Chapter 109
Robotic Exoskeletons and Social, Companion, and Service Robots

Christos Kouroupetroglou
Caretta-Net Technologies, Greece

ABSTRACT

Robotics is an emerging technology presenting great opportunities for the future of eAccessbility and Assistive Technologies. This is why this chapter aims to present the current state of the art in the domain together with the potential that robotics holds for the future. More specifically, it presents recent efforts on social and companion robotics and the dangers and current challenges we are facing in that area, such as autonomy, security, the risk of seclusion for people being taken care of by robots, etc. Furthermore, this chapter is also discussing the developments in another area of robotics dealing with robotic exoskeletons. Exoskeletons are now being used in specific working environments and could in the future become a useful technology of people with disabilities. Some first examples are presented, and the chapter discusses issues such as the potential transfer of knowledge and expertise from other applications and the use of assistive technologies for helping caretakers instead of the actual persons in need.

SOCIAL, COMPANION AND SERVICE ROBOTS

Industrial robots are designed to carry out limited numbers of complex tasks such as welding, placing and assembly with high speed and high precision. They operate expensive custom-build tools with great destructive force for welding, cutting and shredding metal. They are dangerous when operated close to humans and tend to operate in cages or in controlled areas. They require integration into assembly lines, complex tightly scheduled environments that operate 24-7. They must be physically very robust and almost never fail. They require highly trained and often highly paid engineers to manage tool changes or intervene when there is a breakdown. The cost of delays in the work of an industrial robot can often be measured in millions of dollars. They are made from hard metals, using fast-hydraulics and precision

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engineering with high speed real-time controls. They are very expensive and require special industrial environments in which to operate.

Social, companion and service robots are a very different matter. They are intended for non-industrial market. They are consumer oriented and must be safe near humans. They must be capable of learning. They must be able to operate in proximity to humans, especially children or small animals such as household pets. They have to interact with people on a one-to-one basis, in small groups and in unstructured domestic and public spaces. They must maintain themselves as much as possible, for example by re-charging themselves whenever it is necessary and managing their own range anxiety[1]. Eventually they will adapt to new task and new environments by learning. The technologies and systems that allow robots to act in this way have already become available.

Reporters writing about the first Innorobo summit ("INNOROBO 2011 - Video by TLM", 2011) held in Lyon on 23-25 March of this year, claim that the current market for service robots (L' express, 2011) that is robots used in the home, in games or for entertainment, in education or as personal assistants is already worth $3.3B per year and that it is expected to be worth $100B per year by 2020. Many see this sector as one of the biggest new or emerging categories of electronic consumer goods.

The first real service for non-industrial use was the Roomba made by iRobot ("iRobot", n.d.) founded in the USA in 1990. The Roomba was a sweeping or cleaning robot that did its work when no-one was around and re-charged itself by finding a power outlet automatically. Costing between $350 and $800, more than 100,000 of these have been sold in France alone. Since then progress in domestic robotics has been very rapid.

The Japanese have produced a range of high profile proof of concept robots. The first was Asimo by Honda, arguably the most advanced humanoid robot in the world, the result of secret research effort that started back in the 1980s. The latest version of Asimo (Honda, 2014) improves on many ways on the performance of the previous version, and is also capable of autonomous behaviour. Asimo is not available commercially and it is not clear when Honda intends to release it into the market.

Sony has been active as well. Its first major robotic success was Aibo (AIBO-Life.org, 2012), a robotic dog intended for the toy and entertainment sector. Aibo was commercialised, but has since been discontinued. It used to sell in the US for about $1,600. It could recognise its master and would run to welcome him or her when they came home. It was able to play soccer with its other robotic doggy friends.

Sony also developed a humanoid robot called QRIO ("Sony Qrio", 2009) in 2003. Originally called the SDR or Sony Dream Robot, it was intended for the entertainment market and the original plan was to commercialise it by about 2010, but the project was discontinued in 2006. This project though technically successful …An interesting aspect of Aibo was the OPEN-R (SONY, 1998) architecture it developed for Aibo, enabling the dog to be build using interchangeable or replaceable modules. Aibo is now one of many electronic pets listed on electronic pets' website.

Toyota is also in the robot business (Kessler, 2011). It has followed a keep-it-simple philosophy and seems to have more of an eye on cost and early market entry. It recently revealed plans to develop a high-tech robot nurse that is able to lift disabled patients out of bed and can help them walk. It has already developed the "Independent Walk Assist" robot, which consists of a computer controlled leg brace initially designed for help with rehabilitation. Another e-assistance device is the "Patient Transfer Assist" which is intended to help transport someone who is bed-ridden to the toilet. These tools are all intended to ease the physical burden on nurses who may have to move or lift patients up to 40 times in a day. Toyota expects these three devices to be available commercially by 2013.