

# The FRR Project: Developing a More User Friendly Rest Room

Paul PANEK \*), Håkan NEVERYD #), Wolfgang L. ZAGLER \*)

\*) *fortec - Research Group on Rehabilitation Technology, Institute of Industrial Electronics and Material Science, Vienna University of Technology, A-1040 Vienna,*

*Favoritenstrasse 11/366-1B, tel: + 43 1 58801-76613, fax: + 43 1 58801-36697*

*panek@fortec.tuwien.ac.at <http://www.fortec.tuwien.ac.at/fr>*

#) *Certec, Division of Rehabilitation Engineering, Lund University*

*Box 118, SE-221 00 Lund, Sweden*

*Keywords: toilet, rest room, smart card, design for all*

**Abstract.** This paper describes the RTD project FRR (Friendly Rest Room) which is partly funded by the EU in the Quality of Life programme. The objective of the FRR project is (a) to create prototypes of more user friendly rest rooms for old persons and for persons with disabilities and (b) to gain applicable knowledge about specific needs and wishes of old and/or disabled persons and their care persons concerning rest rooms. The FRR project is using a user driven research approach implemented by three test bases in Sweden, Austria and Greece which have already carried out the first user tests on prototypes. The outcome of the user tests and the user investigation via paper questionnaires and computer based interviews provide input to the design and engineering process which is running in parallel aiming at specifying and implementing improved prototype generations. The paper also describes ethical considerations which accompany the high level of user involvement.

## 1. Introduction and Aim

Present European toilet facilities in private and public places usually do not meet the specific needs of many old persons suffering from physical and cognitive limitations. The FRR project is carrying out the necessary research and design steps in order to build and test prototypes for a Friendly Rest Room (FRR) for older persons and/or persons with disabilities. All the elements of the FRR will adjust automatically to the individual needs of older persons with functional limitations or persons with disabilities, allowing them to gain greater autonomy, independence, self-esteem, dignity, safety, improved self-care and, therefore, enable them to enjoy a better quality of life. The methods and technologies involved range from contactless smart card technologies with read-write capabilities, voice activated interfaces, motion control and sensor systems, mechanical engineering and robotic techniques, mathematical modelling, as well as ergonomic research, design for all philosophy, gerontechnology and medical and social sciences. The aim of the FRR project is to empower old and/or disabled persons to use public restrooms in Europe even despite an increasing level of disability and to support secondary users by providing an innovative, user-friendly and highly adaptable, smart toilet system.

## 2. Methods

### 2.1 *Multidisciplinary Approach*

The consortium brings together end-user organisations representing a wide range of European countries, universities, research and rehabilitation centres as well as industrial partners in the area of industrial and public design and the sanitary industry.

## 2.2 *User Involvement and User Needs*

The project involves broad user driven research to define the user parameters for designing and developing the FRR systems. User involvement takes place in all the stages [5,10,12] of the research and problem solving process of the FRR development and testing. Starting from given restrooms („standard restrooms“) [13] it is necessary to find out (a) what older and/or disabled toilet users (primary as well as secondary users) experience as difficult and (b) what they regard as helpful. This is done by applying social research methods (interviews, observations, questionnaires, secondary statistics) and by referring to given technical/design solutions represented in the different FRR prototypes generations or FRR design specifications. For this reason 3 user test sites have been established in Sweden (Univ. of Lund), in Greece (Univ. of Athens) and in Austria (Univ. of Technology Vienna).

## 2.3 *User Test Bases*

The three User Test Bases are organised and maintained by the local FRR project partners. At each site independent User Boards consisting of 7-10 expert users, care persons and professionals from therapy, nursing and medicine and user representing organisations have been established. Additionally, each site is equipped with a “real toilet prototype” in order to run user tests. In the first test phase these “toilet prototypes” have been realised by products purchased from the market, partly modified to extend the functionality. Based on the results gained from the first user tests, currently the next prototype generation is developed out of the first generation.

The test site in Lund is using a Swedish product from Gustavsberg [20] which has been installed in a quasi real-life setting (see Fig. 1). User tests are focusing on old persons with visual impairments. The test site in Vienna is using a Hungarian product from Clean Solution Kft [19] which has been significantly modified with additional adjustable grab bars, position sensors and a PC-unit for controlling the toilets and for measuring and logging the users’ preferred positions. In contrast to Lund, the Viennese prototype is installed in a laboratory environment without being connected to the water supply and sewer (see Fig. 2). Here, the focus of the user tests has been put on users with limitations in lower parts of the body, meaning users moving with wheelchair, cane or other walking aids. The test site in Athens is using the same products as in Lund but has installed them in a public toilet room (size 1.9 m<sup>2</sup>). The Focus of the user tests there is on accessibility concerning the standard small sized Greek restrooms.

## 2.4 *Ethical Aspects*

The setting-up and carrying out of the user tests is being accompanied by ethical reviewers in order to ensure the protection of the dignity and privacy of test persons and users involved [14]. In addition, to ensure the ethical quality of the on-going work the reviewers also help to develop new horizons in the design process about the intimate and sensitive aspects of toileting, personal hygiene and public health as a psychological and cultural phenomenon.

## 2.5 *Qualitative Research*

One of the main tasks of qualitative research in the FRR project are the user tests which are carried out in several cycles with a relatively small group of specifically selected users. The users are asked to use the current prototype system, technical data are measured by the sensors of the prototype. If they have agreed to be observed, the sociologist takes field notes. After the test a post-test interview is conducted. This methodology is based on the “Theoretical Sampling” method and on the “Grounded Theory” by Strauss and Corbin [1]. The

data triangulation ensures validity by cross referencing of different sources and different methods. Additional to the user test cycles, where the users interact with new FRR prototype generations and reflect about interaction during the post test interview (open interviews recorded & transcribed), other methods for collection of qualitative data have been used: Expert knowledge has been gained during expert workshops in Athens, Lund, Milan and Vienna in 2002, by conducting exploratory interviews with secondary users in Austria and is also continuously provided by user boards. Case studies on the practice of disabled and older toilet-users are being conducted in Italy.

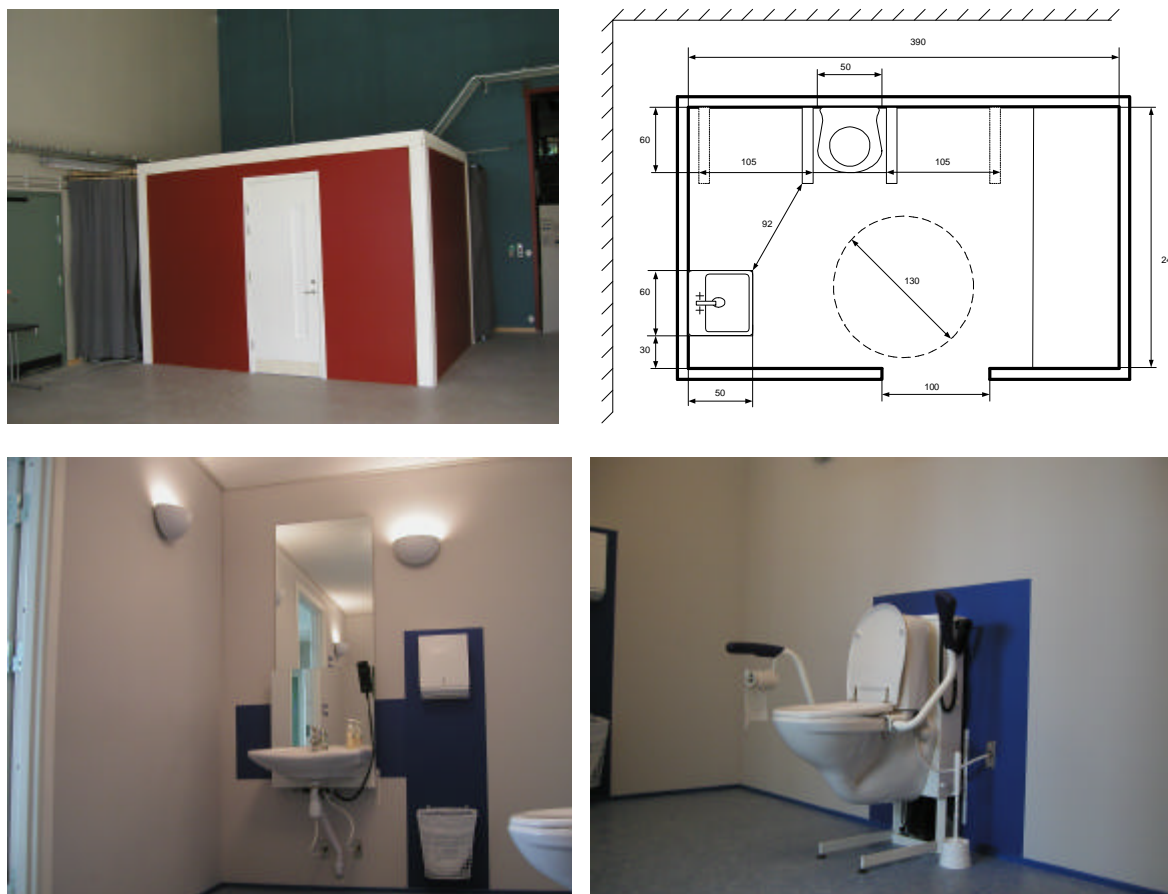


Fig. 1: FRR Test Site in Lund, Sweden. A complete dedicated toilet room has been set up. Behind the curtains the infrastructure (water supply, electricity) is hidden but easily accessible for the technicians. A sink and a toilet bowl from Gustavsberg [20] have been installed, the walls have been marked with white and blue colour aiming at a good contrast in order to provide navigation cues for visually impaired test users.

## 2.6 Quantitative Research

Several thousands FRR questionnaires (4 pages) about the personal situation regarding using one's own toilet were distributed in nearly all regions of the German speaking Europe among members of seniors' organisations by FRR partner Eurag and by the MS-Society of Austria in their members' journal. Additionally, Greek, English and Dutch versions of the questionnaires have been distributed nationally and are currently (April 2003) being returned to the consortium.

## 2.7 Iterative and User Centred Design

Based on the results of user tests the next generation of FRR design specifications [18] and FRR prototypes will be realised and delivered to user tests sites in order to start the next

cycle of user tests regarding the improved prototypes. In the FRR project 4 cycles of testing and redesigning are foreseen in order to come up with the final FRR system end of 2004. Computer Based Interview tools [21] are planned to be used for getting feedback and response from users, professionals and experts to suggested possible design solutions.

### 3. Preliminary Results and Ongoing Activities

Currently (April 2003) the first test cycles in all 3 test sites have been completed, the design process for the 2<sup>nd</sup> prototype generation has been started. Still there are questionnaires being sent back from the users. The test sites are preparing the installation of the new prototypes before summer 2003. A web based FRR knowledge base has been set up and is available for public on <http://frr.nurs.uoa.gr/KB/template/index.htm>



Fig. 2: FRR Test Site in Vienna during one of the first user tests carried out in September 2002. A person in a wheelchair is autonomously transferring from the wheelchair to the toilet. In the background a technician is working in front of the PC which controls actuators and reads sensor data of the toilet assembly, a significantly modified Hungarian product from Clean Solution Kft [19].

### 4. Discussion and Outlook

The multidisciplinary approach causes a significant need of communication to ensure that information flow between partners with different backgrounds, different terminologies and different ways of working is running smoothly. Nevertheless, this approach is ensuring a wide horizon to come up with innovative and reasonable approaches which are meeting the users' needs and the economic necessities. An important feature of the FRR project cer-

tainly is the strong user involvement which also can be observed in the way the project is structured, especially in the 3 user test sites with 3 independent user boards.

More information about the current status of the FRR project can be found on the web: <http://www.frr-consortium.org>

#### **Acknowledgements:**

FRR is partially funded 2002-2005 by the European Commission as project QLRT-2001-00458 in the Quality of Life program. Project partners are: Industrial Design Engineering - Delft University of Technology (NL), fortect - Vienna Univ. of Technology (AT), Certec - Dep. of Rehabilitation Engineering, Lund University (SE), EURAG - European Federation of the Elderly (AT), Laboratory of Health Informatics – University of Athens (GR), Applied Computing – Dundee University (UK), Landmark Design Holding (NL), Clean Solution Kft (HU), SIVA (IT), HAGG – Hellenic Association of Geriatrics and Gerontology (GR).

We gratefully acknowledge the intensive contributions to the FRR project provided by Robert Schlathau from the board of the Austrian Multiple Sclerosis Society.

#### **References:**

- [1] A. Strauss, J. Corbin: Basics of Qualitative Research - Grounded Theory Procedures and Techniques, Newbury Park, 1990.
- [2] D. Rudel, M. Fisk: Can Users of Personal Response Systems in Slovenia Benefit from the 3<sup>rd</sup> Generation Technology, in: C. Marincek et al. (Eds.) AAATE 2001 conference proc., IOS press, pp. 734-737.
- [3] F. Aminzadeh, N. Edwards, D. Lockett, R. C. Nair: Utilization of bathroom safety devices, patterns of bathing and toileting, and bathroom falls in a sample of community living older adults, in Technology and Disability 13 (2000), ISSN 1055-4181, IOS Press, pp. 95-103.
- [4] FRR – Friendly Rest Room Project Web Site: <http://www.frr-consortium.org>
- [5] H. Hyppönen: Handbook on Inclusive Design of Telematics Applications, 1999, electronically available on <http://www.stakes.fi/include/handbook.htm>
- [6] H. Neveryd, J. Molenbroek, P. Panek: FRR - Friendly Rest Rooms for Elderly and Disabled Persons - A User Centered R&D Project, to be printed in proceedings of Gerontechnology Conf., Miami, U.S., 2002
- [7] H. Pain, S. Gore, D. L. McLellan: Choosing bathing and showering equipment for people with disabilities, in C. Bühler, H. Knops (Eds.): Proc. of the 5<sup>th</sup> AAATE Conf., IOS Press, pp. 397-401, 1999.
- [8] INCLUDE Project: INCLUsion of Disabled and Elderly people in telematics, TELEMATICS project 1109, Web Site: <http://www.stakes.fi/include/>
- [9] J. A. Sanford: Best Practices in the Design of Toileting and Bathing Facilities for Assisted Transfers – Final Report fro US Access Board, August 2001, <http://www.access-board.gov>
- [10] J. Nielsen: Usability Engineering, Academic Press, 1993.
- [11] K. Pesola: Bathroom – an important Detail in Designing for Older People, in C. Bühler, H. Knops (Eds.): Proc. of the 5<sup>th</sup> AAATE Conf., IOS Press, pp. 392-396, 1999.
- [12] K. T. Ulrich, S. D. Eppinger: Product Design and Development, Second Edition, McGraw-Hill, 2000.
- [13] Kira, Alexander. The Bathroom, Viking Press, New York, 1976.
- [14] M. Rauhala: Ethical Dimensions of User Involvement in Assistive Technology Research and Development Work, in: H. Hutten, P. Krösl (Eds.): 2<sup>nd</sup> European Medical and Biological Engineering Conference EMBEC'02, IFMBE Proceedings Series Vol. 3 / 2002, ISSN 1680-0737, ISBN 3-901351-62-0, pp. 1694-1695
- [15] Older adult data. The handbook of measurements and capabilities of the older adult: data for design safety, Anthropometric and strength data on older people aged 60 and over, publications@dti, Department of Trade and Industry, UK, June 2000
- [16] P. G. Morasso, L. Baratto, R. Capra, G. Spada: Preventing the risk of falling in elderly patients, in: I. Placencia Porrero and E. Ballabio (Eds.): proc of the 3<sup>rd</sup> TIDE congress, IOS Press, pp. 101-104, 1998.
- [17] P. Gregor, A.F. Newell, M. Zajicek: Designing for Dynamic Diversity – Interfaces for Older People, in ASSETS 2002, ACM ISBN 1-58113-464-9-02/07, pp 151-155
- [18] R. de Bruin, J. FM Molenbroek, T. Groothuizen, M. van Weeren: On the development of a friendly rest room, proceedings of the INCLUDE conference 2003, Inclusive Design for Society and Business, 2003
- [19] Clean Solution Kft, Hungary, <http://www.cstechnologie.com/>
- [20] Gustavsberg, Sweden, <http://www.gustavsberg.com/gustavsberg/>
- [21] K. Hands, P. Gregor, D.R. Peiris, A. F. Newell: A computer-based interviewing tool for usability engineering (UsE-IT), in: CHINS 2001 Consumer Health Informatics Network Scotland, Glasgow, 2001