Rise of the service robots

The market for service robotics is growing. Service robots have been employed in industrial settings for many years, with a steep increase in recent years. Service robots for domestic use are still under development, but they are catching up.

According to figures provided by the International Federation of Robotics (IFR) around 21,000 service robots were sold for professional applications in 2013, generating sales of $3.6 billion. Since 1998, a total of about 150,000 service robots for professional use have been counted. Because of the diversity of these products resulting in varying utilization times it is not possible to estimate how many of these robots are still in operation. Some robots (e.g. underwater robots) might be in operation for more than 10 years, compared to an average of 12 years in industrial robotics. Others, like defense robots, may only serve for a short time.

It is interesting to note that up to 2008 about 63,500 service robots for professional use were sold during a period of more than 12 years. However, during the past five years, some 100,000 service robots for professional use were sold. This demonstrates the accelerating rate of increase in sales. Still, few main application areas make up most of the volume: Service robots in defense applications accounted for almost 45% of the total number of service robots for professional use sold in 2013.

Almost 5100 milking robots were sold in 2013 compared to 4750 units in 2012, representing a 6% increase. 760 units of other robots for livestock farming such as mobile barn cleaners or robotic fencers for automated grazing control were sold in 2013, resulting in an increase of 46%. The total number of field robots sold in 2013 was about 5900 units, accounting for a share of 28% of the total unit supply of professional service robots.

Sales of medical robots decreased by 2% compared to 2012 to almost 1300 units in 2013, accounting for a share of 6% of the total unit sales of professional service robots. The most important applications are robot assisted surgery and therapy with more than 1000 units sold in 2013. Medical robots are the most valuable service robots with an average unit price of about $1.5 million, including accessories and services. Therefore, suppliers of medical robots also provide leasing contracts for their robots.

About 1900 logistic systems were installed in 2013, 37% more than in 2012, accounting for 9% of the total sales of professional service robots. Medical robots as well as logistic systems are well established service robots with a considerable growth potential.

In 2013, about 4 million service robots for personal and domestic use were sold, 28% more than in 2012. The value of sales increased to $1.7 billion. Service robots for personal and domestic use are recorded separately, as their unit value is generally only a fraction of that of many types of service robots for professional use. They are also produced for a mass market with different pricing and marketing channels.

So far, service robots for personal and domestic use are employed mainly in the areas of domestic robots, which include vacuum and floor cleaning, lawn-mowing robots, and entertainment and leisure robots, including toy robots, hobby systems, education, and research. Handicap assistance robots have taken off to the anticipated degree in the past few years. In 2013, a total of about 700 robots were sold, up from 160 in 2012 – an increase of 345%. It is projected that sales of all types of robots for domestic tasks could reach almost 23.9 million units in the period 2014 to 2017, with an estimated value of $6.5 billion. Sales of robots for elderly and handicap assistance will be about 12400 units in the same period. This market is expected to increase substantially within the next 20 years.

Different requirements for industrial and service robots

Industrial and service robots differ significantly in terms of specifications. This can be seen when the required positioning accuracy is considered, or how the robots are integrated into the overall system. While traditional industrial robots perform their tasks in clearly structured environments with external safeguards, service robots usually work in unstructured environments and collaborate directly with humans. While industrial robots are made safe by being deactivated when somebody comes close, service robots have to interact with people. As a result, they require more complex safety concepts in order to ensure safe operation, perhaps even going as far as proximity sensors and tactile skin. Professor Gordon Cheng at the Technical University Munich has been constructing a sensitive skin for robots that will enable close contact between robots and humans. It can also be used in...
exoskeletons, where the artificial skin gives feedback to the person in the exoskeleton. Amazingly, the researchers found that the brain can adapt to this kind of feedback and help people walk.

Industrial safety standards can be applied to service robotics wherever it makes sense to do so. However, at the same time they must not be overdone and end up running up exorbitant costs. Some smaller aspects, such as gripping technology and kinematics, can be applied to service robotics applications relatively easily. The manufacturer needs to consider the far more varied requirements of service robotics. The line between industrial and service robots has already become blurred in areas such as the automotive industry, for example.

Industrial robots that can build a car or assist a worker in building a car, can also help in everyday situations. Schunk is one of the pioneers in the field of mobile gripping systems. The company’s portable grippers and lightweight arms have been pivotal in the field of service robotics. Dr. Markus Klaiber, Technical Director at Schunk said, “We are also working intensively on seeing grippers. This principle has already been put into practice with the one-finger hand of the Care-O-bot 4, which was developed by the Fraunhofer IPA Institute in Stuttgart in partnership with Schunk.” It can be fitted with a built-in hand camera that allows users to view dimly lit areas on high shelves, for example.

This modular, multi-functional robot assistant is one example for a domestic service robot. Like other service robots, all actuators of the Care-O-bot 4 are controlled via CANopen. Schunk Powerball ERB modules are used as arm joints. They control the movements of two axes in a single module with minimum space requirements. The modules also supply high torques and communicate via CANopen.

The Care-O-bot 4 is a mobile robot assistant that is supposed to actively support humans in their daily life. It can be used for a variety of household tasks, for example to deliver food and drinks, to assist with cooking, or for cleaning. The robot can also be applied to a variety of services outside the home: to support patients and personnel in health care institutions, to deliver orders in restaurants, to provide reception and room service in hotels or for entertainment. Unstructured environments are still a problem for the robot, which is why it cannot be used in households yet. This is mainly a software problem though, according to the company, the hardware is ready.

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Figure 2: A built-in camera transforms the one-finger hand of the Care-O-bot 4 into a seeing gripper
(Photo: Fraunhofer IPA)