

The DAT Service, an Integrated Approach to Improve Independence at Home

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Abstract. The DAT Service - located in Milan, Italy, within the premises of the Don Gnocchi Rehabilitation Institute - is a comprehensive service that includes a smart home environment, occupational therapy facilities, and a permanent exhibition of assistive devices for mobility, activities of daily life and communication. Overall, this service offers the opportunity for people with disabilities to undertake rehabilitation and educational programmes aimed at improving their ability to independently cope in their home environment. The DAT service is designed to serve a broad range of clients, including people with orthopaedic and neurological diseases, children as well as adults and frail elderly people. The core of the DAT service is the smart home, a 130 m² flat composed of 7 rooms (entrance, kitchen, living room, office, bathroom, and two bedrooms) and equipped with advanced solutions for independence, security and safety. The smart home was designed according to a hidden technology concept and looks like a traditional home. The subsystems of the smart home technological infrastructure include: climate control, lighting, safety & security, video surveillance, emergency, doors & windows control, ICT & multimedia. In order to accommodate the different requirements of the various DAT clients, the smart home can be easily configured by the therapist in relation to the individual client's need by means of a purposely developed software tool, which allows to activate the selected automation function and to configure their parameters. User empowerment is the key objective of the service. To this end, a multidisciplinary team (including physicians, occupational therapists, physiotherapists, psychologists and bioengineers) works with the clients to help them assess their needs, set objectives and find out the proper solutions to improve their independence. Within the smart home, the DAT service also offers the possibility of individualized education and training on the assistive solutions, in real daily life settings.

Keywords. Assistive Technology Counselling, Smart Home, User Empowerment

Background

The great improvement and widespread that ICT and environmental control technologies faced in the last few years represents an interesting opportunity for people with disabilities to improve their ability to cope with daily life activities. It is nevertheless very important to identify, within the numerous technological solutions the market has brought about, which are suitable for each individual person. To this

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end, the importance of the assistive technology assessment services is widely acknowledged.

For over 25 years the Don Gnocchi Foundation – the largest Italian private non-profit organisation providing care and rehabilitation services to people with disabilities – has been committed in research, information, and education in the field of Assistive Technology through his Biomedical Technology Department and the Assistive Technology Information and Assessment Service (SIVA). The latter was recently integrated in a new service named DAT which offers the possibility of a comprehensive rehabilitation process that includes occupational therapy training, individualized assistive technology counselling and education towards independence.

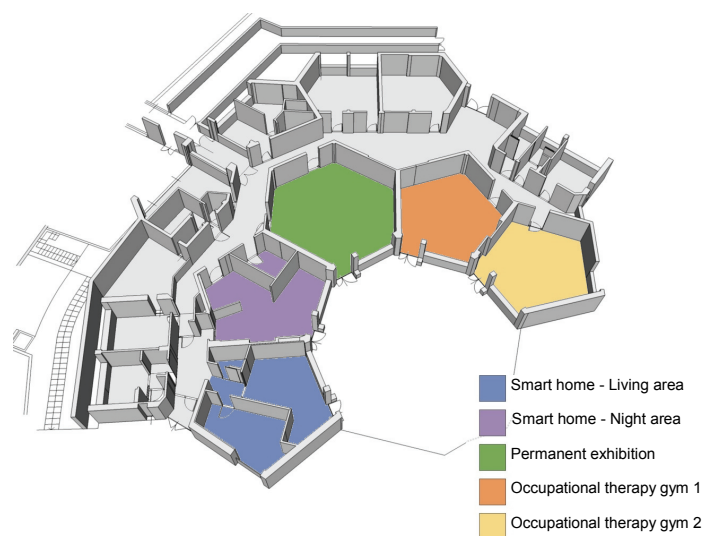


Figure 1. Pan of the DAT facilities.

The DAT service was created with a threefold purpose. Within individual rehabilitation programs, it serves as a physical setting where clients with disabilities can experience how to make the most effective use of technology for their independence at home. With the help of occupational therapists and medical staff, disabled people become aware of possible technological solution they can adopt in their own apartment. In the smart home they are given the opportunity to evaluate their abilities and performance in daily activities and to get better prepared for their return at home.

The DAT service also represents a demonstration and educational laboratory where professionals, caregivers, and the general public can get knowledge of the latest advancements of assistive devices for mobility, activities of daily life, communication, home automation and telecare.

Finally, within the research activities of the Biomedical Technology department, the smart home is used as a test bed for the development of new *clinical protocols* for independence at home and *innovative solutions* in the field of environmental control and home care.

The DAT service is addressed towards a broad range of clients, including people with orthopaedic and neurological diseases, children as well as adults and elderly: substantially, towards any client served by the Don Gnocchi Foundation. A

benchmarking method has been used to describe this complex population, prospective users have been divided into six different categories defined on the basis of six case studies. These include: hemiplegia (e.g. outcome of stroke), paraplegia, quadriplegia (e.g. spinal cord injury), severe motor impairment in adult person (e.g. Amyotrophic Lateral Sclerosis), severe motor impairment in a child (e.g. Cerebral Palsy), and cognitive impairments (e.g. Alzheimer's disease).

The DAT Facility

The acronym DAT stands for “Smart Home, Assistive Technology and Occupational Therapy” (in Italian *Domotica, Ausili, Terapia occupazionale*), the DAT service in fact includes a Smart Home environment, Occupational Therapy facilities and a Permanent Exhibition of assistive devices for mobility, activities of daily life and communication (figure 1). The heart of the project is represented by the Smart home which is composed of 7 rooms: an entrance, a kitchen, a living room, an office, a bathroom, and two bedrooms, one for adults and one for children. The overall surface is approximately 130 squared meters. Outside the apartment, a control room will allow the professional team to customize the home automation configuration and to process / analyse all bio-signals collected from clients for research purpose. Outside the apartment, there is a terrace where clients have the possibility to carry out gardening activities and test their wheelchairs on different terrains.

The subsystems of the smart home technological infrastructure (figure 2) include: climate control, lighting, safety & security, video surveillance, emergency, doors & windows control, ICT & multimedia.

The communication between all the electric and electronic devices of the smart home is ensured through a bus system based on the konnex™ standard. This standard was chosen for its interoperability and the reliability demonstrated in previous similar projects [1]. The basic environmental control function (such as lighting, climate, door, and windows control) are based on *distributed intelligence* automation concept and therefore do not require a supervisory unit to work. On the other hand higher level automation functions (such as the power off of dangerous electrical appliances or automatic stop of tap water involuntary left open) are implemented using a supervisory unit to allow for a higher flexibility and configurability.

The DAT smart home can be configured on the basis of individual needs using a software tool, specifically developed for this purpose. With this tool it is possible to choose which automation functions activate and configure their parameters (e.g. the devices and type of messages used for alerts and alarms). For an easier and faster configuration six pre-charged profiles corresponding to six categories of users described above, are proposed by the software.

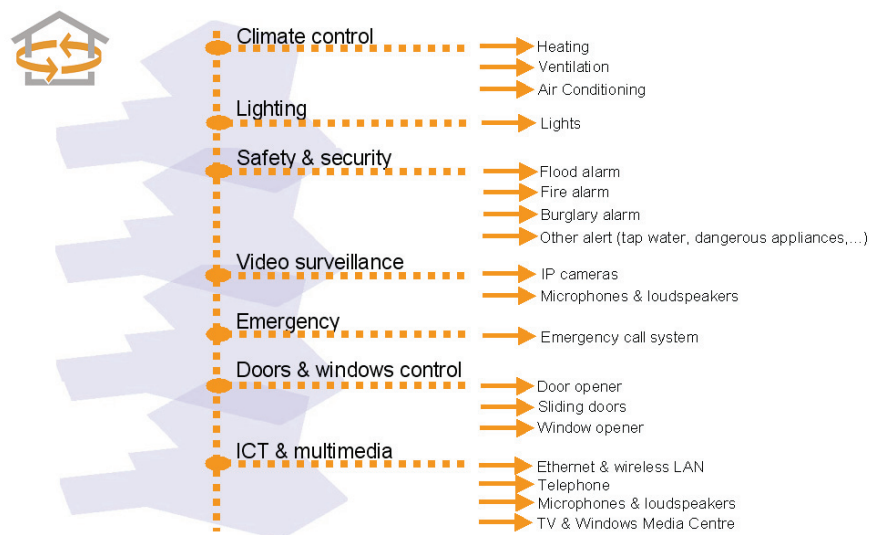


Figure 2. The Smart Home technological infrastructure subsystems.

The smart home was designed according to a hidden technology concept and thus looks like a traditional home. The house has of course been designed to be free of any architectural barriers; special attention have been paid to the kitchen and the bathroom design so as to have them fully usable by people in a wheelchair. Particular solutions for facilitating personal mobility of people with motor disabilities inside the house have been adopted, such as sliding doors and a ceiling mounted hoist.

The DAT Method

In line with the long term experience of the SIVA department, the key objective of the DAT assessment methodology is the user empowerment. The five main areas of activity of the service include: home adaptation & environmental control, mobility & seating, personal care, communication & computer access, and educational software. A multidisciplinary equip (including physicians, occupational therapists, physiotherapists, psychologists and bioengineers) supports clients in the process of setting the objectives and finding the proper solutions to improve their independence in daily life activities. The assessment methodology consists of the following phases:

- **Clinical examination:** in this phase the physiatrist collects information about the medical history of the client and carries out a functional evaluation of his or her motor and cognitive abilities. During this phase an individual rehabilitation programme for the client is defined.
- **Visit of the DAT facilities:** in this phase the DAT equip leads the client into a visit of the smart home and permanent exhibition facilities, with the intent to offer him or her a knowledge of the existing solutions in the field of assistive technology and home adaptation, thus promoting the user empowerment

- Screening of the needs: in this phase the DAT equip helps the client in the process of identifying the needs and setting the objectives, which is a fundamental step in the process of the adoption of an assistive device [1].
- Tests of assistive solutions in real life settings: once the objectives have been clearly defined the client is given the possibility to try out different assistive solutions, proposed by the equip, in real life settings within the DAT facilities. In this phase the DAT team also performs an evaluation of the environment where the client lives.
- Identification of the solutions: in this phase the equip compiles a report containing the identification of the solutions considered to be the most appropriate, on the basis of the elements acquired during the tests and the evaluation of the living environment. The report also contains information on tax relief and other incentives to obtain the assistive devices.
- Medical prescription: in this phase the physiatrist prescribes the assistive devices eligible for medical prescription according to the Italian legislation.
- Training: the client is offered the possibility of an individual training on the use of the assistive devices identified, within the DAT facilities or at home.
- Follow up: with the help of outcome measurement instruments such as the QUEST [3], after a period of approximately 6 month, the DAT equip verifies the effectiveness and usefulness of the adopted solution.

In conclusion the DAT service was created with the intent to offer people with disability the possibility to follow an integrated rehabilitation process to improve their independence in daily life activities.

References

- [1] Lauruska V, Serafinavicius P: Adaptative Smart Home System for Disabled. Assistive technology – Shaping the future. 579-583. IOS Press, Amsterdam 2003.
- [2] Assistive Technology Education for End-Users, Guidelines for Trainers: EUSTAT Project, European commission DG XIII, Telematics application programme disabled and elderly sector.
- [3] Demers, L., Weiss-Lambrou, R., and Ska, B. Development of the Quebec user evaluation of satisfaction with assistive technology (QUEST). *Assistive Technology*, 8, (1996), 3-13.