Automatic Eye Controlled Based Wheelchair System Using Raspberry Pi

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Abstract- *The purpose of this paper is to build an eye controlled electronic wheelchair for the disabled person.The purpose of this eye controlled wheelchair is to eliminate the assistance required for the disabled person. In this system controlling of wheelchair is depend on eye movements. Camera is mounted on wheelchair in front of the person, for capture the image of eye and tracks the position of eye pupil by using some image processing techniques. According to eye pupil position of user, motor will be move in required direction such as left, right and forward. This paper is very useful for the people who are completely paralyzed as well as elderly to make their life more accessible. Person who are unable to walk and are using wheelchair exert great amount of energy using physical strength to turn the wheels. Disabled would save energy and could use their hand and arm for other activities.*

Keywords- open sourcecomputer vision,obstacle sensor, raspberry pi, C&C++, USB camera,face detection, Pupils detection PCA.

I. INTRODUCTION

As we know every year many people partially or fully handicap with accident or other phenomena but for this conventional wheelchair are manually driven. This making those people dependant to others. This inconvenience can overcome by this system. People who are completely paralyzed they can concur there movement with eye gesture it reduces physical strength to turn wheel. movement based commands by the user. DC motors which are connected to Raspberry Pi and wheel chair helps

II. LITERATURE REVIEW

Person who are unable to walk and are using wheelchair exert great amount of energyusing physical strength to turn the wheels Disabled would save energy and could use hand and arm forother activities.

Currently there are different eye based method will be used for controlling wheelchair such as EOG, ECG, EEG based, Eyeball sensing method [1][2][3]. Voice activated power wheelchair system, which works properly when user speak the command clearly, according to it left, right, forward, back and stop. Other voices which come from surrounding user may affect the system [4].

The head movement based system and chin control based system, bad movement gives problem [5] [6] [3].

Infrared reflection based eye pupil detection system provides accurate detection of eye pupil centre location. But the infrared radiation affects the eye and people may loss the eye visibility [7].

III. PROPOSED SYSTEM

In order to implement Automatic Eye Controlled Based Wheelchair System based on raspberry pi, we need a list of materials which is briefly mentioned below:

Hardware: Raspberry Pi 3 Model B, Logitech C310 Camera, obstacle sensor, DC motors, wheelchair kit.

Software: Open CV, xrdp server and Viewer, SQ lite, C&C++.

Camera is used to capture the image in real time based on face, eye and eye pupil detection with minimum delay of time and analyze the image as input to set the commands to interface the motor driver I through sending the command to GPIO pins, to perform the different operation such as left, right, forward and stop. Image processing open computer vision (openCV) library is used for face and eye detection.

The proposed Smart security system is divided into blocks Camera, Facedetection, Pupils detection its direction, direction unit, obstacle Unit, Raspberry pi, DC Motor, wheelchair system

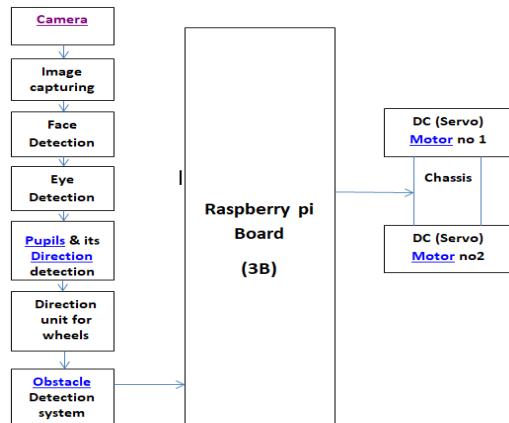Figure.1 shows the block diagram of proposed system

Figure 1-System Architecture

IV. HARDWARE DESCRIPTION

A. Camera

Camera captured the image in real time based on face, eye and eye pupil detection with minimum delay of time and analyses the image as input to set the commands to interface the motor driver to perform the different operation such as left, right, forward and stop.

B. Raspberry pi

Raspberry pi board is brain of the system. Raspberry pi board have its own operating system is known as raspbian which is Linux based operating system and compatible with raspberry pi board. A real time data receive and determine the digital data by raspberry pi B+ model board, which is very efficiently work with the multiple images. Raspberry pi sends the command to motor driver which is enabling the GPIO pin to raspberry pi.

C. Obstacle Sensor:

It is used to detect obstacle in path of robot i.e. when obstacle is in path of robot obstacle sensor stop the robot i.e. it prevent accident. The range of Obstacle sensor is approximately 10cm-30 cm.

D. DC Motor

Two 12V DC motor is used in project to demonstrate running of wheelchair in forward, reverse, left and right direction. L293D motor driver is used to interface with raspberry pi which is TTL compatible. Two H bridges of L293D can be connected in parallel to increase its current capacity to 2 Amp.

V. SOFTWARE DESCRIPTION:

Here we are using Linux operating system. In Linux OS, kernel software is the heart of these Linux OS and it is used for interface between the user and hardware.

C is a natural choice to program in on the Raspberry Pi. It's very powerful, usable on virtually all hardware platforms and really similar to lots of other programming languages such as Java, PHP, C# and objective C. As popular programming languages go its as powerful as it gets, with only assembler beating it in terms of programming to the bare metal of a hardware platform. It's also what Linux itself is written in.
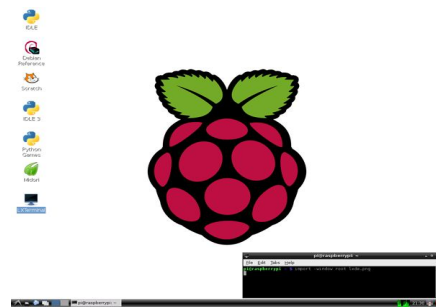

Figure2- Software icons in Raspberry-pi B+ processor shown at desktop

Here we largely focused on programming in C and C++ and we typically do this running on the Raspbian operating system. Once we start using some of the higher level features of C++ we can cause problems by also using straight C, but by the time we are comfortable doing that you should have learnt enough about the language to avoid those sorts of issues so don't worry about it at the outset.

VI. IMPLEMENTATION

A. Accessing Raspberry pi from remote access control
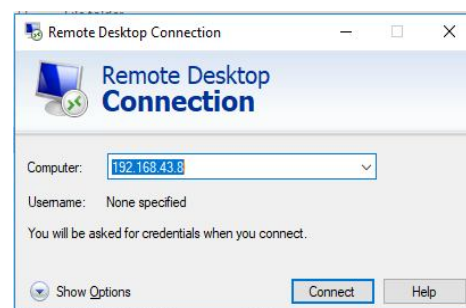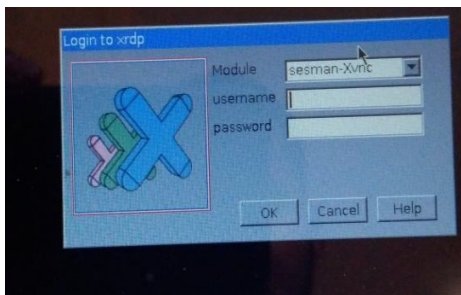
Figure 3: Login to xrdp

As Automatic eye control base wheelchair system consist of eye moment on basis of eye moment wheelchair will move or turn automatically and automatic wheelchair access control system we need to access raspberry pi from remote Desktop connection. Following task can be achieved by accessing raspberry pi from remote location Accessing database, Adding or removing user from database, seeing previous alerts, seeing current status of system. All this can be achieved using xrdp server

xrdp has long been the best way to access any computer remotely on the same network. Recently, xrdp Connect came out to make it easy to access your Raspberry Pi from anywhereusing a cloud connection and port forwarding. Once it's set up, we can access our Raspberry Pi's graphic interface from any other computer or laptops using the xrdpViewer app

B.   DESIGN METHODS

In proposed system the wheelchair is controlled with the help of face& eye detection .the input to wheelchair is given by camera is attached on elevated rod & camera is oriented in way to capture the face & eye of the user.the camera is further interface to the raspberry pi controller.

The proposed system has divided in to two parts. The face detection is achieved by using haar cascade & eye &pupils detection is done with the help of hough circle method.

A .face detection: Existing facial databases cover large variations including: different subjects, poses, illumination, occlusions etc. However, the provided annotations appear to have several limitations.
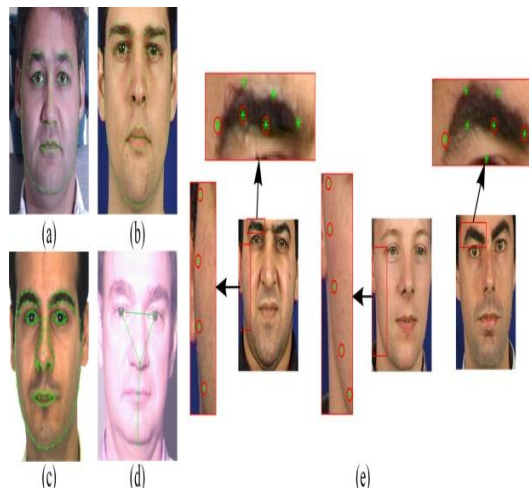
Figure4 – Face detection algorithm

The majority of existing databases provide annotations for a relatively small subset of the overall images.The accuracy of provided annotations in some cases is not so good (probably due to human fatigue).

The annotation model of each database consists of different number of landmarks.

B . Pupil'sdetection:

The pupil center coordinates are detected by using model-based approaches [12]. Model-based approachesdo not explicitly detect features, but rather find the best fitting model that is consistent with the image [12]. In our case, the HT is used to find the best-fitting circle for the eye pupil contour.

The hardware component of this pupil detection technique uses a head-mounted eye-tracking system, which consists of an infrared webcam mounted on frame glasses right underneath the eye, and a PC for image acquisition and processing. In order to improve eye pupil detection, the dark-pupil technique has been implemented. The result of the infrared illumination is that the pupil is clearly demarcated as a bright regiondue to the photo reflective nature of the back of the eye [12].
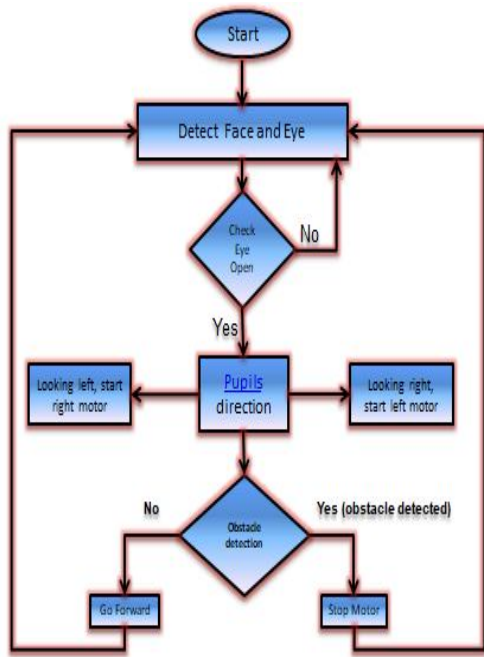
Figure 4 .Flowchart

Here for avoiding accident we have use obstacle detection sensor i.e. when any obstacle comes in to picture wheelchair (motor) will be automatically stop author wise it goes forward direction.

The obstacle detection sensor is used to avoid accident .when obstacle detects wheelchair will automatically stops.

C) Results

Here we obtain result shown as follows. In this output window display the position of wheelchair according there eye position. When obstacle comes in to the path of wheelchair become automatically stop. The obstacle sensor used to avoid or prevent accident .xrdp is used for online communication between machinei.e laptop & raspberry pi.
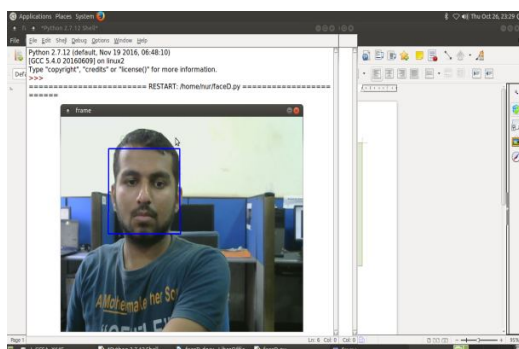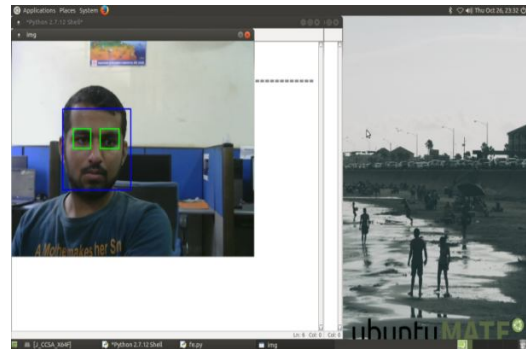

Figure5 - Face detection
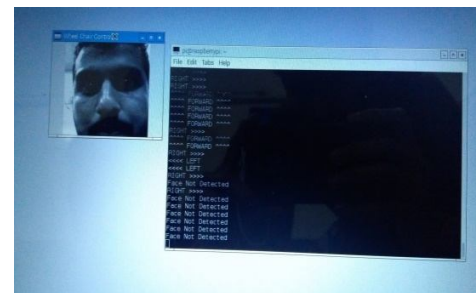

Figure6-Eye Detection

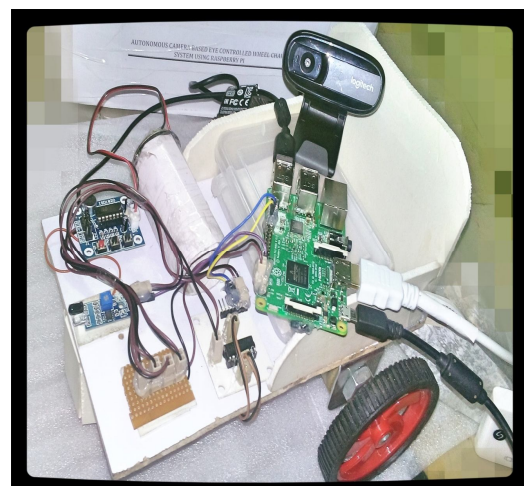**Figure7**-Pupils detection with direction

Figure 8-Hardware System

VII. CONCLUSION

Hence by using An Autonomous Camera Based Eye Controlled Wheel Chair System Using Raspberry-Pi is to eliminate the assistance required for the disabled persons.

With this solution, this project is very useful for the people who are completely paralyzed as well as elder people to make their life more accessible.

VIII. FUTURE SCOPE

This project can be extended by introducing GSM service to send messages for caretaker of disabled when obstacle is detected, Use more web cameras gave resources possible that allow the user to look at user "backward control" to see behind them as they go forward, During at dark nights, the tracking of eye pupil is some complex, So using of flash light USB webcam the eye controlled wheel chair works efficiently at night times also.

REFERENCES

[1] Eye Controlled Wheel Chair Using EOG, Alex Dev, Horizon C Chacko and Roshan
Varghese, International Conference on Computing and Control Engineering (ICCCE
2012), 12 & 13 April, 2012.

[2] Peng Zhang, Momoyo Ito, Shin-ichi Ito, Minoru Fukumi, ―Implementation of EOG
Mouse using Learning Vector Quantization and EOG-feature based methods‖, IEEE
Conference on Systems, Process & Control (ICSPC), dec.-2013, SPC.2013.6735109.

[3] D. Hareesh, R. Raja kishor, K. Satyavathi, ―Sensor based automated wheelchair‖,
International research in computer and communication technology, Sept. 2013.

[4] R. PuriarasiMrithaRamalingam, ElanchezhianChinnavan, ―Low cost self-assistive
Voice controlled technology for disabled people‖, International journal of modern
engineering research vol.3, Jul-Aug 2013

[5] Lee W. O, Lee H. C, Cho C. W, Gwon S. Y, Park K. R, Lee H, Cha J (2012) Auto
  - focusing Method for Remote Gaze Tracking Camera. Optical Engineering. 51:
063204-1- 063204-15.

[6] Automation of wheelchair using ultrasonic and body kinematics, PreethikaBritto,
Indumathi.J, SudeshSivarasu, Lazar Mathew, CSIO Chandigarh, INDIA, 19-20 March
2010.

[7] Kohei Arai, Ronny Mardiyanto, ―Eyes based wheelchair control system‖,
International journal of advanced computer science and applications, vol.2, 2011

[8] Sarangi, P., Grassi, V., Kumar, V., Okamoto, J.:"Integrating Human Input with autonomous behaviours on an Intelligent Wheelchair Platform", Journal of IEEE Intelligent System, 22,2, 33-41, [2007].

[9] Matt Bailey, ET. Al, "Development of Vision Based Navigation for a Robotic Wheelchair", in Proceedings of 2007 IEEE 10[th]International conference on rehabilitation robotics.

[10] Shafi. M, Chung. P. W. H:"A Hybrid Method for Eyes Detection in Facial Images", International Journal of Electrical,Computer, and Systems Engineering, 231-236, [2009].

[11] Automation of wheelchair using ultrasonic and body kinematics, PreethikaBritto, Indumathi. J, SudeshSivarasu, Lazar Mathew, CSIO Chandigarh, INDIA, 19-20 March 2010.

[12] Dongheng Li, David Winfield, Derrick J. Parkhurst, "Starburst: A hybrid algorithm for video-based eye tracking combining feature-based and model-based approaches", Human Computer Interaction Program, Iowa State University,