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Eye Pupil Controlled Wheelchair

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Abstract: Elderly and disabled people find it very difficult to move freely to their desired areas at any opportune time in today's fast-paced environment. Thankfully, some people are physically fit and have good eyesight, which helps to assure their survival. This paper attempts to investigate the use of a design approach for a system that aids the disabled who are unable of operating a wheelchair in the conventional manner. This system uses information collected from the sensors and offers a system that will help replace traditional method. An intelligent vision system that analyses head movements, pupil position, the patient's angle of view, and other factors can be used to determine the necessary movements of the chair. In order to detect the pupil's position and control the wheelchair to travel in the desired direction, the suggested technology uses image processing algorithms. Project is built with the use of ultrasonic sensor to avoid the obstacles in the way.

1. INTRODUCTION

Everybody values freedom of movement highly. But it can occasionally be challenging for someone with a physical impairment. Partial or complete paralysis is possible.

Arms and legs are both affected by quadriplegia, which is a medical term for paralysis. The lain term for immobility is plegia. A spinal cord injury is the main reason for quadriplegia. The area of spinal cord that is hurt and how much damage is done determine the degree of impairment. Because the central nervous system, which carries messages throughout the body, is primarily made up of the brain and spinal cord, spinal cord injuries can be very devastating.
The human eye is additionally believed to be an intuitive means of deciphering human contact and communication that may be utilised to examine data about the surroundings and make suitable responses. Only 22% of the 132 million people who need wheelchairs actually have access to one. It should be highlighted that this is because many disorders significantly restrict a person's physiological capacity to produce regulated movement in any limb, including the head. Even the most sophisticated wheelchairs are inaccessible to them. It is vital to look at cutting edge eye tracking and recognition technologies that can enhance human-computer interaction and raise the living standards of these impaired people.

Many applications, including eye-tracking operated wheelchairs, mental health monitoring, driving tiredness warning systems, and other human-computer interaction systems, have gradually adopted eye tracking research. However, there are a number of limitations, including the need for a portable and unobtrusive system as well as consistent real-time performance, high precision, and constituent availability. Furthermore, it's critical to build a system with enhanced resistance to issues like fluctuating lighting conditions, genuine eye appearance, surrounding eye features, and eyeglass reflections. Eye-controlled wheelchair systems have been proposed in several similar publications; These, however, infrequently address the user's comfort and safety as well as the system's unique algorithms, physical issues not related to the system, and performance constraints of the system's software.

2. LITERATURE REVIEW

In recent years, the development of eye-controlled wheelchairs has been a growing research area. Eye-controlled wheelchairs allow people with physical disabilities to control the wheelchair with only their eyes [1]. This technology uses eye-tracking software and hardware to enable a person to control the wheelchair with eye movement. In this review, the current state of eye-controlled wheelchairs is discussed, along with the advantages and disadvantages of this technology. Eye-controlled wheelchairs use eye-tracking technology to allow people with physical handicaps to maneuver the wheelchair with their eyes [6]. The system works by tracking the direction of the user’s gaze and then sending the appropriate commands to the wheelchair’s motors. This

technology has been used to create a variety of wheelchair designs, from traditional manual wheelchairs to powered wheelchairs. The technology has also been used to create hybrid designs, combining elements of both manual and powered wheelchairs [2]. Eye-controlled wheelchairs offer a number of advantages. They enable people with physical disabilities to maintain their independence and autonomy. They are also easy to use and don't require the user to learn a complex set of commands [3]. Additionally, they allow the user to control the wheelchair in any direction, providing more flexibility and freedom than a manual. In their work, they have used Arduino UNO as microcontroller and raspberry pi and open-cv for image processing [4]. The Arduino controller chip for the core microcontroller system is connected to the camera and voice assistant modules. When user move his eyeballs left side then the wheelchair move left side, when ball right side then the wheelchair move right side and eyeball straight the move forward in all other case wheelchair will stop. From this research paper we get how the change the direction of wheelchair by using eyeballs. This article presents a wheelchair system using an eye movement that help differently abled people to move freely around [2]. The model uses LabVIEW for eye tracking and direction determination of glaze. This signal is then used to drive the motor desired direction. Using LABVIEW which is a graphical programming language for the processing of eye image captured by camera. For reasons of safety, they limited the robot's work area. [3]. This project supports the use of eye gaze to control assistive robotics. This paper explains about how to efficiently improve the time of completing the task of movement of wheelchair [7].

3. METHODOLOGY

Eye controlled wheelchairs are motorized wheelchairs that are operated using a person's eye movements. In order to translate the user's eye motions into orders that the wheelchair can understand, they use eye-tracking technology to detect, analyse, and interpret the user's eye movements. The user can control the wheelchair's direction and speed by simply looking in the desired direction. This technology can be beneficial for people with disabilities who have limited mobility and cannot use traditional wheelchairs. We started by using a wooden block as the car's structure. Fundamentally, this is our prototype. The wooden frame was then given four wheels.

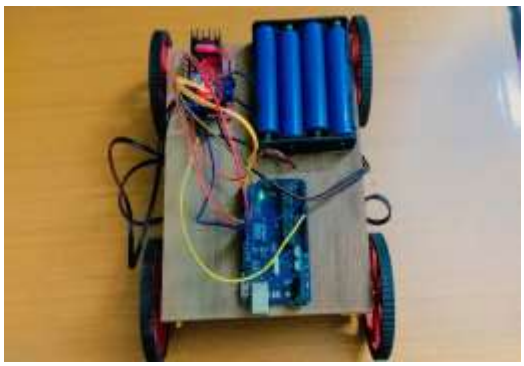

Fig.1. Prototype of system

We then used Python's OpenCV library to construct a Python module that can identify a human's eyes. We have created a module that can recognize if the eye is travelling left or right. We have created a module that can track the eye's movement, whether it is travelling left or right. Additionally, we created an Arduino programmed in the Arduino IDE that will use driver circuitry to control the movement of all 4 BO motors. The output of the Python module was then imported into the Arduino Uno using the cvzone library. Then, to connect all of the circuits, we utilized jumper wires. Last but not least, we tested our prototype and fixed the issues we encountered. Wheelchairs with eye controls employ cameras and eye tracking systems to let the user steer the chair by moving their eyes and heads. The user looks in the direction they would like the wheelchair to move, and the wheelchair responds to the user's gaze. The wheelchair can be programmed to respond to different types of eye and head movements, allowing for a range of motion. For instance, the user can look left and right to move the wheelchair forward and backward, or look up and down to move the wheelchair up and down. The wheelchair can also be programmed to respond to voice commands, allowing for even more control. The eye tracking system can be adjusted to the user's individual needs, allowing for a customized experience.

Fig. 2. Pupil Tracking

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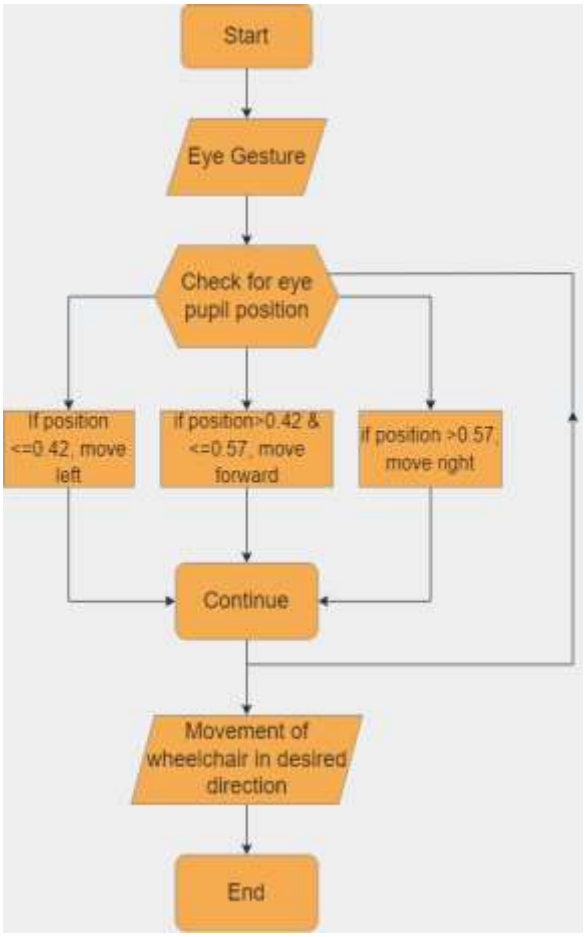

Fig. 3. Block Diagram of Proposed System

4. COMPONENTS

4.1 BO Motor : A "Bo motor" is a small, battery-powered DC geared motor that offers good torque and rpm at low voltages. Here, you could find BO motors with a range of rated speeds. This motor can rotate at a rate of about 200 rpm when fueled by a single Li-Ion battery. Excellent for battery-operated, portable robotics. The motor can work with minimal to no lubrication because of its inherent lubricity. This motor set is the ideal option for use in a mobile robot car because it is reasonably priced, small, and easy to install. They're widely used in our 2WD platforms.

4.2 Motor Driver: Linking the control circuits and the motors together are the motor drivers. While the motor demands a lot of current, the controller circuit can work on signals with minimal current. Because of this, the function of motor drivers is to transform low-current control impulses into higher-current signals that can drive motors

4.3 Arduino UNO: The Arduino Uno microcontroller board is built on the ATmega328P microcontroller chip. It has a reset button, an ICSP header, a power jack, 6 analogue inputs, a 16 MHz quartz crystal, 14 digital input/output pins, an ICSP header, and an ICSP connector. The Arduino programming environment and language are used to programme. It has a wide range of uses, including managing motors and lighting as well as gathering sensor data.

4.4 18650 Batteries: 18650 batteries are a type of lithium-ion rechargeable battery. With a nominal voltage of 3.6V, they typically range in capacity from 1800mAh to 3600mAh. The 18650's name isn't really inventive, to be honest. Power tools, spotlights, cameras, laptops, and e-cigarettes are just a few examples of the many products that include them. Even Tesla's Model S and X automobiles, which debuted in 2013, use 18650 batteries.

5. ADVANTAGES

5.1. Increased Independence: Eye-controlled wheelchairs allow users to gain greater independence by enabling them to move around without having to rely on the help of another person.

5.2. Improved Quality of Life: Eye-controlled wheelchairs can improve the quality of life of users by helping them to remain independent and active.

5.3. Increased Mobility: Eye-controlled wheelchairs allow users to move around more freely, which can lead to increased mobility.

5.4. Improved Safety: Eye-controlled wheelchairs help to keep users safe by providing more precise control of their wheelchair.

5.5. Enhanced Comfort: Eye-controlled wheelchairs can provide a more comfortable experience by allowing users to make small adjustments to their posture and pressure points.

5.6. Increased Efficiency: Eye-controlled wheelchairs can help users to move around more quickly and efficiently. This can be especially beneficial for those who are traveling long distances.

6. LIMITATIONS

6.1. Accuracy: Eye-controlled wheelchairs require a high level of accuracy for the user to effectively control the wheelchair. The user might not be able to steer the wheelchair in the appropriate direction if the system is not accurate enough.

6.2. Cost: Eye-controlled wheelchairs can be expensive. The cost of the technology, plus the time and effort required to set up the system, can be prohibitive for many individuals.

6.3. Fatigue: Eye-controlled wheelchairs require intense concentration and can be tiring to use over an extended period of time. This can be particularly challenging for individuals with limited physical strength or stamina.

6.4. Limited Mobility: Eye-controlled wheelchairs are typically limited to forward and backward motion, and may not be able to turn or move in other directions.

6.5. Environmental Factors: In some lighting situations, eye-controlled wheelchairs may be unable to precisely track a user's eye movements. Additionally, obstacles in the user's environment may block the user's vision, making it difficult or impossible to accurately control the wheelchair.

7. FUTURE SCOPE

Eye-controlled wheelchairs have a very bright future. People with impairments now enjoy greater independence and movement thanks to technological and creative advances. The following are some potential uses for eye-controlled wheelchairs: It is possible to programme an eye-controlled wheelchair to move and navigate on its own. This will make it possible for people with impairments to move around unhindered without depending on others. Eye-controlled wheelchairs can be designed to stop or slow down when they encounter impediments in their path, preventing any potential mishaps. Eye-controlled wheelchairs can be set up to understand user commands, enabling the user to interact with the outside environment. The use of eye-controlled wheelchairs makes it simpler for persons with impairments to enter public spaces by allowing them to navigate ramps, stairs, and other barriers. It is possible to programme the eye-controlled wheelchair to recognise eye motions and hand gestures, giving the user greater exact control over the wheelchair's movement. Overall, eye-controlled wheelchairs are an innovative breakthrough that, with more study, may serve to better the lives of people with impairments.

8. RESULTS

We get the conclusion that the model developed operates as planned after performing several experimental tests. Using Python's media pipe, NumPy, and math library, the model tracks the eye and establishes the direction of sight. The motor is then moved using this signal in the direction of the signal received. The motor will then turn the wheelchair in that direction. The direction of the look may result in a collision with a moving vehicle on the road (for real time application). By using a model-built robot, we were able to function as we saw fit despite the limited software and hardware.

9. CONCLUSION

People with disabilities can move around on their own thanks to the wheelchair technology detailed in this study, which makes use of eye movements. The model tracks the eye and determines the glazing direction using Python programming. This signal is then used to drive the motor in the desired direction. Thanks to this technique, persons with disabilities can now manoeuvre their wheelchair on their own, without help from anybody else

10. ACKNOWLEDGEMENT

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