

NEWSLETTER

NUMBER

2

AUGUST

2014

Editorial



Welcome to the Second Edition of the ISVR Newsletter! We are keeping the ISVR community up to date on exciting research and technological developments around the world. Members of the ISVR community are moving the field of virtual rehabilitation ever forward through innovation, team work, and a commitment to improving patient care, treatment, and quality of life. This issue provides further examples of the success that can result from teams

dedicated to the development and application of virtual rehabilitation technologies by members of the ISVR community. We hope that by sharing this information we can bring awareness to the research and the implementation of virtual rehabilitation technologies worldwide with a further goal of improving collaborative efforts.

In this issue, the Technology Profile article highlights the ARMin robot, the first arm exoskeleton for rehabilitation. The Sensory-Motor Systems lab headed by Robert Reiner of ETH Zurich assisted in the research and development of the ARMin robot over the last 10 years, seeing it all the way through to commercialization. The Clinical Profile features the Nisa Neurorehabilitation Hospital Units in Spain who have integrated VR-based therapy, including exoskeleton robots, as part of their everyday clinical practice.

One of the most exciting aspects of ISVR is that it is a community in which experts from different disciplines share ideas, dreams and interests in the pursuit of advancing the field of virtual rehabilitation for the benefit of a wide variety of patient populations. We currently rely on our conference series (ICDVRAT and ICVR) and associated partnerships to facilitate this information exchange. However, the new ISVR website hosts a discussion forum that we hope will provide a means of outreach that is quicker and more organized than even our popular Facebook site. We invite Society members to volunteer to lead special interest groups/discussion groups in topics of interest to the society. If you are interested in supporting our society in this way, please contact me: president@isvr.org.

Our affiliated partnerships are extremely important to us and ISVR is an associate member of IISART (see article on page 6) who are leading the way in establishing searchable databases for people interested in virtual rehabilitation. Take a look at the IISART Techindex to find out more about technologies that are currently available and the IISART Educationindex for a variety of courses aimed at clinicians, scientists and engineering audiences. Both databases may be valuable to ISVR members and, of course, offer the opportunity for you to publicize your own courses. Send your details to education@iisartonline.org.

We look forward to hearing more about the work of our members and hope to highlight you in coming issues of the ISVR Newsletter, so please join us in this community building effort and send in your ideas for news items and profile article to the Newsletter editors.

Sue Cobb, President

IN THIS ISSUE



Technology Profile

Arm rehabilitation robot ARMin

Pages 2 - 3

Clinical Profile

Hospitales Nisa

Pages 4 - 5

Feature Article

International Industry Society
in Advanced Rehabilitation

Technology

Page 6

ISVR News

Pages 8 - 9



Editors:

Sergi Bermudez i Badia
Kynan Eng

newsletter@isvr.org

Copyright © ISVR 2014

TECHNOLOGY PROFILE

Sensory-Motor Systems Lab

Robert Riener

Full Professor for Sensory-Motor Systems at the Department of Health Sciences and Technology
ETH Zurich

<http://www.sms.hest.ethz.ch/>

Where is your lab located?

We are located in Zurich, Switzerland, in the buildings TAN (Tannenstrasse 1) and ML (Sonneggstrasse 3), at the campus ETH Zentrum. As I am double affiliated with University Hospital Balgrist, I am also sharing lab and office space at that clinic, Forchstrasse 340.

How did it start, how long has it been around?

Robert Riener has been Assistant Professor for Rehabilitation Engineering at ETH Zurich since May 2003. In June 2006 he was promoted to the rank of an Associate Professor and in June 2010 to the rank of a Full Professor. As he holds a Double-Professorship with the University of Zurich, he is also active in the Spinal

Cord Injury Center of the Balgrist University Hospital (Medical Faculty of the University of Zurich). (11 years)

Who are the members?

Head is Prof. Robert Riener, 8 senior research associates (including postdocs and senior researchers), 17 doctoral students, 4 technical & therapeutic staff, 2 administrative staff & 4 guest affiliations.

What research interests does your lab have?

Active knee prosthetics, arm rehabilitation robotics (ARMin), cardiopulmonary control, climbing holds, Cognimat (cognitive training), gait rehabilitation

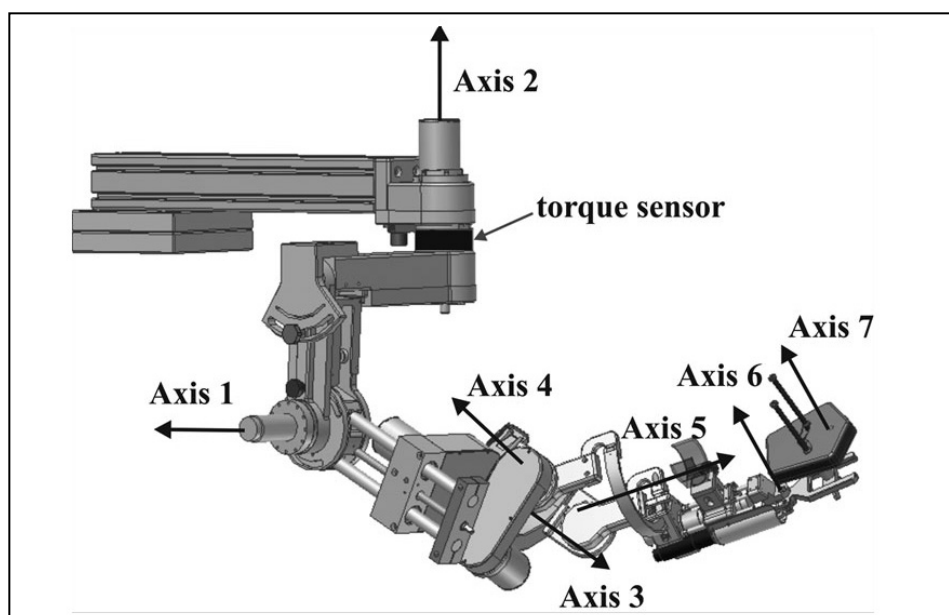


ARMin Experimental Setup

robotics (Lokomat), MR-compatible robotics, robot-assisted training in sports (M3-Lab), Somnomat (vestibular stimulation to enhance quality of sleep), work and muscle fatigue, see also our webpage.

What problem does your system solve?

The ARMin robot is a device for neurorehabilitative therapy. It assists the rehabilitation of arm movements after stroke or other neurological injuries. ARMin actively supports the patients, helping them to perform movements that they would otherwise be unable to achieve. Since the robot does not get tired, it can provide such support indefinitely, allowing training to be performed longer and at a higher intensity. Furthermore, it allows motions to be practiced in



Schematic of ARMin III with 7 degrees of freedom

TECHNOLOGY PROFILE

(continued from page 2)

different virtual environments, providing structured tasks and goal-oriented training. Finally, its position and force sensors allow to measure the patient's motions, providing a quantitative assessment of motor performance.

What makes it unique?

An exoskeletal structure with seven actuated degrees of freedom that is unique among rehabilitation devices. Innovative, cooperative control strategies that allow the patient's abilities, efforts and intentions to be taken into account, adapting the robotic assistance according to the patient's contribution. Finally, a multimodal display based on visual, audio and haptic cues that allows task-oriented functional training and increases patient motivation and participation.

How is it better than other existing systems?

ARMin is the first exoskeleton device that allows training of the arm in the three dimensional space, thus allowing to train relevant tasks of daily living. Effectiveness was proven in a controlled clinical study.

Tell us about the development process.

The first version, ARMin I, was designed starting 2003 and was characterized by 4 degrees of freedom actuating the shoulder in 3D and flex-/extend the elbow. ARMin II was characterized by a complete exoskeletal structure with two more degrees of freedom allowing also pro-/supination and wrist flexion/extension. Furthermore, the shoulder actuation was optimized. ARMin III and IV were further improved with

respect to mechanical robustness, complexity, user operation, and reliability.

At what level of readiness is the technology now?

We are exploring the role of social interaction in serious gaming to further enhance motivation and participation.

In a pediatric version of ARMin, we implement strategies that consider special requirements of robots for children.

Is it available to the community? How can one get access to it?

The concept of ARMin was transferred into a commercial product, the Armeo Power (developed and distributed by Hocoma).



User testing ARMin

CLINICAL PROFILE

Hospitales Nisa - Servicio de NeuroRehabilitación

Enrique Noé

Medical and scientific director

Servicio de Neurorrehabilitación y Daño Cerebral

Hospitales NISA

C/ Río Tajo, 1 - 46011 Valencia

www.neurorhb.com



Where is your clinic located?

Currently we have several neurorehabilitation units in Spain. Specifically, we are present in Valencia (Valencia al Mar and Consuelo Hospital), Alcira (Aguas Vivas Hospital), Elche (Brain injury service Nisa Vinalopó), and Sevilla (Nisa Aljarafe Hospital).

What patient populations do you serve? How many per year?

We take care of brain injury populations including different etiologies (stroke, traumatic brain injury, anoxia, etc.). We serve approximately 200 patients each year.

We started to work with VR rehab systems in 2007. Initially, we developed a prototype system for balance rehabilitation that was integrated into clinical practice almost immediately. We used it for years to involve the patients in intensive training. Even though it was a prototype that presented some technological limitations, the physical therapists loved it, because it helped them in their daily practice with patients with very different motor and cognitive conditions. It motivated us to keep on researching the potential of VR applied to neurorehabilitation. We have followed the same strategy with the rest of our systems, trying to develop clinically effective and usable VR systems. So far, we have developed more than ten different VR rehab systems for motor and cognitive rehabilitation, which have been combined under a common management tool in which therapists can manage patients, configure training sessions, and see results presented in a very simple way.

In all of our clinical practice, we have always combined VR-based therapy with conventional therapy, and we have analyzed the clinical effectiveness of these interventions, with promising results. VR-based therapy is administered to all those subjects who are able to benefit from it. Therapists determine the dosage according to each patient's needs and configure the therapy including VR systems as required.

CLINICAL PROFILE

(continued from page 4)

What VR rehab system(s) do you have installed?

Currently, we have 15 units of our VR system (including different exercises for different skills) distributed in our network. In addition, we have other robotic systems (Hocoma Armeo and Lokomat) that are also used for interventions.

What benefits do you gain from using this VR rehab system?

VR rehab systems allow our therapists to provide personalized intensive interventions according to each patient's needs. Patients can train different skills in a very specific way, with motivating exercises. In addition, they always have feedback of their performance so they have a reference and a goal to beat. These factors are important to maintain motivation, which is crucial in the long-term rehabilitation process.



What problems did/do you have with using these systems?

Initially, we mainly experienced problems derived from existing technology. For instance, as we have mentioned, in our first VR rehab system for balance rehabilitation we use optical tracking to track the patients, which forced us to control lighting conditions, keeping windows closed, avoiding reflective objects, etc. With technological evolution, we only have problems related to inexperience with new systems, but this is also common in non-technological tools.

Are you involved in clinical research using VR rehab systems? If so, please describe briefly.

Even though our main goal is clinical intervention, we have been always very concerned about clinical research. We have

thoroughly investigated the effectiveness and usability of all our systems under different conditions. Now we are focused on more basic studies including neuroimaging and physiological data. We hope to publish these studies in the following years.

What do you see as the most important challenge for VR rehab research and development?

From our clinical perspective, and from what we can observe in our work and in our colleagues' work, we expect that incoming advances in neuroscience will help us increase our knowledge about 1) the neural mechanisms that support improvement after VR interventions; 2) how the characteristics of each patient determine their evolution; and 3) how to use data derived from VR to assess patient condition and to configure subsequent training sessions.



Patients using the VR system

International Industry Society in Advanced Rehabilitation Technology

Gery Colombo, President

During the 11th International Conference on Rehabilitation Robotics (ICORR) in 2009 in Kyoto, research and industry players encouraged the creation of an industrial association in the field of rehabilitation robotics. At the end of the congress, approx. 30 persons voted for the creation of such an association. The goal was to have the initiative presented during the ICORR 2011 in Zürich. With more than nine companies and representatives of academic institutions, including the ICORR, we initiated the work towards the creation of such an association starting at the end of 2010. The initiators established the framework for IISART, the International Industry Society in Advanced Rehabilitation Technology. The IISART was founded on June 1, 2011. IISART is a non-profit association governed by the present statutes and, secondarily, by Articles 60 et seq. of the Swiss Civil Code. It is politically neutral and non-denominational.

Although most of the original founders of IISART focused originally more on robotics, virtual reality technology is naturally a key component of modern rehabilitation systems. We are thus very pleased to have mutual reciprocal associate membership between ISVR and IISART, and are looking forward to a fruitful cooperation between the two societies.

Of particular interest to our members and the wider community are the following new indexes:

IISART TechIndex: A continuously growing database of robotic devices and new technologies for rehabilitation that are currently on the market. The list displays devices for different application fields, types and characteristics and is intended to give the rehab world a summary of available products for rehabilitation at a glance.

IISART EducationIndex: A resource to support clinicians, scientists and engineers to build or further deepen their knowledge of advanced rehabilitation technologies by providing an overview of international education possibilities in modern healthcare technology in rehabilitation.

IISART's objectives are as follows:

- To promote the common interests of its members at the international level;

- To advocate and maintain appropriate healthcare industry standards in robotics and advanced technologies in rehabilitation throughout the world for the benefit of patient and user;
- To collect and study relevant laws and regulations applicable to the industry and disseminate such information to its members and to appropriate international organizations;
- To anticipate and initiate response to new developments and requirements;
- To disseminate and foster scientific knowledge and expertise;
- To foster transparent and reliable relationships with national and international public authorities, institutions and other relevant stakeholders, to best communicate the social, economic and scientific relevance of robotics and advanced technologies for rehabilitation industry in the world;
- To represent IISART members generally, to strive for a representative view of all members and to promote their interests:
 - To the various national and international authorities;
 - To all other healthcare trade associations (after consultation with the relevant International or National Association where

appropriate);

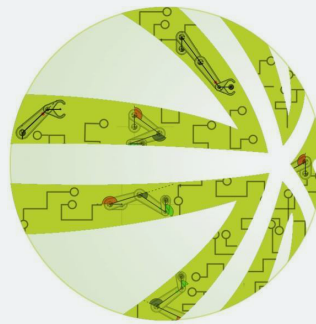
- To any local, national (after consultation with the relevant National Association where appropriate), or international professional, patient, or consumer group in the healthcare field.
- To oppose trade discrimination practices in the world;
- To work for a favorable business environment for robotics and the advanced technologies in rehabilitation industry in the world; and
- To work with other associations and organisations on general matters of mutual interest.

IISART is composed of:

Full members (voting): Any company or subset of a larger organization in the field of robotics and advanced healthcare technologies in rehabilitation developing, manufacturing, and marketing products or supplying commercial services in the field of interest of IISART.

Associated members (non-voting):

- Individuals
- Service organisation, e.g. Integrated Services, Wheelchairs To Go, ...
- Distribution organization, e.g. Rehabmart, Hospimed, ...
- Interest organization, e.g. ICORR, ISVR, COST, IFESS, ...



IISART
INTERNATIONAL INDUSTRY SOCIETY IN
ADVANCED REHABILITATION TECHNOLOGY

MISSION

IISART is dedicated to advance and promote modern healthcare technology in rehabilitation for the benefit of the patient and society at large. The main focus is on Robotics, Virtual Rehabilitation and Therapeutic Electrical Stimulation.

IISART exists to represent the interests of companies developing, manufacturing, and marketing medical devices and their accessories and active capital medical equipment in the field of robotics and advanced healthcare technology in rehabilitation.

<http://www.iisartonline.org/>



Join Us:

If you are interested to help advancing this field then you should get involved and help us promoting the field by joining our new initiative. Any participation in IISART is welcome and it would be nice to see our initiative grow, so we can improve patient care in rehabilitation in the best way possible in the near future.

Please apply by e-mail:
info@iisartonline.org

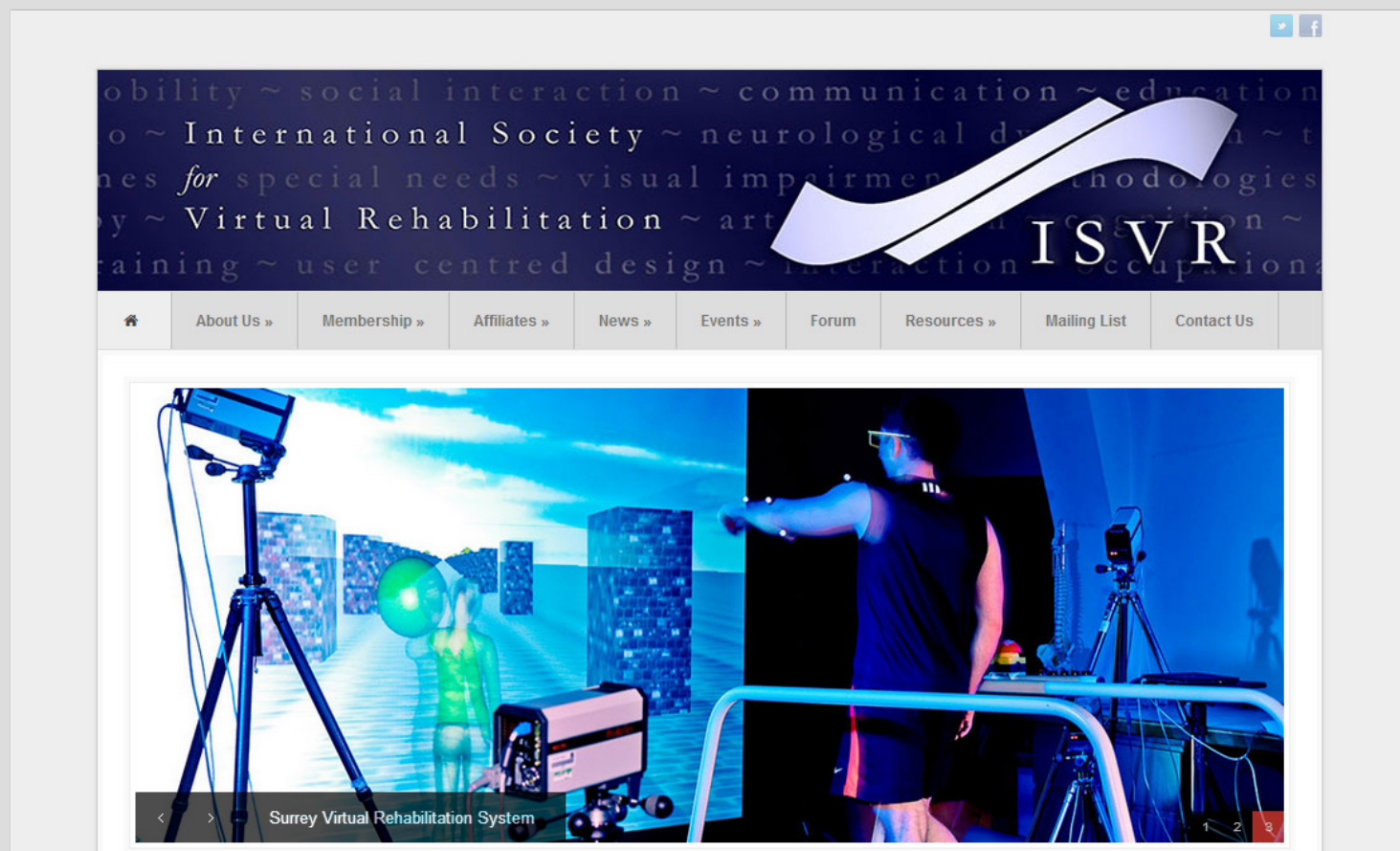
Company Members:



Associate Members:



ISVR Society News



The website at <http://www.isvr.org> acts a portal for information about the society. We are keen to enhance the community aspects of the site as well as to make it the first port of call for people wanting to know what is going on in the field of virtual rehabilitation and its associated technologies and disciplines. Please do visit the site and let us know details of any upcoming events or conferences or news items you would like us to feature on the site. We intend to add further features in the coming year including member profiles; a directory of journals who publish virtual

rehabilitation related work; and a list of Masters and PhD level theses completed or currently being undertaken in the field. As well as sending us details of events and news for display, we would welcome suggestions from members about what else they would like to see on the site, or ideas for how we can further develop the virtual rehabilitation community through it. Please mail r.j.mccrindle@reading.ac.uk with any information/ideas using ISVR INFO in the subject header.

Membership information

Membership of ISVR is open to all qualified individual persons, organizations, or other entities interested in the field of virtual rehabilitation and/or tele-rehabilitation. Membership (regular or student) entitles the member to receive a reduced registrations at ISVR sponsored conferences (ICDVRAT, the next to be held in Gothenburg, Sweden, in September 2014; and ICVR, to be held in 2015 in Valencia, Spain) and affiliated meetings (see webpages for more details). There is also an active ISVR facebook page, which is another source of useful information, currently with 977 members.



10TH INTERNATIONAL CONFERENCE ON DISABILITY VIRTUAL REALITY AND ASSOCIATED TECHNOLOGIES

GOTHENBURG, SWEDEN
SEPTEMBER 2-4, 2014

WWW.ICDVRAT.ORG

IMAGE: WWW.GOTEBORG.COM/GÖRANASSNER

The ICDVRAT conference Series provides a forum for international experts and researchers to present and review how advances in the general area of virtual reality can be used in the area of disabilities and rehabilitation. High quality papers are sought in which technical innovation is backed up by evidence of original and practical implementation, or which promise practical implementation in the very near future. Presentations which include video material and/or experimental systems are particularly welcome. Facilities for presenting such material will be available at the conference. The research presented at the conference will be published in a peer reviewed Proceedings which will be made widely available through the ICDVRAT Online Archive at www.icdvrat.org/archive.htm.

Papers are encouraged in all areas that span Disability,

Virtual Reality and its Associated Technologies, encompassing both practical application and more generic research. The following topics are just a few of those that will be relevant to the conference: Virtual and enhanced environments, Sensory impairment, Communications aids, Motor rehabilitation, Medical systems, Tools for architectural/CAD design, Clinical assessment, Input devices, sensors and actuators, Product design, testing and prototyping, Cognitive rehabilitation, Multi-user systems for user interaction, Training tools for rehabilitation, Communication and language, Computer access, Augmented reality applications, Ambisonics and audio environments, Virtual humans, Human factors, Haptic devices, Balance, posture and mobility, Rehabilitation robotics, Physical rehabilitation tools, Robotics and Sensors, Human-computer interfaces, Remote/Telecare, Wearable devices, Mobile health applications.



Gothenburg – the capital of West Sweden

Gothenburg may be small but therein lies its beauty. Discover quaint canals, the cobbled streets of historical Haga and countless green open spaces, including Sweden's largest botanical gardens, boasting over 16,000 species. Immerse yourself in the Swedish lifestyle, soaking up the buzzing outdoor café culture with 'fika' (a drink, usually coffee, and a bite) or indulge in food markets, impressive museums and fine restaurants – five with Michelin stars. What's more, there's the city archipelago right on Gothenburg's doorstep – easy to reach via a half-hour tram ride and a short passenger ferry.

UPCOMING EVENTS

Siggraph2014

August 10-14, 2014, Vancouver, Canada

<http://s2014.siggraph.org/>

Reabilitacao Fair & Forum

August 13 - 15, 2014, Sao Paulo, Brazil

<http://www.reabilitacao.com/ingles/>

2014 RO-MAN

August 25-29, 2014, Edinburgh, Scotland, UK

rehabilitationrobotics.net/ro-man14/

ICDVRAT 2014 - 10th International Conference on Disability, Virtual Reality and Associated Technologies

September 2-4, Gothenburg, Sweden

<http://www.icdvrat.org/>

Rehacare 2014

September 24-27, 2014, Düsseldorf, Germany

<http://www.rehacare.de/>

VirtRehab 2014

October 25-26, 2014 - Rome, Italy

<http://www.neurotechnix.org/VirtRehab.aspx>

Rehab Tech Asia 2015

March 26 - 28, 2015, Singapore

<http://www.rehabtechasia.com/>

Rehab Week 2015

Recent Advances in Neurorehabilitation
(ICRAN)

International Neurorehabilitation
Symposium (INRS)
International Conference on Virtual
Rehabilitation (ICVR)

June 9 - 12, 2015, Valencia, Spain

<http://www.rehabweek.org/sys/>