Preparation of Papers for Review by the IEEE Eye Control Wheelchair model (May 2023)

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***Abstract*— This project presents a system to control a wheelchair using the movement of the eye, by detected the eye by using a phone's camera through a mobile application. The eye movement technique is to record the eye movements, then determine the place where the eye movement goes, and after that the chair moves to this point. Example: If a person wants to move forward, he closes his eye and opens it three times in a row to move the one to the right moves his eye to the right and the same breath. The thing to the left and if it wants to stop, it closes its eyes once for two seconds. And this technology aims to serve people who suffer from muscular dystrophy or paralysis diseases to make them able to move and to make them able to communicate with others to improve their psychological state by not leaving him alone in his room because this causes other diseases such as depression, which leads to his death Thus, people who have some kind of severe motor disability would be able to control a wheelchair with the help of this technique, acquiring some autonomy in locomotion. According to the results obtained, this technique was a promising alternative to be considered.**

I. INTRODUCTION

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.[1]Today, many people suffer from many diseases, including muscular dystrophy and paralysis, whether total or half or any part of the body. These people suffer a lot because they are unable to deal with other people, and some of them suffer from other diseases such as depression and psychological diseases. Others negatively affect him and his health because most of the time he is left alone, unable to move or speak, and this is harmful to him and causes death in most cases. According to the census data provided by the Brazilian IBGE in 2010, which shows the statistics of the population with disabilities every 10 years, there are approximately 4,560,048 persons with disabilities in Brazil. Of these 45 million, 2.33% (about 1 million) are people with severe motor impairments. Data provided by the World Health Organization showed that more than one billion people suffer from some form of disability. This represents about 15% of the world's population. Worldwide, there are more than 1,000 million people with disabilities and they constitute approximately 15% of the world's population (ie 1 in 7 people is disabled). The number of people with disabilities will continue to rise due to an aging population and an exacerbation of chronic health conditions in the world. National disability patterns are influenced by trends in health conditions, environmental factors and other factors - such as road traffic accidents, falls, violence, humanitarian emergencies such as natural disasters and conflict, diet, and drug use.

Despite the magnitude of this problem, there is a lack of awareness and scientific information regarding disability problems. There are few documents that provide compilations and analyzes of the ways in which countries have developed policies and responses to meet the needs of people with disabilities. So after reading this you now know how bigger of this problem, Therefore, we decided to look for a solution to this problem, and we concluded that the common solution for all types of these diseases is the eye, because the eye is the only thing capable of movement in a person who suffers from total paralysis and is the most dangerous and most problematic disease because this person is unable to speak or Moving anything in his body except the eye, so we decided to create a device capable of moving people with special needs through the eye.

II. RELATED WORK

The technology that allows extensive use of eye-tracking principles includes sectors in the automotive industry, medical

[1] This paragraph of the first footnote will contain the date on which you submitted your paper for review. It will also contain support information, including sponsor and financial support acknowledgment. For example, "This work was supported in part by the U.S. Department of Commerce under Grant BS123456." The next few paragraphs should contain the authors' current affiliations, including current address and e-mail. For example, F. A. Author is with the National Institute of Standards and Technology, Boulder, CO 80305 USA (e-mail: author@ boulder.nist.gov).

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science, exhaustion simulation, automobile simulators, cognitive tests, computer vision, behavior recognition, etc. Over a while, the importance of eye recognition and monitoring in industrial applications grew. This importance of eye-tracking applications leads to more effective and durable designs required in many modern appliances. An extensive review of the literature relating to the eye-tracking system has been carried out in healthcare applications.

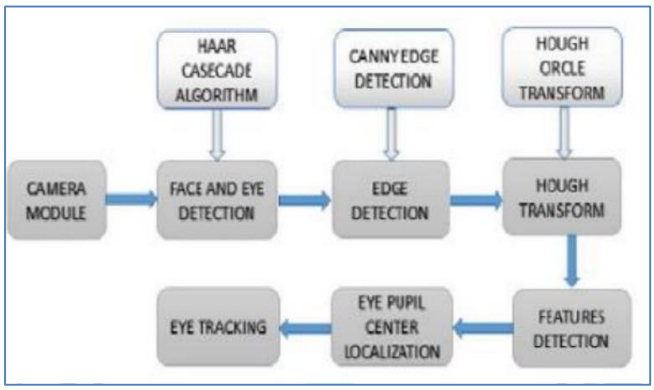
Powered wheelchair controlled by eye-tracking system 2006 they use the optical-type eye tracking system to control powered wheelchair. The user's eye movements are translated to screen position using the optical-type eye tracking system. The pupil-tracking goggles with a video CCD camera and a frame grabber analyzes a series of human pupil images when the user is gazing at the screen. A new calibration algorithm is then used to determine the direction of the eye gaze in real time. they design an interface with nine command zones to control powered wheelchair. The command at the calculated position of the gazed screen is then sent to move the powered wheelchair. [5]

Eye controlled wheelchair 2015 Spinal injury is the most common cause of quadriplegia, though there are many diseases that can produce the same result - inability to produce controlled movement in any of your limbs or head. For people in this situation independent control of their wheelchairs is not possible – the technology just isn't available. Independent mobility increases quality of life significantly, and it is loss is keenly felt by those robbed of it, through accident or disease. The scale of the problem is enormous. ALS is responsible for only a tiny fraction of the people in this situation, yet there are five thousand ALS sufferers at any one time in the UK alone, and twenty thousand in the US. Most of them will end up sat immobile in their wheelchairs, unable to move on their own. Eye drivomatic could help most of them.

To create an inexpensive and accessible way for people with motorized wheelchairs to take control of their mobility via eye movement, using open-source methods as much as possible. [6]

Eye Gaze Controlled Wheelchair 05, May-2020 Eye gaze wheelchair is a unique technique executed mainly for the disabled persons who are fully paralyzed. In this system manual control of wheelchair is being replaced be automatic control i.e. controlled by the eyeball movement, so that the patients feel free and less or no difficulty in their movements. Continuous image is captured with the help of webcam which further undergoes several image processing techniques, to detect the position of eye pupil Hear cascade algorithm is being implemented with the resultant of the image processing technique wheelchair moves accordingly. DC motor is mounted to the wheels for easy motion of the wheelchair. The ultrasonic sensor is mounted to the wheelchair so that it detects any obstacles in the path of its movements and wheelchair stops movement as per sensor command.

System Overview The basic fundamental of the proposed system is eye tracking and detection of eye movement. To detect the location of eye pupil Haar cascade algorithm is used this technique comprises of several stages which are implemented to find the eye movement and also for face and eye detection, color switching, object tracking, Hough transform, edge detection and motion detection. Initially system captures image by making use of webcam. First step is the algorithm accurately detects the face of the user, if there is a greater number of faces it displays the error in runtime. According to the algorithm the system represents the user face in specific area of indicated image. Several process of image processing techniques is performed for eye pupil tracking. Fig.1. shows the process of the system. [7]



Eye-gaze control of a wheelchair mounted 6DOF assistive robot for activities of daily living (2021) In recent times, eye gaze has been introduced to control graphical user interfaces directly. Eye gaze-controlled interfaces have been used for people with a severe motor impairment who cannot use the alternative computer peripherals. In this research, we developed a control architecture for an eye-gaze control of a wheelchair mounted assistive robot for activities of daily living (ADL) of individuals with upper limb impairment. Functional impairments of the Upper or Lower Extremities (ULE) are common in the elderly. We demonstrated the usability of using this eye-gaze system to control a robotic arm mounted on a wheelchair in activities of daily living for people with disabilities. We found high levels of acceptance with higher ratings in the evaluation of the system with healthy participants.

In this study, our research objective is to design an eye tracking assistive robot control system capable of providing targeted engagement and motivating individuals with a disability to use the developed method for self-assistant activities of daily living. The graphical user interface is designed and integrated with the developed control architecture to achieve the goal.[8]

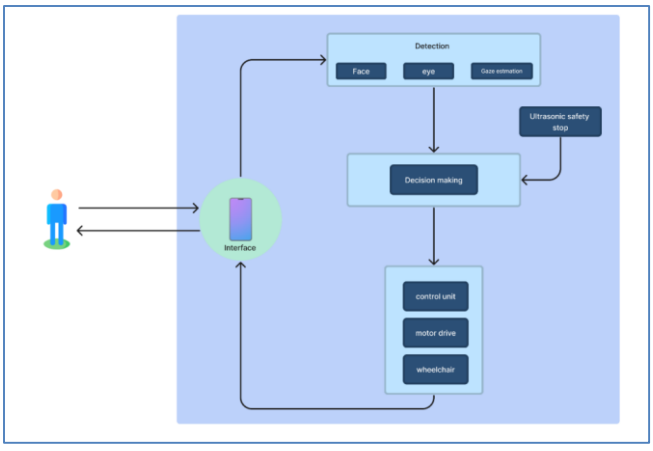
Wheelchair Control System based Eye Gaze 6, 2021 The inability to control the limbs is the main reason that affects the daily activities of the disabled which causes social restrictions and isolation. More studies were performed to help disabilities for easy communication with the outside world and others. Various techniques are designed to help the disabled in carrying

out daily activities easily. Among these technologies is the Smart Wheelchair. This research aims to develop a smart eye-controlled wheelchair whose movement depends on eye movement tracking. The proposed Wheelchair is simple in design and easy to use with low cost compared with previous Wheelchairs. The eye movement was detected through a camera fixed on the chair. The user's gaze direction is obtained from the captured image after some processing and analysis. The order is sent to the Arduino Uno board which controls the wheelchair movement. The Wheelchair performance was checked using different volunteers and its accuracy reached 94.4% with a very short response time compared with the other existing chairs.

The proposed system is simple and has low-cost components, as shown in Fig. It is based on taking the user's face image. Getting the eye's location and then determining `the pupil's direction which has a different value. The obtained values are transmitted to the Arduino board connected to a wheelchair to control its moving directions.Wheelchair consists of an integrated circuit called L293d and a motor of the type of DC that works from 3 to 6 V.[9]

III. PROPOSED SYSTEM ARCHITECTURE

A system architecture is the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. A system architecture can consist of system components and the sub-systems developed, that will work together to implement the overall system.



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A. SOFTWARE AND HARDWARE TOOLS:

1- Software:

- 1- Python The main programing language to use in AI projects
- 2- OpenCV An open-source computer vision and machine learning software library that we use for image processing and performing computer vision tasks like body detection and body tracking.
- 3- Anaconda A distribution of python (like an environment) used for scientific computing.
- 4- PyCharm an integrated development environment used in computer programming specifically for python.
- 5-Flutter it is Google's portable UI toolkit for building beautiful, nativelycompiled applications for mobile, web, and desktop from a single codebase

2- Hardware:

- Arduino Uno: The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010
- 4 gearmotor with wheels: A gearmotor (or geared motor) is a small electric motor (AC induction, permanent magnet DC, or brushless DC) designed with an integral (non-separable) gear reducer (gearhead) attached
- Bluetooth module (HC-05): The Bluetooth module [11-12] (HC-05) is a device which is used for short range wireless communication to the respective connected device. which can communicate in two ways. Which means, it is full-duplex.
- Ultrasonic sensor: An ultrasonic sensor [13] is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converts the reflected sound into an electrical signal
- Motor driver(L298N): This dual bidirectional motor driver (L298N) [14]is based on the very popular L298 Dual H-Bridge Motor Driver Integrated Circuit. The circuit will allow you to easily and independently control two motors of up to 2A each in both directions
- Smart phone with camera: Any smart phone with camera to capture the patient's eye
- Wires: some wires to connect the components with each other

IV. METHOD

Tables, graphs, charts, and images should be embedded in the text of your paper rather than collected in pages after the text.

They should be mentioned before

Depending on the facial appearance and facial shape patterns, Facial landmark detection algorithms are classified into three.

Here, the facial appearance refers to the distinctive pixel intensity patterns around the facial landmarks or in the whole face region, while face shape patterns refer to the patterns of the face shapes as defined by the landmark locations and their spatial relationships.

The three major categories of landmark detection algorithms are:

Holistic methods
Constrained Local Model (CLM) methods
Regression-based methods

Some recent methods combine deep learning models and global 3D shape models for landmark detection.

Dlib library includes face detection and landmark detection functions in it. DLib face detection uses histogram-oriented methods(HOG) and landmark detection is based on Kazemi's model. It returns different 68 feature points from a face. The below image demonstrates the positions of those 68 points identified on a face.

V. RESULTS AND ANALYSIS

A PROTOTYPE THAT CAN MOVE BY EYE CONTROL THAT BY GIVING IT (WITH MOBILE APPLICATION ACCESS TO THE CAMERA USING CAMERA TO DETECT EYE MOVEMENT AND MOVE THE WHEELCHAIR DEPEND ON EYE TRACKER CLASSIFICATION) AN ORDER TO IMPLEMENT IT AND MOVING THE CHAIR FROM POINT TO ANOTHER AND IT WILL BE A MAP IT WILL HAVE YOUR DAILY ROUTINE TO MAKE IT MUCH EASIER FOR THE PEOPLE.

The obtained average of accuracy is . It is evident from the results that this study provided a noticeable improvement in eye tracking compared to previous studies. Table II presents all the proposed system components‟ costs.

Tool	Price
Arduino uno	15$
Bolthouse module	6.5$
Ultrasonic sensors	3$
Car chest and four motor	13.5$
2 lithium battery	5.25$
Motor driver L298n	11.5$
Battery holder	1$

VI. CONCLUSION

Eye tracking is an interesting area of research, in particular to help the completely disabled to better communicate with society and carry out all activities of life without anyone helping him. For the proposed eye-tracking system, a circuit will be built and this electrical circuit will be connected to the smartphone through an application that will open the camera to monitor eye movement.

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