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Design of Wheelchair for Physically Challenged People Based on Eye Movement Detection Using Image Processing

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Abstract

The number of Paralyzed or Physically handicapped people is increasing day by day. People who have the ability to move on their own are very valuable. However it is sometime difficult for a person with physical disability. They have lost their self-confidence. There are many wheelchairs available in the market but the proposed system present a low cost and real time solution so anyone can use it. The main objective of this system is to create wheelchair for physically handicapped people to move their wheelchair independently through the movement of eyes. The proposed system helps handicapped person to gain their self-confidence and will definitely help them to be a more independent. The proposed system initialized with camera. Viola-Jones algorithm is used for face detection. Eye movement is performed on MATLAB. MATLAB is communicating with PIC microcontroller using RF communication.PIC relays the control signal to L293D. L293D rotate the DC motor and direction display on LCD.

Keywords: Physically Handicapped People, Image Processing, MATLAB, RF Communication, PIC Controller, LCD, L293D Motor Driver, DC motor.

I. INTRODUCTION

The number of paralyzed or physically handicapped people is increasing day by day. Due to which people have to depend on others and loss their spirit. They have to suffer a lot and also their near ones face lots of problem. People that have the ability to move on their own are very valuable. However it is sometime difficult for a person with physical disability. The main objective of this system is to create wheelchair for physically handicapped people to move their wheelchair independently through the movement of eyes. An eye movement controlled wheelchair designed for physically handicapped or paralyzed People. Through a wheelchair one can easily move right, left, and forward or Reverse with the movement of eyes. This system can be a life changer thing that can be very useful to them to gain some self-confidence.

Presently Wheelchair became more important for elderly people and disabled People. There are many types of wheelchair available in the market. In order to help physically handicapped people or paralyzed people eye movement based wheelchair system came into existence. Scientist Stephen W. Hawking is perhaps the most well-known victim of major paralysis; they used a wheelchair to move. Many of those who are physically handicapped or suffering from paralysis, they can control their eye movement and controlled their wheelchair using eye.

In this proposed system Voila-Jones Algorithm is used for face and eye detection. Viola-Jones algorithm was designated for face detection though it is used for all sorts of object detections. Good

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detection, Robust, High detection rate, Real time algorithm, For face detection are the advantages of Viola-jones Algorithm.

II. LITERATURE REVIEW

Researchers have applied many technologies to eye controlled wheelchair, which has acquired significant relevance in the domain, is becoming an important research and development topic. In previous papers various techniques were proposed for eye controlled wheelchair such as coherence algorithm, Circular Hough transform algorithm which is discussed below.

Finding in studies suggests that System is enabled by voice control. Once enabled, it processes consecutive frames from the webcam to detect the direction of eye movement. A signal is sent to the Raspberry Pi microcontroller to turn the motor in the desired direction. Detection is done by Pupil monitoring using contours. Blink detection is carried out using two method, SURF and Harries corner and facial landmark. In this system voice control is achieved on Raspberry pi with the help of Google Assistant SDK [1]. The system used the novel methodology to segment the iris utilizing a combination of machine learning and image processing. The main objective of this paper is to perform iris segmentation [2].

On other study, The Author designed Eye Tracking Interfacing with Embedded system is for the people who are suffering from the Spinal cord disease and who are physically disabled with the chronic disease. The main functioning of this wheelchair is just by moving of eyes, that the people can control their wheelchair without depending on the caretaker. In this model all the sensor system is connected to the Arduino [3].

Currently, Coherence algorithm is used to detect the eyes. The eye blinking algorithm is used to control the starting and stopping of wheelchair. The heart beat sensor control the heart beat values, whenever the heart beat values crosses a threshold value, then a buzzer is activated and a call is made to concerned person using GSM [4]. The system designed using raspberry PI and IR camera module. OpenCV is used for image Processing and python used for programming the Raspberry Pi. The proposed system consists of the two modules: Iris detection algorithm and threshold algorithm [5].

In this study, webcam capture the eye images and send the signal to Raspberry Pi. The webcam is connected to raspberry Pi. The Raspberry Pi also communicates with other modules like wheelchair module, appliance controlled module, SMS manage module as well.12v DC motor electric wheelchair is used in this system. Hough circular Transform algorithm is used for eye ball detection in this system [6].

Recursive circular Hough Transform is used for pupil movement detection. In this system, continuous video is captured and the video data is sent to the Pc for processing via Bluetooth [7].

The purpose of the system is to make a low cost and real time solution for physically handicapped people. A dummy wheelchair equipped with camera and controlled using MATLAB. Viola-Jones Algorithm is used for Face detection which decodes iris movement. The drawback of this system is that, you have to carry laptop all the time [8].

One of the paper, patients sitting on the wheelchair and look at the camera. The wheelchair moves with the movement of eyes in a particular direction. MATLAB monitored the signals from camera which will help to give command to motors [9].

In another study of paper, the concept is to apply eye movement to control home appliances, wheelchair and send SMS to caretaker. The system comprises four components including image processing module, home appliances controlled module, and Wheelchair controlled module and communication module. Circular Hough transform is used to detect circles. The drawback of this system is a webcam that attached on eyeglass is large size [10].

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III. PROPOSED SOLUTION

A. Block Diagram

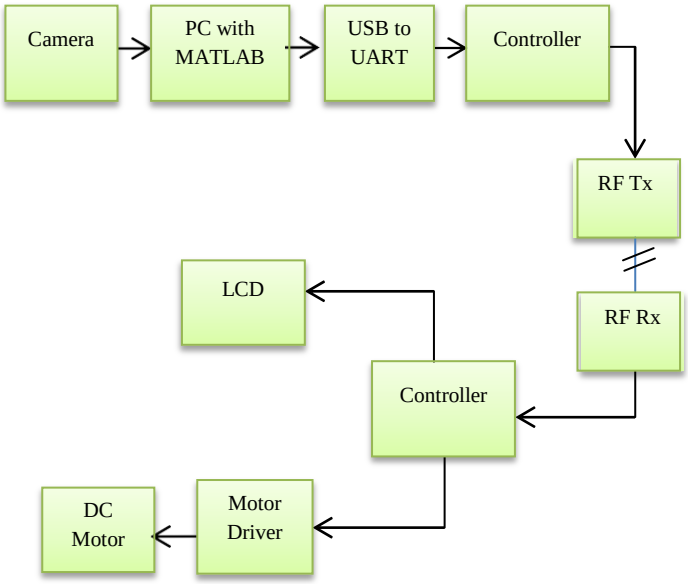

Figure1. Block Diagram of Proposed Work

In the proposed framework camera takes snapshot of face from live video. Face will be detected using Viola-Jones object detection algorithm and also detect the region of eyes within the photo frame. The photo frame converted into black and white image. After that, crop the photo and captured the eye region only. At that point algorithm will created to detect right and / or left eye movement. Brought command will be mapped into the semi-circle space and corresponding direction of movement will be recognized. Command corresponding to the direction will be transmitted over RF based communication system. RF will receive the data transmitted from other side of the system and provide that data to the controller. Motors will be driven as per the received command using Motor driver IC interfaces with controller.

B. Proposed Algorithm

1. ***Initialization:***
   Initially set up the transmitter and receiver circuit for the interfacing between MATLAB and controller, video capturing and send data.

2. ***Video capture and Face Detection:***
   Now, take continues video and converted into frame. Each frame is converted into black & white Frame. Using which we can detect face and eye region only.

3. ***Eye Extraction:***
   Now, after converting each frame into black &white image, try to detect eyes. Apply algorithm for eye movement.

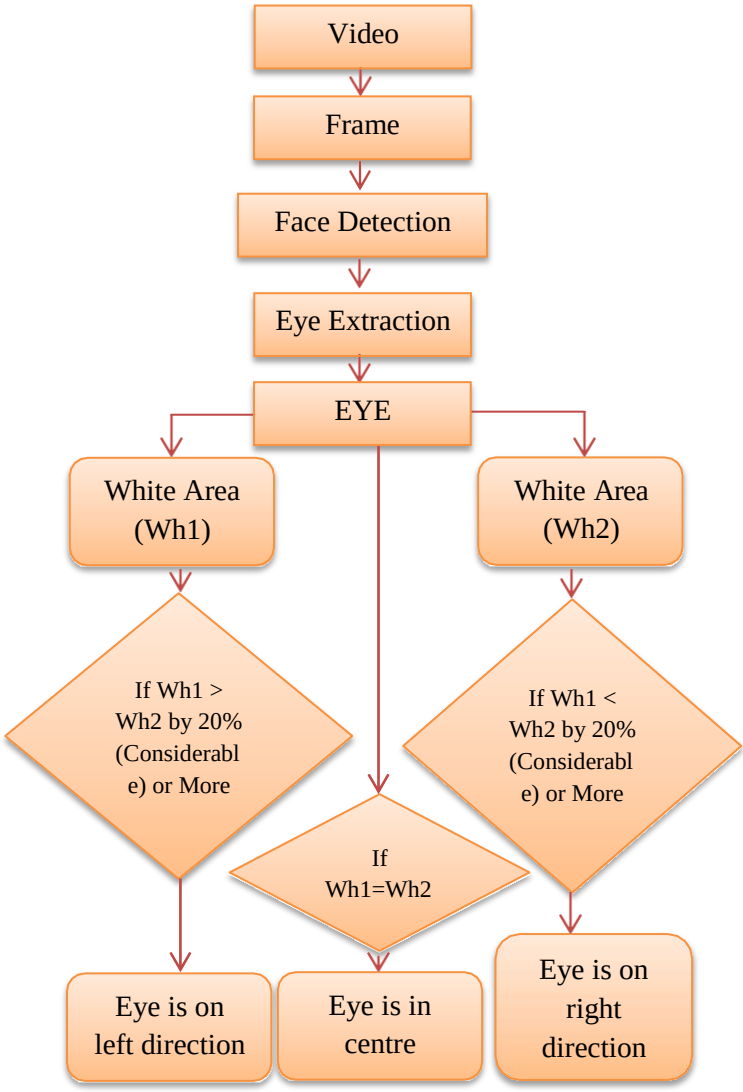

Figure2. Proposed Algorithm

4. ***Movement Detection:***
   After detecting the eye movement, make a decision to drive motors accordingly. The idea is to black & white frame divided into two parts: first part white pixels Wh1 and second part whit pixels Wh2. Now if Wh1>Wh2 by 20%

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(Considerable)or more, eye is on left direction else if Wh1<Wh2 by 20% (Considerable)or more eye is on right direction. If Wh1=Wh2, eye is on Center.

- Left Movement: If the patient eyes turn left, the wheelchair will go left.
- Right Movement: If the patient eyes turn right, the wheelchair will go right.
- Forward: If the patient looks forward, the wheelchair will go forward.

5. ***Eye blink****:*

In proposed system, eye blinking used for start and stop the wheelchair. In case of emergency, the patients can blink eyes, and can stop the wheelchair.

6. Serial communication:

According to detected command, the MATLAB software will transmit like 2,3,4,5 for Forward, backward, left and right respectively to the controller which will drive the motors.

IV. HARDWARE DESIGN

The system contains four main parts:

1. A webcam that mount on patient's head and laptop for movement of patient's eyes.
2. RF transmitter Circuit and RF receiver Circuit.
3. L293D motor Driver which can control 4 DC motor.
4. LCD which is display the direction.

A four wheel differential drive has been used as dummy wheelchair. Motor Driver Circuit is connected with this dummy wheelchair which is driving the DC motors as per the directions. The Camera will mount on the patient's head. The Hardware prototype is shown below.

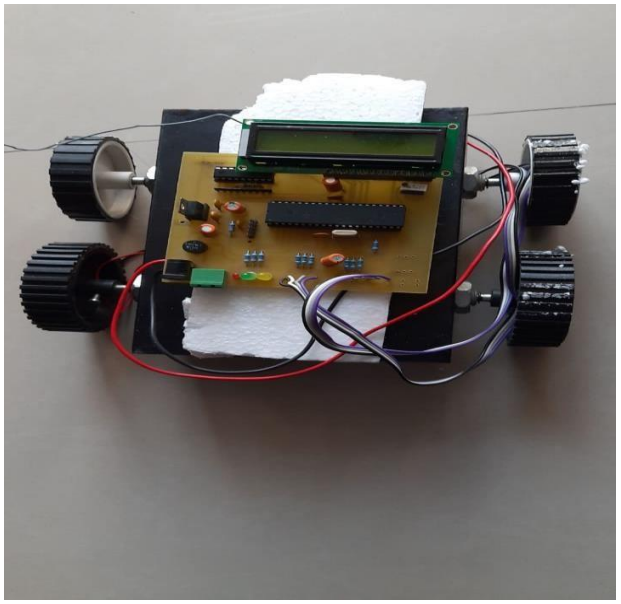

Figure3. Hardware Design

V. RESULTS

These are the results for forward direction, Left Direction and Right Direction. The direction is displayed on LCD.

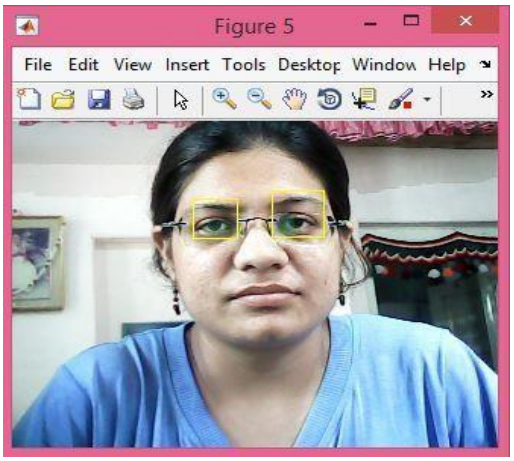

Figure 4. Forward Direction

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Figure 5. Left Direction

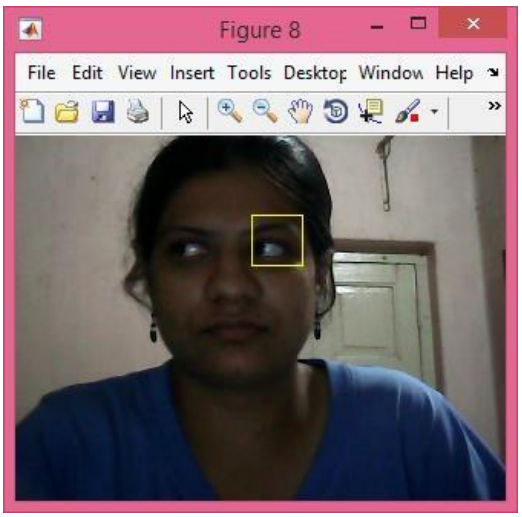

Figure 6. Right Direct

This project has been done with live video. It Might not work in certain lightning condition. The performance accuracy is around 85-95%. The results are testing after 50 Attempts of the many people.

Name	**Left Direction**		
	Attempts	**Successful**	**Accuracy**
Farhana	50	45	90%
Riddhi	50	43	86%
Maulika	50	48	96%

Name	**Right Direction**		
	Attempts	**Successful**	**Accuracy**
Farhana	50	46	92%
Riddhi	50	42	84%
Maulika	50	44	88%

Name	**Forward Direction**		
	Attempts	**Successful**	**Accuracy**
Farhana	50	42	84%
Riddhi	50	48	96%
Maulika	50	45	90%

Table1. Comparison Table

VI. CONCLUSTION

This Paper gives a novel methodology for eye controlled wheelchair. An eye movement controlled wheelchair designed for physically handicapped or paralyzed People which gives 85-95% accuracy. Through a wheelchair one can easily move right, left, forward or backward with the movement of eyes. This system consists of digital camera, MATLAB, Motor L293D, PIC controller, LCD, RF module. The proposed system helps handicapped person to gain their self-confidence and will

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definitely help them to be a more independent. It might not work in certain lightning condition. This paper presents cost effective system for physically handicapped persons.

REFERENCES

[1] *Reshma Abraham, Ritta Maria Thaliath, Swapna Davies. "Eye Controlled Wheelchair with Asthenopia." Ernakulam, India: Proceedings of the Third International Conference on Electronics Communication and Aerospace Technology, 2019.*

[2] *Sudhir Rao Rupanagudi, Varsha G Bhat, Shreya K. Gurikar. "A Video Processing Based Eye Gaze Recognition Algorithm for Wheelchair Control." The 10h IEEE International Conference on Dependable Systems, Services and Technologies, DESSERT'2019. Bangalore, India, 2019.*

[3] *Shalini Shinde, Sandeep Kumar, Prashant Johri. "A Review: Eye Tracking Interface with Embedded System & IOT." 2018 International Conference on Computing, Power and Communication Technologies. UP, India, 2018.*

[4] *V. Theivapriya, S. Jagatheeshwari, D. Aishwarya "SMART WHEEL CHAIR FOR QUADRIPLEGICS." IEEE. Chennai, India, 2018.*

[5] *Jatin Sharma, Chandan Chakraborty, Anbarasu M, Shanmugasundaram M. "Iris Movement Based Wheel Chair Control Using Raspberry Pi-A State of Art." International Conference on Innovations in Power and Advanced Computing Technologies. Tamilnadu, India, 2017.*

[6] *Nutthanan Wanluk, Aniwat Juhong, Sarinporn Visitsattapongse, C. Pintavirooj. "Smart wheelchair based on eye tracking." The 2016 Biomedical Engineering International Conference. Bangkok, Thailand, 2016.*

[7] *Rakib Hyder, Sayeed Shafayet Chowdhury, Shaikh Anowarul Fattah. "Real-Time Non-intrusive Eye-gaze Tracking Based Wheelchair Control For the Physically Challenged." 2016 IEEE EMBS Conference on Biomedical Engineering and Sciences. Dhaka-1000, Bangladesh, 2016.*

[8] *Prateek Arora, Anmoal Singh Soni, Anshul Sharma, Aman Garg. "Control of Wheelchair Dummy for Differently Abled Patients via Iris movement using Image Processing in MATLAB." IEEE INDICON 2015. New Delhi-110063, 2015.*

[9] *Ms. Humera Mujawar, Ms. Tanaya Patil, Ms. Pooja Patil, Mr. Dinesh O. Shirsath, Mrs. S. S. Sankpal. "Eye Monitored Wheel Chair Control for Physically Handicapped." International Journal of Innovative Research in Computer Science & Technology, Sangli, India, 2015.*

[10] *Aniwat Juhong, T. Treebupachatsakul, C. Pintavirooj. "Smart Eye - Tracking Syastem" IEEE, Bangkok, Thailand, 2018.*

[11] *Shyam Narayan Patel, V. Prakash "Autonomous Camera based Eye Controlled Wheelchair system using Raspberry-Pi" IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems, Chennai, India, 2015.*

[12] *Bharat Thakur, Kush Kulshrestha "Eye Controlled Electric Wheelchair", IEEE, Chandigarh, Panjab, India, 2014.*

[13] *Sreejith. T, Vishnu. J, Gopika Vijayan "Trackball Controlled Novel, Cost Effective Electric Wheelchair", International Conference on Control, Power, Communication and Computing Technologies (ICCPCCT), kerala, India, 2018.*

[14] *Priyanka Khelbude, Sushama Shelke "Real Time Iris Based Robot", 2016 Conference on Advances in Signal Processing (CASP)Cummins College of Engineering for Women, Pune. Jun 9-11, 2016.*

[15] *Jeet K. Desai, Lifford Mclauchlan "Controlling a Wheelchair by Gesture Movements and Wearable Technology, 2017 IEEE International Conference on Consumer Electronics (ICCE), USA, 2017.*

[16] *Vikash Raj, Sourabh Ranjan, Mrinal Shekhar Puri, Nitish Kumar, Dr. H. C. hrinivasaiah "Eye-monitored wheel chair prototype", International Journal of Advance Research, Ideas and Innovations in Technology, Bangalore, Karnataka, 2018.*