

Eye Gesture–Based Human–Robot Interaction System for Real-Time Robot Navigation Using Blink and Gaze Control

Dr. Sachin B M, Manohar M. Athani, Narasimha S., Pavan K. Gudi

Assistant Professor, ECE Department, Bangalore Institute of Technology, Bengaluru, India.

U.G Students, ECE Department, Bangalore Institute of Technology, Bengaluru, India

Abstract: *Hands-free human–robot interaction has become increasingly relevant in assistive mobility and rehabilitation systems, particularly for users with impaired hand functionality. Eye-based interaction offers an intuitive and minimally intrusive interface for controlling robotic platforms. This paper presents a real-time eye-gesture–controlled rover that interprets blink patterns and gaze directions using a standard laptop webcam. MediaPipe Face Mesh is used to extract eyelid and iris landmarks, enabling the recognition of double blinks, long blinks, and blink-gaze combinations based on temporal thresholds and geometric ratios. Classified gestures are transmitted from the laptop to an ESP8266 NodeMCU over Wi-Fi, where a non-blocking control mechanism drives an L298N motor driver for differential-drive actuation. Experimental evaluation demonstrates low-latency gesture detection, stable wireless communication, and accurate 90° pivot turns during navigation. The proposed system provides a low-cost, camera-based alternative to wearable eye-tracking devices and offers a practical assistive solution for mobility enhancement..*

Keywords: Assistive mobility, Blink detection, ESP8266, Eye gestures, Gaze estimation, MediaPipe Face Mesh, Human–robot interaction.

