficult task because, there are more number pixels in it. As such we convert this color image into binary image i.e; black and white image, using color spaces in OpenCV. We first, convert the color image into grayscale image using colorspaces. Grayscale image is nothing but shades of black and white, so we use thresholding to get a binary image. When the eyeball is converted into grayscale image , it would definitely be darker shades of grey, because, eyeball is the darkest region in any human eye. Now, we fix a threshold value that is nearer to zero, because black pixel value is zero. All the pixels that are greater than this threshold value are converted to white and the pixels whose value is less than or equal to this threshold value is converted to black.

Fig. 1. Pi-Camera v2 5MP

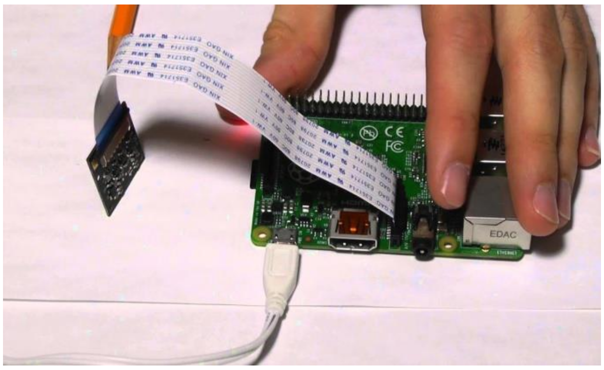

Fig. 2. PiCamra with RaspberryPi

B. Stage two – Image division

Now,we divide the image into 3 vertical sections.We count the number of black pixels using our python code.If the number of black pixels are more on the right section then we must move towards right.If the number of black pixels are more on the left section then we must move towards left.If the number of black pixels are more in the middle section then we further divide the image into 3 horizontal sections.

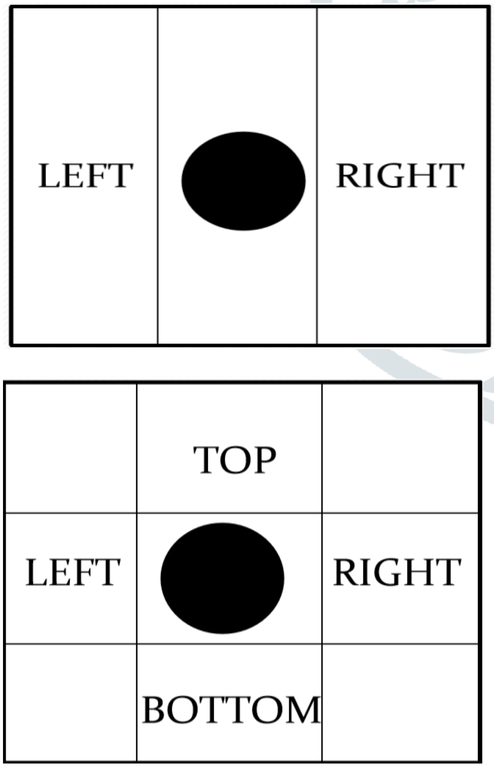

Fig. 3. Diagrammatic representation of image divison

We count the number of black pixels in each section using our python code.If the number of black pixels are more on the top section then we must move forward.If the number of black pixels are more on the bottom section then we must move backward.If the number of black pixels are more in the middle section then we stop the chair.

C. Stage three – Sending the dc motor logic from raspberrypi using L293D

L293D is a driver motor IC that operates on based on the principle of H-bridge circuit. A H-bridge circuit has 4 switches connected parallel to a power supply .In between the parallel connetion we hav a motor.If S1 and S4 are ON then motor rotates forward, if S2 and S3 are On then motor rotates backward.

Fig. 4. Simple H-bridge circuit.

We connect the dc motors to L293D driver motor IC which is in turn connected to Raspberry pi GPIO pins. If we give HIGH-LOW as input to motor it moves forward, if we give LOW-HIGH as input to motor it moves backward. Since we require turning movement we use two dc-motors.

10 10- Forward 01 01-Backward
01 10-Right 10 01-Left

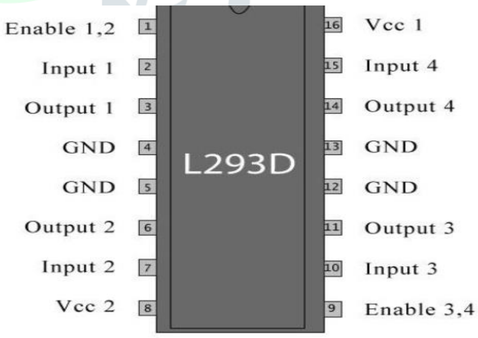

Fig. 5. Pinout description of L293D driver motor IC

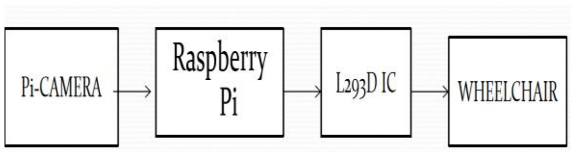

Fig. 6. Block diagram of the system

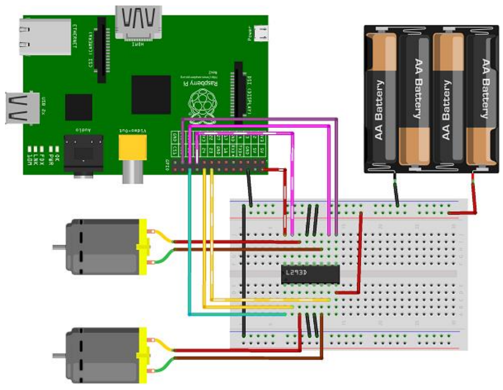

Fig.7. Circuit Diagram of DC motor

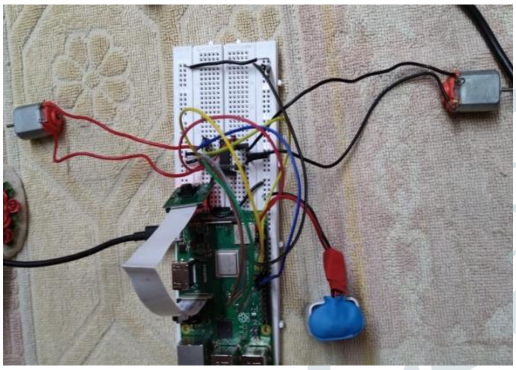

Fig. 8. Prototype of the system

III. RESULTS

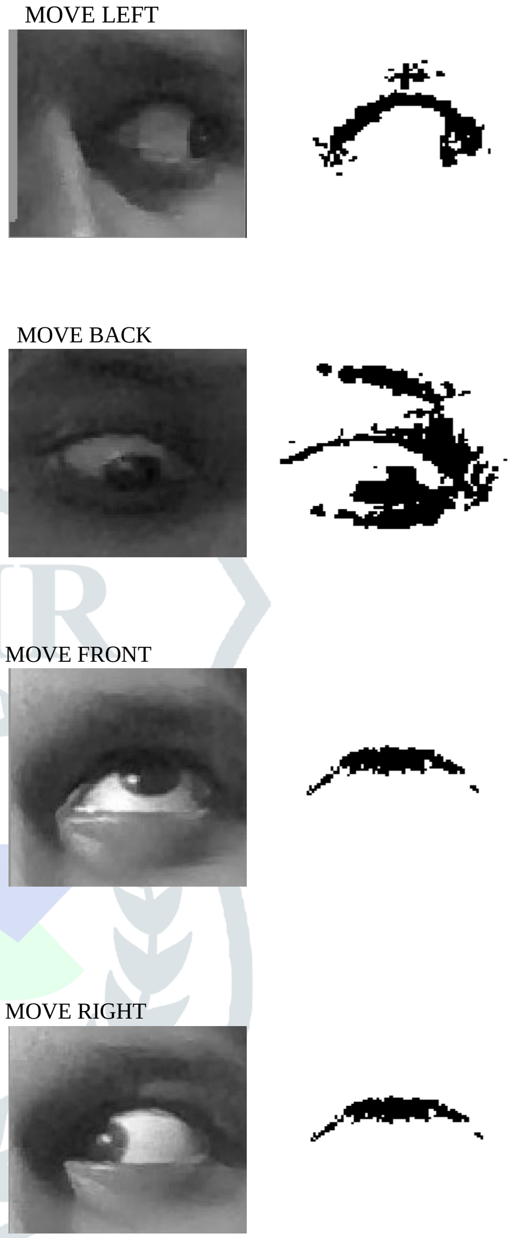

Fig. 9 Grayscal and Binary images along with directions

IV. Conclusion

In this project a specific technique to design an automated wheelchair through eyeball detection for the physically challenged individuals is presented. The result obtained is suitable for driving the wheelchair smoothly for any physically impaired person of any age. That is by moving the eye in the specific direction, the wheel chair will be moved in the desired direction.The output obtained will also be accurate as we are capturing every frame of the eyeball and then counting the pixels in each

References

[1] Microsoft Research patents, http://www.engadget.com/2010/01/03/microsoft-research-patents controller-free-computer-input-via-em/.

[2] Culpepper, B.J, Keller, R.M: "Enabling computer decisions based on EEG input", IEEE Trans on Neural Systems and Rehabilitation Engineering, 11, 354-360, [2003].

[3]United States Patent, http://www.freepatentsonline.com/4677569.html.

[4] David L. Jaffe: "An ultrasonic head position interface for wheelchair control", Journal of Medical Systems, 6, 4, 337-342, [1982].

[5] K. Abe, S. Ohiamd M. Ohyama: ”An Eye-gaze Input System based on the Limbus Tracking Method by Image Analysis for Seriously Physically Handicapped People”, Proceedings of the 7th ERCIM Workshop ”User Interface for All” Adjunct Proc., 185-186, [2002].

[6] http://www.creact.co.jp/jpn/por.pdf

[7] Kuno, Yagi, Fujii, Koga, Uchikawa ”Development of the look input interface using EOG”, the Information Processing Society of Japan paper magazine C39C5, 1455-1462, [1998].