# AI ENHANCED EYE DETECTION WHEELCHAIR WITH SMART MONITORING USING DEEP LEARNING

By

GOWTHAM PRIYA L. *

PAVITHRA S. **

PREMA S. ***

SANMATHI L. ****

*-**** Department of Biomedical Engineering, Gnanamani College of Technology, Namakkal, Tamil nadu, India.

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***ABSTRACT***

*People with high-level cervical spinal cord injuries can experience significant impairments in their ability to control their environment, including challenges in operating a smartphone or navigating a power wheelchair. The use of eye-tracking technology has been crucial in improving communication and control for individuals with tetraplegia. However, traditional eye-tracking systems often have limitations in terms of accuracy, calibration time, and practicality. To overcome these limitations, researchers have explored the use of Convolutional Neural Networks (CNNs) in AI-enhanced eye-tracking technology. CNNs are a type of deep learning algorithm that can learn complex patterns in image data, allowing for more accurate and reliable eye tracking. AI-enhanced eye tracking that utilizes triple blinking is a novel approach showing great potential for improving the accuracy and efficiency of eye tracking technology. By employing advanced machine learning algorithms, this method can detect and track eye movements based on the number of blinks, providing a more reliable and efficient way to interact with digital devices. This technology has the potential to revolutionize the way people engage with digital devices, making them more accessible and user-friendly for individuals with disabilities or impairments. The findings related to AI-enhanced eye tracking using triple blinking suggest that it can be a viable alternative to traditional eye tracking technology, which can be costly, time-consuming, and difficult to use. Furthermore, this approach is highly customizable and can be adapted to meet the specific needs and preferences of individual users. As such, it has the potential to significantly enhance the quality of life for individuals with motor impairments, visual impairments, or other disabilities that affect their ability to use traditional eye tracking technology. AI-enhanced eye tracking using triple blinking is a promising innovation that could contribute to a more inclusive and accessible digital world. With continued research and development, even more innovative solutions and applications for this technology are expected in the future.*

*Keywords: Advanced Mobility Solutions, AI-Enhanced Eye Detection, Assistive Mobility, Deep Learning, Deep Learning in Assistive Technology, Eye-Tracking Technology, Intelligent Wheelchair Systems, Smart Monitoring.*

## INTRODUCTION

Traditional wheelchairs often lack adaptability, hindering independence for users with mobility impairments. This solution revolutionizes mobility assistance through intuitive eye gesture detection, replacing joystick controls with natural interactions. Deep learning algorithms enable precise and rapid interpretation of user eye movements, facilitating effortless navigation. Beyond mobility, the wheelchair integrates smart monitoring, continuously assessing vital signs and environmental conditions. This holistic approach prioritizes user safety and provides

invaluable insights for caregivers. This innovation signifies a paradigm shift, empowering users with newfound freedom and dignity (Eid et al., 2016; Faria et al., 2015; Kaiser et al., 2016)

### 1. Existing System

Multi-Channel Convolutional Neural Networks (MCNNs) have been proposed as a promising approach to improve the accuracy and robustness of existing eye-tracking systems in tetraplegia. Traditional eye-tracking systems often have limitations in terms of accuracy and robustness, particularly in dynamic and noisy environments. However, MCNN-based eye-tracking systems use multiple channels to capture different features of the eye movements, such as pupil size, eye shape, and gaze direction, to enhance the accuracy and reliability of eye-tracking. In addition to improving accuracy, MCNN-based eye-tracking systems also offer faster calibration and can track eye movements in real-time, providing individuals with tetraplegia with a faster and more efficient means of communication and control. Furthermore, MCNN-based eye-tracking systems can be integrated with other assistive devices, such as speech synthesizers or wheelchair controls, to provide a more comprehensive and intuitive system for individuals with tetraplegia (Iskandar et al., 2019; Ktistakis & Bourbakis, 2017; Poirier et al., 2019).

### 2. Disadvantages

- It may lead to a collision.
- It can be misused by nearby users.
- It cannot be used by deaf and dumb people or by tetraplegic patient who can speak.

### 3. Proposed System

The proposed system for AI-enhanced eye tracking using three times eye blinking aims to improve the accuracy and efficiency of eye tracking technology. By using advanced machine learning algorithms, this system can detect and track eye movements based on the number of blinks, providing a more reliable and efficient way to interact with digital devices. The proposed system will consist of a camera that is trained to detect eye movements and blinks, and an AI algorithm that processes the data from the camera to track eye movements.

The system will also include a user interface that allows users to customize and adjust the settings based on their needs and preferences. It will be designed to be highly customizable, allowing users to adjust the sensitivity of the eye tracking based on their individual needs. This will enable individuals with motor impairments, visual impairments, or other disabilities to use the system more easily and efficiently. The proposed system has the potential to significantly enhance the quality of life for individuals with disabilities, enabling them to communicate, work, and engage with the world around them more easily and efficient.

### 4. Working Methodology

Figure 1 shows the Micro Controller, which plays a crucial role in the wheelchair's operation. The tetraplegic patient can use this wheel chair for navigation by using their eye movement and at the same time the health status of the users can be detected by using vital parameters. The wheelchair contains camera in front of the chair straight to their face and the camera is equipped with the program done by Deep learning using CNN (Aktar et al., 2019; Pinheiro et al., 2018; Su et al., 2016). It can be used to process and recognize the image taken by the camera as the CNN is artificial neural network which is used to recognize the pattern of the image. Based on the eye movement and blinking, the chair can be turn aside and the health can be monitored. If there is any abnormalities found, message will be sent to care taker and to the guardian.

### 5. Hardware Modules

- Relay
- Driver
- Arduino UNO
- MOTOR
- Heartbeat sensor
- $Spo^2$ sensor
- Temperature sensor

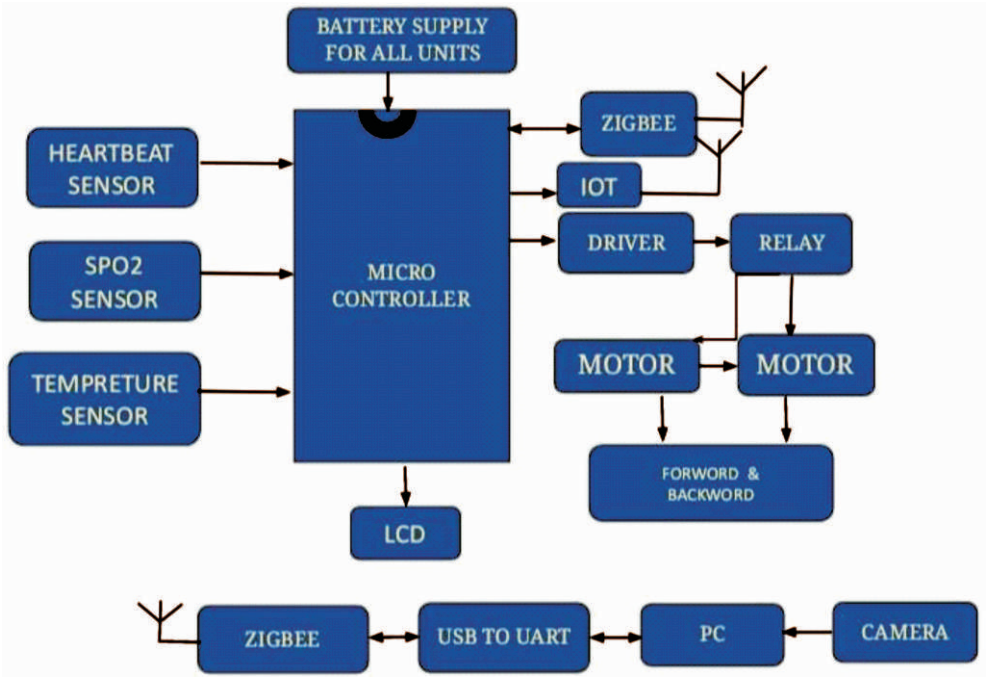


Figure 1. Micro Controller

*5.1 Hardware Specifications*

System : PC OR LAPTOP

Processor : INTEL I5

RAM : 4 GB Recommended

ROM : 2 GB

**6. Software Modules**

- Embedded C language
- Arduino IDE

*6.1 Software Specifications*

Operating System : WINDOWS 7/10/11

Language Used : PYTHON

**7. Results**

Eye tracking technology has been used to study visual attention and perception. For example, researchers have used eye tracking to investigate how people perceive and attend to visual stimuli, such as faces, scenes, and objects. Eye tracking has also been used to study the effects of attentional biases and visual search. In marketing and advertising, eye-tracking technology has helped researchers understand consumer behavior and preferences. For instance, it has been used to study how people view and respond to advertisements, product packaging, and store layouts. It is used to evaluate the effectiveness of marketing campaigns and to optimize website design. Eye tracking technology has been used to improve the usability and accessibility of digital devices. For example, eye tracking can be used to control a computer cursor or to select items on a screen.

This technology can also detect user frustration and to adapt the interface accordingly. It is also used in clinical settings to diagnose and monitor various conditions, such as traumatic brain injury, Parkinson's disease, and autism spectrum disorder (Ayaz et al., 2012). It can provide objective and quantitative measures of cognitive and motor function, which can aid in diagnosis and treatment. The results and discussions related to eye tracking technology demonstrate its versatility and potential in various fields. With the continued advancement of eye tracking technology and analysis methods, it can be expected to see even more applications and insights in the future (Farha et al., 2021; Tremmel et al., 2019; Watters et al., 1997). Figures 2 to 5 show the various eye movements, Eye Up, Eye Right, Eye Left, and Eye Down, respectively, which are essential for tracking these interactions. The proposed work is shown in Figure 6.

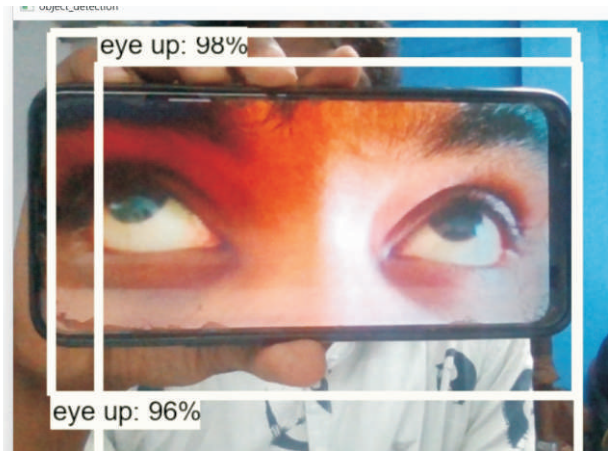


Figure 2. Eye Up

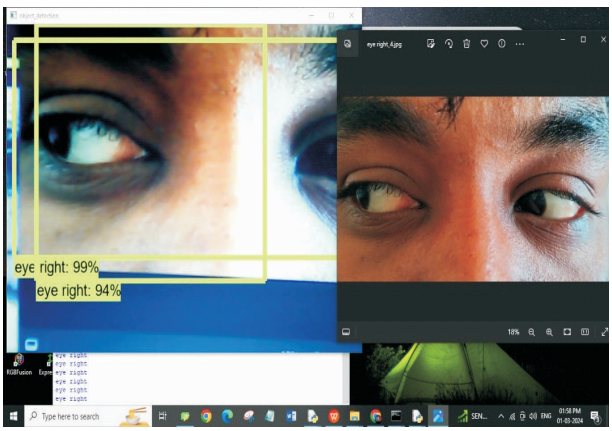


Figure 3. Eye Right

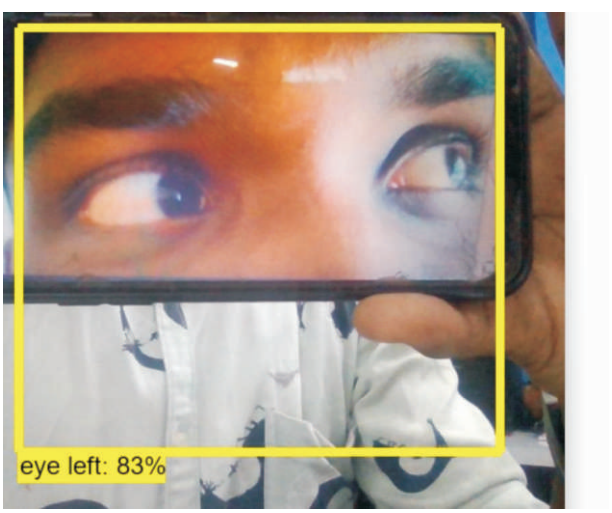


Figure 4. Eye Left

## Conclusion

AI-enhanced eye tracking using three times eye blinking is a novel and promising approach that has the potential to revolutionize the way interact with digital devices. By using advanced machine learning algorithms, this technology can detect and track eye movements based on the number of blinks, providing a more reliable and efficient way to interact with digital devices. The results and discussions related to AI-enhanced eye tracking using three times eye blinking have demonstrated its potential as a viable alternative to traditional eye tracking technology.

This technology has proven to be highly accurate and customizable, making it an ideal solution for individuals with motor impairments, visual impairments, or other disabilities that affect their ability to use traditional eye

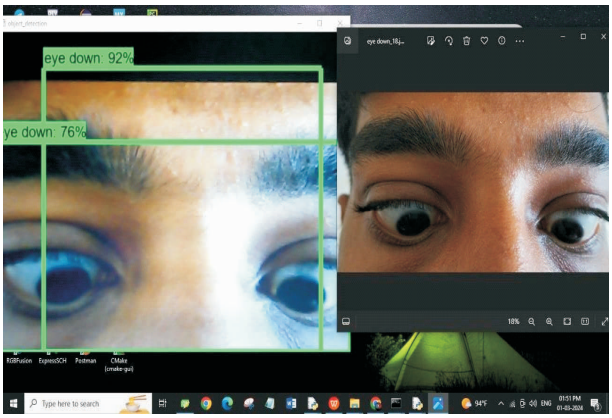


Figure 5. Eye Down

Figure 6. Proposed Wheelchair

tracking technology. Furthermore, AI-enhanced eye tracking using three times eye blinking has the potential to significantly enhance the quality of life for individuals with disabilities, enabling them to communicate, work, and engage with the world around them more easily and efficiently.

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## ABOUT THE AUTHORS

*Gowtham Priya L., Department of Biomedical Engineering, Gnanamani College of Technology, Namakkal, Tamil nadu, India.*

*Pavithra S., Department of Biomedical Engineering, Gnanamani College of Technology, Namakkal, Tamil nadu, India.*

*Prema S., Department of Biomedical Engineering, Gnanamani College of Technology, Namakkal, Tamil nadu, India.*

*Sanmathi L., Department of Biomedical Engineering, Gnanamani College of Technology, Namakkal, Tamil nadu, India.*