The bodily interaction between assistive devices for healthy/frail elderly and their user

Jorge Solis
Dept. of Engineering and Physics
Karlstad University, Karlstad, Sweden
solis@ieee.org

***Abstract*—Up to now, the embodiment of bodily-kinaesthetic, perceptual and cognitive capabilities for assistive robots has been scarcely studied. This research aims to incorporate and develop the concept of robotic human science and to enable its application in a human-friendly robot for assistive purposes. In this presentation, the speaker introduces different assistive robots for providing support to healthy/frail elderly.**

Keywords—Assistive devices, walking-aid

I. Introduction

At Karlstad University, the author has proposed in [1] to incorporate and develop the concept of robotic human science introduced by Takanishi in [2] and to enable its application in a multipurpose human-friendly robot for assisting elderly persons as well as assisting care givers. On the one hand, models of human motor control and learning, as well as cognition should allow creating truly interactive human-friendly robots; on the other hand, modelling human-friendly robots allows the development for reverse engineering and scientific understanding of human motion, perception and cognition. The focus of the research is embodying perceptual, cognitive and bodily-kinaesthetic capabilities.

Due to the complexity of the proposed research, two assistive robots vehicles are under development at Karlstad University: an intelligent carrying-medical tools robot vehicle [3] and a human-friendly assistive robot vehicle for supporting physically elderly [4]. The development of a human-friendly robot vehicle for carrying-medical tools (*iCAR*) was presented in [3]. *iCAR* is composed by a mobile robot vehicle with on board sensors, and two-actuated and four-passive wheels (Figure 1a). A simplified fuzzy logic controller has been implemented for the navigation control. The iCAR was able to correct its posture in order to follow the subject after a transitional period of time. After the transitional period of time, the robot was able to smoothly follow the user while walking straight. On the other hand, a time-delay neural network (TDNN) was designed and implemented for the 3D gesture recognition. A successful gesture recognition percentage of 91% was obtained [3].

The development of a human-friendly walking assistive robot vehicle (hWALK) was presented in [4]. The hWALK is composed by a two-wheeled inverted pendulum mobile robot, a 3-DOFs desktop haptic interface, a mobile computer and a wireless module for communication purposes. A PID controller has been implemented for the stability control and preliminary experiments were presented to verify the stability of the two-wheeled inverted pendulum. Under dynamic conditions on a surface with carpet padding, the system smoothly followed the desired walking motion of the user without instabilities [4].

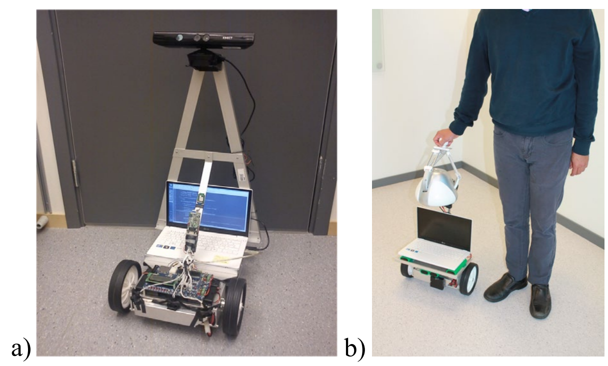

Fig. 1. a) The Intelligent Carrying Assistant Robot (iCAR) b) Human-friendly walking assisting robot vehicle (hWALK).

In this presentation, an overview of the development of *iCAR* and *hWALK* are given. In addition, the current development of a nutrition-aid device and vision control system for an eating assistive device are given.

References

[1] Solis, J.; et al. (2015) "Towards the development of multipurpose assistive vehicle robot for the ambient assisted living," International Conference on Automation Science and Engineering, pp. 1145-1150.

[2] Takanishi, A. (1995). "In Memoriam: Professor Ichiro Kato", Autonomous Robots, vol. 2, pp. 7-10.

[3] Solis, J., Teshome, T. (2014). Development of a human friendly robot vehicle for carrying-medical tools: Embodying perceptual capabilities, 14^{th} Mechatronics Forum Int. Conf. Mechatronics, pp. 370-376

[4] Solis, J., De la Rosa, J.P. (2015). Development of a human-friendly walking assist robot vehicle: System Integration and Preliminary Stability Tests, 14^{th} World Congress in Mechanism and Machine Science.