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# Ultra-Wideband Radio Assessment of Locomotion in Elderly

William D. Kearns

*University of South Florida*, kearns@usf.edu

James L. Fozard PhD

*University of South Florida*, jfozard@usf.edu

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W.D. Kearns, J.L. Fozard. *Ultra-wideband radio assessment of locomotion in elderly. Gerontechnology 2008; 7(2):138.* Approximately 30 psychiatric syndromes including dementia and geriatric depression have disordered movement as a diagnostic sign. Moreover, changes in locomotor patterns result from pharmacological and behavioral interventions<sup>1</sup>. Using ultra-wideband technology we are developing a system for realtime monitoring of the direction, duration and acceleration of movements by multiple residents in nursing home and assisted living environments. The long term goal is to provide a system that simultaneously addresses security, clinical interventions and a platform for a variety of research applications. This paper reports progress on studies of feasibility of the technology<sup>2</sup> and early results from the application in an assisted living facility. **Methods** We conducted a feasibility trial to detect two behaviors characteristic of persons with dementia who wander and later elope from professional care settings; lingering near exit doorways and 'shadowing' or following closely behind another individual who is leaving the area. Using a commercially available Ultra-Wideband Radio (Ubisense), we first determined the ability of the device to resolve the position of any given individual or groups of individuals (*absolute location test*). A UWB device was attached to a fixed height on a rotating platform which spun at 120 rpm for 10 seconds at each of the 20 calibrated locations within an area 2 meters square (*Figure 1*). We then conducted a *shadowing test* with two volunteers to determine the system's ability to locate and follow each individual in the area in realtime and to dynamically estimate the distance between them. The study of movement patterns of elderly residents is in progress. **Results and discussion** - *Absolute location test* - UWB yielded errors under 20 cm throughout the quadrant and improved as distance from the walls increased (*Figure 1*). Location errors were observed when the tag was not fully visible to a sensor positioned on a wall or doorway. *Shadowing test* - The results of the analysis of all data showed that the mean inter-tag distance when both tags were in motion averaged 1.07m with a SD of 0.48m and a SEM (standard error of the mean) of 0.089m. The tags diverged from 0.33m to a maximum of 2.23m during the test and the observations were normally distributed. We conclude that UWB is capable of generating accurate location data and measuring distances between individuals as they move in concert. Currently, locomotor data from elder residents are being collected to obtain normative estimates of diurnal locomotor variability in an assisted living facility. Early results will be presented. The implications for the technology as an early warning system for dementia are discussed.

**References**

1 Teicher, MH, McGreenery, Cynthia E, Ohashi K. Proceedings of the 18th World Congress on Psychosomatic Medicine; 2006; pp 32-37

2. Kearns W, Moore, D., Algase, D., Ahmed, S. Gerontechnology 2008;7:48-57

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Address: Louis de la Parte Florida Mental Health Institute, USA; E: kearns@fmhi.usf.edu

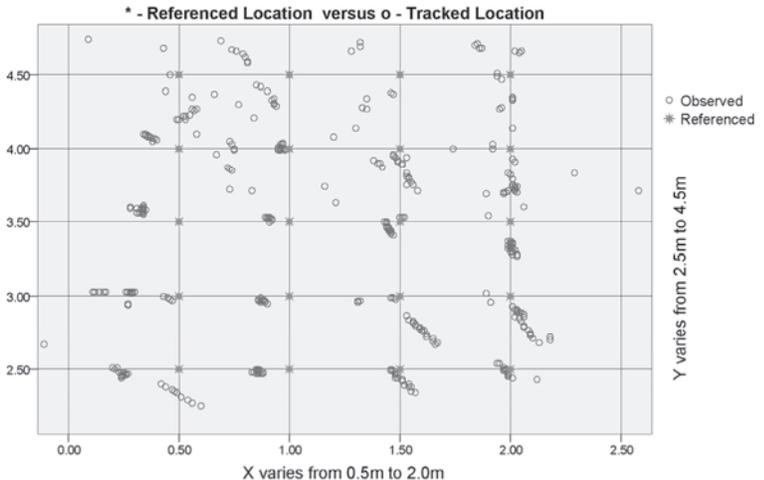


Figure 1 Intersections represent reference locations; Circles represent obtained values