

Design and Development of Head Motion Controlled Wheelchair

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Abstract: *The aim of this project is to design and develop a head-motion-controlled wheelchair that enables individuals with severe physical disabilities to achieve safe and independent mobility using simple head-tilt gestures. The system is targeted for users who are unable to move their hands or legs but can perform controlled head or eye movements. A tilt-based communicator system equipped with tilt sensors is used to capture head orientation data, which is then transmitted wirelessly to the wheelchair control unit. Based on the detected head tilt forward, backward, left, or right—the wheelchair moves in the corresponding direction, allowing intuitive and hands-free navigation.*

The prototype integrates tilt sensors, wireless modules, and a microcontroller-based control system to ensure reliable and responsive operation. The wheelchair has been practically implemented and tested with a user sitting on it, demonstrating stable performance and a weight-bearing capacity of up to 100 kg. The design focuses on achieving functionality at a significantly lower cost compared to commercial assistive wheelchairs, while maintaining ease of operation and user safety.

The head-motion-controlled wheelchair provides a valuable mobility solution for quadriplegic patients and individuals with 45% or more disability, offering an accessible, gesture-based alternative to joystick or voice-controlled systems. Experimental results confirm that the system is user-friendly, robust, and capable of effectively translating head gestures into precise wheelchair movement.

Keywords: Tilt Sensors, Wireless Control, Gesture-Based Control, Head Motion Interface, Assistive Technology, Gear Ratio.

