

# Aging and Disability

**Toward Accessible Remote Physiotherapy for Older Adults: A Feasibility Study of a Markerless Motion Tracking System Using Adapted Consumer-Grade Sensors** Jeff Gajdacs, Qiyin Fang, Pasqualina Santaguida, Mhan Pourumidi. *Gerontechnology* 25(s)

**Purpose** Markerless motion tracking offers a promising approach to remote physiotherapy, particularly for older adults and individuals in low-resource settings. However, existing systems are often optimized for gait analysis and lack validation for therapeutic exercises [1]. This study aimed to adapt a consumer-grade, privacy-focused sensor (the AltumView Sentinare 3) into a low-cost, dual-camera system for geriatric rehabilitation monitoring, and to conduct a preliminary feasibility evaluation. **Method** The system was configured in a controlled laboratory setting using two orthogonally positioned AltumView cameras. Preliminary kinematic data were collected from three researchers (ages 24-35) performing standardized geriatric-relevant exercises (simple step-ups, partial squats). A custom Python pipeline retrieved anonymized 2D joint coordinates via a secure API, using a framework conceptually similar to methods like OpenPose [2], reconstructed 3D kinematics through vector triangulation, and calculated joint angles (knee, hip, spine), angular velocities, and accelerations. Validation included synchronized qualitative video recording and systematic logging of tracking errors, data dropouts, and measurement consistency. Performance was evaluated in terms of occlusion resilience, setup time, and practical deployment feasibility. **Results and Discussion** Initial testing demonstrated the system's ability to generate continuous 3D joint angle profiles during multiplanar movements relevant to geriatric rehabilitation. Tracking was robust under clear viewing conditions, with skeletal data successfully captured for >95% of frames during exercises such as step-ups. Data loss occurred primarily during severe self-occlusion (e.g., cross-body movements), highlighting a known limitation of monocular vision-based systems. The system's sampling rate (~5 fps) limited temporal resolution but remained sufficient for slow therapeutic exercises. Practical advantages included rapid setup (<10 minutes), no requirement for marker placement, and inherent privacy preservation through skeletal-only data transmission. This feasibility study demonstrates that repurposed consumer eldercare sensors can capture clinically relevant kinematic data for geriatric rehabilitation, aligning with broader goals of improving health equity and access [3]. While not yet validated with older adult patients, the system offers a low-cost, accessible entry point for remote movement monitoring. Key limitations - including framerate and occlusion sensitivity - highlight the need for hybrid sensing approaches in future iterations. The system aligns with gerontechnology principles by supporting aging-in-place through scalable, privacy-conscious tele-rehabilitation tools.

## References

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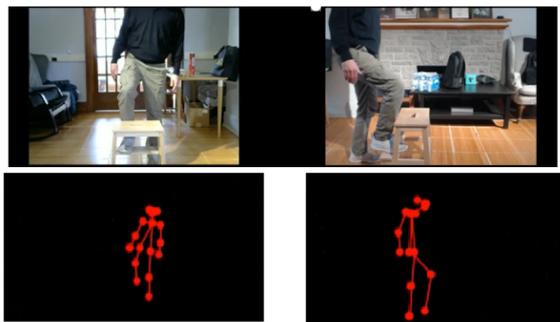
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**Affiliation:** McMaster University, Engineering Physics

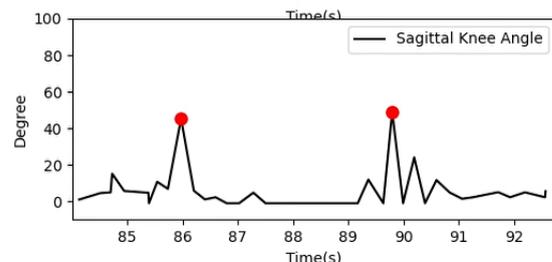
**Email:** [gajdacj@mcmaster.ca](mailto:gajdacj@mcmaster.ca)

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**Figure 1.** A frame of video showing a participant performing a step-up movement, comparing live video to our markerless capture.



**Figure 2.** An example of the right knee angle quantified from the sagittal camera, of the same participant in Figure 1, performing the step-up movement followed by a step-down movement.



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