# Review on Eye Gaze Wheelchair

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*Abstract*— A novel technique is implemented for the eye controlled based independent and cost-effective system. The purpose of this Eye Wheel is to eliminate the necessity of the assistance required for the disabled person based on the movement of his eye and it provides great opportunity for the disabled to feel independent accessible life. The implemented system will allow the disabled person to control the wheelchair without the assistance from other persons. In this system controlling of wheelchair is carried out Based on Eye movements. The camera is mounted in front of the user, to capture the image of any one of the Eye (either left or right) and track the position of eye pupil with the use of Image processing techniques. According to the position of the eye, wheelchair motor will be directed to move left, right, forward and backward. In addition to this, for the safety purpose ultrasonic sensor is mounted in front of wheelchair to detect the obstacles and automatically stop the wheelchair movement.

***Keywords:*** novel technique, Eye gaze wheel, Raspberry

## I. INTRODUCTION

The Wheelchair is dependent system used by elderly and physical disable persons. As per requirement of the disabilities different kind of automatic systems are available in market such as voice control or joystick control system. Sometime for totally paralysed person it may be very difficult to use that type of systems. Here the Eye control system provides the independence to make their life easy and more convenient.

It saves huge amount of energy or external manpower. Camera captures the image in real time and analyses the image as input to set the commands for interface the motor driver IC through sending the commands to GPIO pins. The motor driver circuit is used to perform the different operation such as left, right, forward, backward and stop. For the advance level of Image Processing open computer vision library is used for Face and Eye detection.

Several application and algorithms are used to find out accurate pupil location detection and tracking of that. One of them is Haar cascade like features detection algorithm used to detect single or multiple face and detection of both eyes, to detect the exact eye pupil and locate its centre point is goal of this system. For automatically finding of Eye pupil and tracking eye pupil many computer vision libraries of Image processing are used like object detection, motion detection, image colour conversion, edge detection, pattern matching etc.

But they have their own limitation. In ECG, EEG and EOG sensor-based eye pupil detection technique, voltage variation-based output assumed to decide the location of pupil. For different user, different output voltage will be generated, which will result faulty location of the eye pupil. In head movement-based system, user cannot access the system physically.

Whereas, voice activated power wheelchair works properly, when user speaks the Command system works according to it like left, right, forward, back and stop. But a noisy environment distracts the system, and system cannot respond properly. The infrared reflection-based eye pupil detection system provides accurate detection of the eye pupil, centre location, as well as system can track the eye movement. But the infrared radiations affected the eye and user May loss the eye visibility.

Therefore, an effective camera captured image-based eye pupil detection and tracking system is introduced. This is efficient as well as cost effective system. Here real time video image capturing based on Face, Eye and Eye Pupil detection with minimum delay of time is used. The system includes multistage mainly to track the Eye pupil centre. This is efficient as well as cost effective system. Here real time video image capturing based on Face, Eye and Eye Pupil detection with minimum delay of time is used.

It is a novel Eye tracking technique, which captures the image and detects the presents of human face. After detecting the face, it detects area of the eye location on the face detected image and performs several operation of basic image processing like colour image to grey conversion, filtering, threshold, pattern matching, noise reduction and circle detection on it.

The Raspberry pi board is used to perform the control of the complete system operation. Digital Image processing-based output signal is sent to the Raspberry pi board. The Raspberry pi acquires the data and analyses it. Raspberry pi sends the control signal to motor driving circuit based on the location of eye pupil. This will decide to perform operation on motor like run the motor in clock vice direction, antilock vice direction and stop the motor. In a Wheelchair two individual motors are embedded on each wheel. The Ultrasonic sensor is also mounted on the wheelchair for detection of any static or mobile obstacle. If sensor gets the obstacle very close to the wheelchair, it will indicate raspberry pi and raspberry will send the signal to motor driving circuit to stop the motor.

## II. RELATED WORKS

Related works have been taken up for the development of smart wheelchair some of them are shown below:

Smart wheelchair based on eye tracking is designed for people with locomotor disabilities. The system consists of four components imaging processing module, wheelchair controller module, SMS manager module, and appliance controller module. Webcam captures the eye image and sends the signal to Raspberry pi for digital image processing based on open CV library to drive the 2-D motion direction of eyeball and also it communicates with other modules. Arduino is used to receive ON-OFF command from Raspberry and send command to remote Arduino to turn relay ON-OFF accordingly. The command is used to control the

 

bidirectional servo control unit to control the motion of wheelchair in any direction depending on motion direction of eyeball [1].

For persons with motor impairments due to diseases, such as amyotrophic laterial sclerosis (ALS) a novel system is proposed so that it enables a person with motor disability to control a wheelchair via eye-gaze and to provide a continuous, real-time navigation in unknown environment. The system consists of a premobile wheelchair, eye tracking glasses, a depth camera to capture the geometry of the ambient space, a set of ultrasound and infrared sensors are used to detect the obstacles with low proximity, a laptop placed on a flexible mount for maximized comfort, and a safety off switch to turn off the system whenever needed. A novel system algorithm supports continuous, real-time target identification, path planning and navigation in unknown environment [2].

Human Computer Interface (HCI) have replaced joysticks in powered wheelchair for a person with a disability of the upper body. A system based on gaze detection and recognition are integrated by the fuzzy set theory in real-time for motion control of wheelchair depending on the passenger gaze towards the direction he or she wants to move, the control system automatically calculate the direction of motion and velocity to avoid obstacle in real-time environment [3].

A wheelchair system is completely controlled with eye movements and blinks by using deep convolutional neural network. The head mounted camera capture the image of the eye, the captured image is sent to a computer where the eye images are divided into pixels, by assuming that neighbouring pixels in image carry related information that is pixel which are spatially close are assumed to be collectively for a particular feature. Four frames of images are being captured per second by the mounted camera if a person looks in particular direction for 2 second the wheelchair move in that particular direction or stops the movement [4].

In electric wheelchair controlled by eye movement uses a eye tracer of Tobit which is connected to the wheelchair. Eye tracker identifies position of the pupil by collecting corneal reflection data. Due to different position of light source, they produce a bright or dark pupil effect the two different adjacent control areas is being created form motion control which is reduced by Kalman filter where it reduces the fluctuation range of gazing point and to achieve a purpose identifying the controller area. The signals sent to the computer by a network port and the motion of wheelchair is controlled depending upon the direction of adjacent control area [5].

Smart eye tracking system is designed for people with disabilities and elderly people. Wheelchair movement is mainly based on the eye movement the camera is mounted on the person head which captures the image of the eye and process the image by digital image processing with open source Computer vision (CV). The captured image is transmitted to Raspberry pi microcontroller to drive the wheel chair. The blink is regarded as the enter button on the keyboard to start the movement of the wheelchair. Two servo motor is used to move wheelchair in 2-Dimension and also to automatically stop the movements when there is any obstacles and change the direction of the wheelchair movement [6].

Autonomous camera-based eye-controlled wheelchair system is implemented with Raspberry pi. The principle of this proposed system is mainly eye pupil detection and eye tracking based on computer vision (CV) technology. For detection the eye pupil location several techniques like face detection, eye detection, color conversion, edge detection, Hough transformed, motion detection and object tracking is being implemented. Depending on the pupil position microcontroller sends the message to the motor to control the direction of wheelchair movement. A system started with capturing the image continuously by camera and captured images are processed in Raspbian system and movement is controlled by motor present [7].

A dummy wheelchair is controlled via iris movement using digital image processing in MATLAB. The whole system is divides into two parts, First the eye image is captured continuously by using web camera which is mounted on the helmet the captured image is being processed by using digital image processing where the edge detection technique is being incorporated to calculate the position of iris and also to calculate the distance to be moved in that particular direction. Motor is being incorporated to control the movement Arduino micro controller receives signal from relays via serial communication and generates the appropriate signal to L293D motor driver to run the motor in particular direction which in turn starts the movement of the dummy wheelchair to move in that desired direction without any delay and if there is any obstacle in between the infrared sensors present in the system senses the obstacle and send message to the microcontroller which in turn sends the message to the motor to stop the movement or to change the direction of motion [8].

A simple robotic arm with four degree of freedom (DOF) for people with severe motor skill impairment, such as SMA (Spinal Muscular Atrophy), Cerebral Pasly etc... in order to achieve daily life task. The system is controlled by a cheap embedded platform in order to keep the size and the cost low as possible. A camera captures the surrounding environment and shows it on a display. When the user selects the object to reach (like a button), the robotic arm autonomously carries out the task, using the camera image for position feedback. The end effector has also proximity sensors in order to calculate the distance from the object and other environmental sensors. The brain of the WMRA is an embedded application processor that acquires data from sensors, executes the visual servoing algorithm and drive the servo motors [9].

Intelligent wheelchair are commonly adopted using several non-manual command techniques. Eye tracking is one of such techniques. a simple webcam, placed in front of the user, to detect the users gaze direction of both eyes. A C++ application using OpenCV library was developed. First the user face is detected then; the region of each eye is extracted using Viola and Jones technique. Each eye will be treated as a separate image. To detect user pupil position, the extracted eye images must be converted to gray scale then to binaries images. By using Fuzzy logic-based method, it influences the behaviour of the system by changing at least one input of that system and according to a rule or set of rules that model how

 

the system operates, depending on the position of the pupil the wheelchair rotates accordingly [10].

A power assisting control system with driving assistance using monocular fish-eye vision for electric wheelchair is implemented for highly disabled persons. The fish eye camera is mounted on the front part of the robotic wheelchair to capture the image of eye pupil and direct drive motor for wheel actuators. RT-preempt patched Linux PC and image processing PC are placed under the seat for motor controller. The distance that has to be travelled is calculated based on the optical flow vector (OFV), depending on the optical flow vector calculated from the floor area in the fish eye image the electric powered wheelchair moves from one particular area to another [11].

OPCM model application on a 3-Dimensional simulator for powered wheelchair is designed to the analysis of the powered wheelchair driving task. This paper mainly aims to modelling and analysing the human wheelchair couple using OPCM (optimal preview control module) by using 3-D simulator view the user can calculate the initial speed of the wheelchair and the distance have to be covered using an high tracking system, which allows to compute directly the preview time for the OPCM (optimal preview control module). This allows to get a presided reconstruction of the experimental trajectory for the powered wheelchair driving task. The objective of the user in this paper consists of the collision free trajectory following task at various speeds using a standard joystick and then OPCM outputs a trajectory that should match with the one achieved by the user for a given driving velocity [12].

Performance Analysis of an Electrooculography based on Intelligent Wheelchair Motion Control is designed to control wheelchair motion based on EOG and to analyse the performance of fuzzy logic control. The eye movement signals were classified using the fuzzy classifier (FC). Then, the PD-type fuzzy controller is designed and tested on the wheelchair model, for wheelchair motion control. The wheelchair model system was developed using MSC. Visual Nastran. The eye movement signals that acquired through the EOG technique is acted as a motion input references. The simulation results obtained show that the PD-type fuzzy logic controller designed has successfully managed to track the input reference for linear motion set by the EOG signal [13].

## III. Conclusion

The concept of the eye-controlled wheelchair is not only representing the alternative resources but more important to help physically disabled persons to make their life independent. The aim of implementing an autonomous eye-controlled wheelchair is to high light the features of digital Image processing. There is some real time design constants measured lie a system takes some time (4second) to execute the system for processing the video in Real time Environment.

Therefore, the system performs the Wheelchair movement operation with some delay time. It's very hard to track the Eye pupil in dark light places, so the system works perfect on environmental light and in a room light with fluorescent mercury vapour lights, which is low in infrared.

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