

Introduction to the special issue on rehabilitation robotics

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This special issue of "Robotica" gives an opportunity to present a cross-section of the wide range of research and development projects in rehabilitation robotics. Rehabilitation Robotics (RR) is the application of robotic technology to the rehabilitative needs of people with disabilities as well as the growing elderly population. The updated papers were originally presented at the ICORR'97 conference, organised by the Bath Institute of Medical Engineering and held in April 1997 at the University of Bath. ICORR'97 was the fifth in the series of International Conferences on Rehabilitation Robotics and, after a break of three years, was a welcome and overdue time for sharing of ideas between workers in the field.

The conference opened with a couple of overview papers of where the field is now, and both the opportunities and problem areas. One of these keynote speakers was Christian Bühler (Wetter, Germany). In his paper he reviews the European projects, and the collaborative funding available within Europe and sees the way forward particularly in terms of more co-ordinated marketing by researchers and manufacturers.

If a robotic device is to be used by a person with disabilities one of the major problem areas is how a person with a disability and often very limited functional ability can control a multi degree of freedom manipulator. Many of the speakers presented differing approaches to this problem. One of the most respected RR projects is the MANUS wheelchair mounted manipulator developed in the Netherlands by Hok Kwee (Hoensbroek, Netherlands) and others. Alongside the commercial device there is continuing development of the hardware and software environment of the manipulator. A flexible and accessible architecture allows several different control strategies to be developed.

While the initial attempts at robotic control often use either a switch or joystick input, Shoupu Chen (Wilmington, United States) outlines a master/slave telemanipulator control system using force feedback to the user, described as a 'virtual headstick' (a severely disabled person might often

use a head mounted stick to manipulate his or her environment). The control interface need not be just a physical movement of an input device. Zunaid Kazi (Wilmington, United States) describes a multi modal approach to manipulator control, using pointing, voice control, vision sensors and a world model database. With such a wide range of human/computer interfaces in use, the prototyping strategy described by Bob Dowland (Cambridge, United Kingdom) has potential value.

Many disabled people suffer from a deficiency in their ability to move a limb either because of reduced strength, range of movement or impaired control. It may not however be necessary or appropriate to hand over the complete manipulative task to a robotic manipulator. William Harwin (Reading, United Kingdom) describes the use of a device with programmable mechanical impedance, used in conjunction with the user's residual limb function.

While many of the rehabilitation robotic projects include what is easily identifiable as a robotic arm/manipulator, one of the difficulties facing the organisers of ICORR'97 was to decide what was and what was not a "robot". Two papers which were welcome additions to the conference programme and which extended the field covered were the two papers by Kyberd and Suzuki. Peter Kyberd (Oxford, United Kingdom) took us into the area of prosthetics, and in particular prosthetic hands. His project represents the refinement of many years of development both at Oxford and earlier work at Southampton to a device which could be on the market in the short term if the prosthetics industry was willing to take up the ideas. Makoto Suzuki (Tokyo, Japan) has been applying robotic technology to assist elderly people in walking.

It is hoped that this special issue of Robotica will challenge both those working within the field of rehabilitation robotics and those working in more general areas of robotic research, to push forward their efforts to realise the potential of robotic technology to benefit disabled and elderly people.