Miniaturization in electronics and mechanics are continuously helping to discovery new domains and possibilities for ICT applications to solve new challenges that could not be even imagined till few years ago. One of the domains in which ICT possibilities are likely to be heavily exploited is elder assistance. This is an EC priority as in Europe, the share of people aged 65 years or over in the total population is projected to increase from 17.1% to 30.0%, going from 84.6 million in 2008 to 151.5 million in 2060. Similarly the number of people aged 80 years or over is expected to almost triple from 21.8 million in 2008 to 61.4 million in 2060. Elders with physical and cognitive problems are recovered in nursery homes too early: too little is done to let them staying at home longer and ICT has the possibility to change this.

We have been working in the last years on a particular sub-problems, that does not regard only elders, that is autonomous post-stroke rehabilitation at home. Aim is to realize a platform that can be deployed massively at home and enables patient to exercise intensively and autonomously. Such effort has been supported by the EC projects FITREHAB and REWIRE. Such platform is based on a multi-level structure where at the basis is the Patient Station, deployed at patient’s home that is controlled by a Hospital Station that works as a server and is allocated in the cloud.

At home, the patient is prompted to exercise through exergames that can be completely tailored to his needs and idiosyncrasies. One of the most important needs is safety, that is avoid maladaptation that would make more harm than good. To this aim we have integrated inside the game engine a Virtual Therapist, with reasoning capability, that looking in real-time at patient’s movement and launches warning and even stops exercising according to how wrong the motion is going. Adequate tracking devices are required: for instance, for posture rehabilitation a Kinect can be used for whole body tracking, integrated with a pressure board to measure accurately the center of pressure. This experience has allowed us to define a methodology to develop therapeutic exergames, in which first the therapeutic requirements (not only the motion required, but also the constraints, and the parameters that define the degree of challenge) have to be defined first and the game has to be build upon these specifications. To maximize compliance with exer-games we leave to the patient the possibility to personalize assets, music and avatar. Preliminary results have shown that intensive rehabilitation also long after the stroke event (3 months, when they are not given any more rehabilitation) does improve patients’ condition measured through clinical standard indexes.

The cloud server provides to the clinicians a Web tool to customize the exercises and review the results. Scheduling is then downloaded to the client at home proposing daily exercises to the patients. At the end of a session, the client uploads the results. It has also to provide a summary to the clinicians of the progress. To this aim we have defined global variables, inspired to motion control literature, that can apply to all exercises: amplitude, accuracy and speed. These allow to set a challenge progression for each exer-game along one of these dimensions and evaluate the progression over a time span.

At the same time, we are exploring the use of smart objects as new trackers that can enable rehabilitation of the hand. In this domain exoskeletal are usually used. We have recently developed a modular pressure sensing system that can be embedded inside 3D printed manufactures or Lego structures. These are under testing with children who underwent surgery.

3. http://www.rewire-project.eu
7. J. Held et al., Autonomous rehabilitation at home based on virtual rehabilitation: safety, usability and compliance, a pilot study, to be submitted to BMC Neurology