J. KANTOROVITCH, A. LAIKARI, V. PEHKONEN, J. VÄRE. ***Could a vacuum robot rescue your elderly relative?*** *Gerontechnology 2012;11(2):378;* doi:10.4017/gt.2012.11.02.554.00 **Purpose** Falls are a major health hazard for elderly people and also a major obstacle to their independent living. In this paper we propose a vacuum cleaner robot as a platform for developing pervasive safety services addressing accident related emergency situations. The product presented in the paper is able to localize the fallen person, communicate with them, and alert care givers. **Method** As people grow older they are increasingly at risk of falling and consequent injuries. Moreover the fear of falling can cause seniors to limit their participation in physical and social activities, so that they become physically deconditioned, and socially isolated. Fear of falling again has been recognized as a potentially debilitating consequence of falling in elderly persons[1]. Various technical solutions have been suggested to help elderly people in emergencies, such as alert products in the form of watchbands and pendants. The issue of fall detection has also attracted academic research[2]. Most approaches are based on the output of variable accelerometers. However, just likes watchband and pendants, they are on-body devices that the elderly must remember to wear. This is not guaranteed bearing in mind these individuals may suffer from memory loss. There are also methods proposed for capturing images of people and then detecting visual falls based on image processing techniques. However video feeds from cameras involve privacy issues. Care robots are designed with idea to resemble anything from lunch carts to human companion to assist senior with day-to-day tasks. But robot-designers still have to allay any misgivings that the elderly might have about relying on new technology to watch over them[3]. The cost of the system has also presented a challenge. The product presented in this paper responds to the challenges discussed above. **Results & Discussion** Recently vacuum cleaning robots have become popular in many households. People can expect that robots will soon be able to provide more functionalities than ever before. As well as a cleaning service, these new devices may give comfort and safety to the people owning them. In many ways elderly people are like children; routines, familiar surroundings, furniture, and appliances may provide a reassuring structure and confidence to their day, as their cognitive functions decline. We believe that these small diligent devices will be soon also a part of every elderly person's home. In our prototype, with environment sensors (movement-, ultrasonic- and sound-detection), the robot cleaner is able to provide various services. For example, it can activate itself to localize the fallen person. It is able to bring the emergency button, thanks to the touch sensor augmented on robot platform. It can talk to the injured person clarifying the level of injury and to enable communication (call, Skype, SMS) with relatives and caregivers. Our set-up, based on the iRobot development environment[4], is presented in Figure 1. UPnP-middleware has facilitated the implementation of services and communication infrastructure. The conceptual prototype has been evaluated with a group of elderly people (65 persons 60-75 years old living alone) using focus groups discussion and post-test questionnaires. Evaluation results have shown a 78% acceptance rate of the technology.

References

1. Arfken CL, Lach HW, Brige SJ, Miller JP. The prevalence and correlates of fear of falling in elderly persons living in the community. Am J Public Health 1994;84(4):565-570; doi:10.2105/AJPH.84.4.565
2. Noury N, Fleury A, Rumeau P, Bourke AK, Laighin GO, Rialle V, Lundy JE. Fall Detection – Principle and Methods. Proceedings of 29th Annual Conference of IEEE EMBS, Lyon; 2007; pp 1663-1666; doi:10.1109/IEMBS.2007.4352627
3. Horowitz BT. Cyber Care: Will Robots Help the Elderly Live at Home Longer; 2010; www.scientificamerican.com/article.cfm?id=robot-elder-care; retrieved April 5, 2012
4. iRobot platform; www.irobot.com; retrieved April 5, 2012

Keywords: iRobot, emergency, sensors, elderly
Affiliation: VTT, Software Intensive Systems, Espoo, Finland*; E*: julia.kantorovitch@vtt.fi
Full paper: No

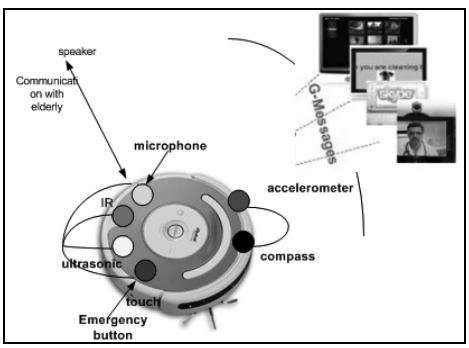

Figure 1. The set-up for irobot system