

Application Fields and Innovative Technologies

FrailTrack: A Technology-Supported Approach to Ecological Frailty Assessment

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Purpose Frailty is a common condition among older people and has a major impact on mobility, independence, and health outcomes. Despite this, frailty is not routinely assessed in many healthcare systems. In settings such as Spain, formal evaluation often occurs only after an adverse event or when an institutional process requires proof of disability or loss of independence. This reactive approach means early and subtle changes are usually missed. Current assessments rely on self-reports and occasional clinical tests, which provide only brief snapshots of daily life. To support proactive care, frailty must be monitored more continuously and in real-world environments. To address this need, we developed an app capable of estimating frailty unobtrusively in the home, showing changes in functional status before crises arise.

Method We reviewed the main frailty scales currently used in research and clinical practice, identifying all items they assess across physical, psychological, cognitive, and social domains. Following this review, we examined which items could be captured through technology, either directly or indirectly, and mapped them to potential digital measures (Climent-Pérez and Florez-Revuelta, 2025). The resulting system supports several configurations. In its simplest form, the app runs only on a mobile phone, collecting short daily responses to a small set of targeted questions. Over time, these responses generate an evolving frailty profile that updates as answers change. Additional devices can extend coverage: a smart wristband can provide mobility and physical activity data; a Home Assistant setup can supply weight and home-activity information through connected sensors; and a smart speaker can enable voice-based interaction for users who prefer or require hands-free operation. This modular design allows the system to adapt to different home environments and levels of digital readiness while maintaining low burden. Usability principles, iterative testing with older adults and caregivers, and privacy-by-design practices guided development, ensuring data security and an interface suited to daily use. **Discussion** The app is being integrated into a wider Ambient Assisted Living system developed within the project, enabling long-term ecological assessment in the home. A validation study will take place next year with 30 older participants in Spain and 30 in Romania. The study will compare the app's frailty estimates with established frailty scales and clinical assessments, and will examine stability, adherence, and ease of use during daily operation. Although exploratory in scale, the two-country design will allow us to assess performance across different cultural and environmental contexts. Findings will inform the refinement of the algorithms and interaction methods before broader deployment. The approach offers a novel path towards continuous, adaptive, and user-centred frailty estimation, supporting earlier and more proactive interventions in ageing populations.

References

1. Climent-Pérez P, Florez-Revuelta F. Privacy-aware video-based methods for gait and frailty recognition in active and assisted living environments. In: Salah AA, Colonna L, Florez-Revuelta F, editors. *Privacy-Aware Monitoring for Assisted Living*. Cham: Springer; 2025. p. 155–186. (Intelligent Systems Reference Library; vol. 270).

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