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Integrated Assessment of Cognitive Alertness and Gait Stability: A Systemic Review

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Cognitive alertness and gait stability are vital indicators of neurological and motor health. These are often affected in elderly individuals, mentally challenged persons, and alcohol intoxicated individuals. Traditional assessment methods are separate, costly, and require clinical or software-based setups thereby limiting portability. The present review aims to identify a low-cost, standalone hardware system for simultaneous real-time assessment of both parameters. The system integrates an MPU6050 inertial measurement unit for gait stability monitoring and a reflex-based cognitive alertness test using an LED stimulus and push button/IMU response. Immediate alerts via buzzer or LED are triggered upon detecting abnormal gait patterns or delayed responses. The device operates without computer or mobile applications, making it suitable for use in homes, rehabilitation centres, and roadside safety checks. The proposed approach offers a compact, non- invasive, and affordable solution, with potential applications in fall prevention, post- accident monitoring, and support for vulnerable populations. In the present review, we describe some prototypes demonstrating how this can be done and identify important areas for progress to enable it to happen. The future of cognitive assessment will include semi- and fully automated assessments involving neuroimaging, standardized perturbations, and artificial intelligence. Furthermore, the cognitive assessments take place in a social and interpersonal context, normally between the patient and clinician, which makes the human-machine interface highly consequential and will be discussed.

Keywords: Cognitive alertness, Gait stability, IMU sensor, Reaction time, Standalone system

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