Figure 3: Example of a user interface: reminder for an expiry date

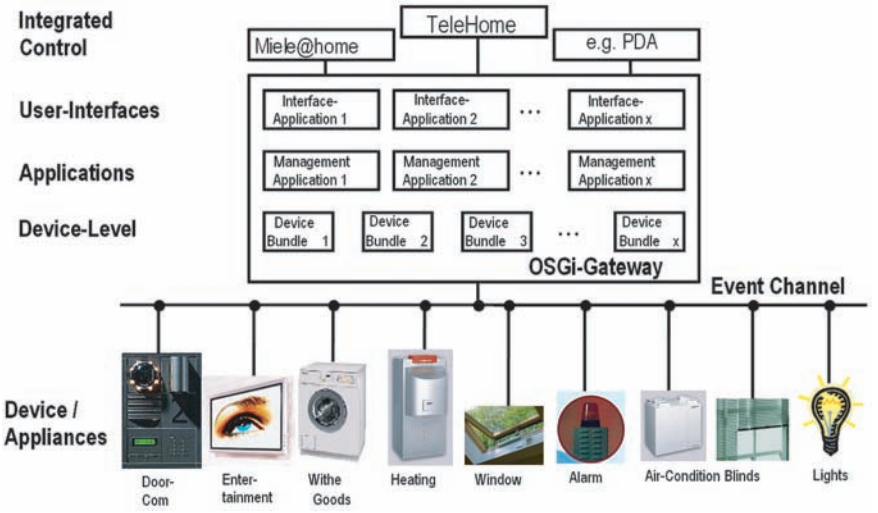

Figure 4: IT infrastructure in smart homes

HomeBox is intended for delivery and temporary storage. The HomeBox is an access-secured pick-up box with various units for food, drugs and other goods. The supplier receives an access code for a unique delivery and places the goods into the HomeBox. The stock receipt is acknowledged and notified to the user.

System Design

The combination of smart home technology and services is an important reason for customers to instal infrastructures and smart devices in their homes. Today, while developing smart components less attention is normally devoted to easy integration into complete applications. This is not only a question of standardized communication protocols. Our approach is a co-development of smart devices and proxies that can be integrated and manage the basic communication between the device and other services (Figure 4). This approach offers the chance for easy integration of different user interfaces [Ressel 04]. Our system will be installed in a pilot project in Germany, called "Smarter Wohnen NRW". During this project more than 200 dwellings will be equipped with infrastructures, intelligent devices and new services for the customer. This approach is being developed further under a EU project called AMIGO (www.amigo-project.org).

References

[1] vBoegel 02
Dr. Gerd vom Boegel, OPERATION OF APPLIANCES CONTROLLED BY SMART LABELS, IEEE International Symposium on Consumer Electronics 2002, September 2002 Erfurt / Germany

[2] Ressel 04
Christian Ressel, Integrated Operation of Intelligent Environments, Convention Documentation of ehome 2004, Berlin, 9/2004

[3] Grinewitschus 04
Dr. Viktor Grinewitschus, Das vernetzte Haus – Anwendungslösungen durch Systemintegration, Convention Documentation of ehome 2004, Berlin, 9/2004

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Technologies for Smart Toilets

Georg Edelmayer, Paul Panek, Peter Mayer and Wolfgang L. Zagler

In the framework of the EU-funded Friendly Rest Room (FRR) project (QLRT-2001-00458) several prototypes of adaptable toilet facilities have been developed and evaluated. By applying integrated sensor technologies, these prototypes of smart and user-friendly toilets are capable of adjusting automatically to the individual needs of the user; in particular, attention has been given to the needs of old people, of persons with a disability and of accompanying carers.

Introduction

Toileting is a sensitive topic not often talked about. However, Assisted Living research activities are also being done in this area. In order to outline the high needs of users a questionnaire was developed and used in the framework of the Friendly Rest Room (FRR) project. The results show that 36.1% out of more than 323 old and disabled persons who answered the questionnaire [6] in several European countries face moderate (23.4%) or severe limitations (12.7%) in their quality of life due to missing adequate toilet facilities, forcing them to stay at home instead of participating in societal life. To overcome this, the FRR project aimed at developing a new type of intelligent toilet for semi public environments (airports, theatres, museums, care institutions) usable by "all citizens" and also supporting the carers of old and disabled users [3].

Methods

The needs and wishes of users were

assessed and interpreted in direct interaction between users, researchers, technicians and designers, and thus operatively influenced the development process [7]. One of the final prototypes located in a laboratory environment (see Fig. 1) is described below.

Figure 1: FRR prototype in Vienna lab.

The toilet hardware (based on a product of [1]) is installed in a 'booth' which is wide enough to provide space for a wheelchair and a care person and was defined following the needs of laboratory testing with elderly and disabled persons. The prototype is connected to electricity but not to water. Testing simulations are done with the clothes on. During the tests a technician was available for supervision of the system.

System Control

The prototype system was controlled via a standard PC running Windows-XP, using a self-developed software (C++) for measuring, steering and logging tasks. PCI bus I/O cards (binary input, ADC, digital counter, relays output) connected the several sensors, the remote control and the motors with the system PC.

The basic functionality of the toilet is the adjustability of height and tilt of the toilet bowl, seat and support bars. The height of the seat can be adjusted between 44.5 cm and 77.5 cm at a speed of 1.1cm/sec. The tilt angle of the seat ranges from 9° (forward) to -1.5° (backwards) and changes with a speed of 1.3°/sec. Direct steering of the toilet by users is possible by a simple 6-button remote control and alternatively with a touch screen user interface, which also provides capabilities to control the more enhanced features of the system (speech recognition, audible feedback, lighting control, user preference settings, etc.)

Voice Control provides additional means for steering the toilet hardware and environment. For carers who are using both hands for assisting the primary users the voice control offers a "third hand". Using a simple desktop-type microphone and an off-the-shelf speaker-independent speech recognition engine with an adapted grammar for the specific task of steering the toilet 90% of the commands (pre-defined word-triplets) were recognized correctly for different speakers in a noisy environment.

Sensors

In the prototypes the following sensors were used for data gathering about the system and the user.

- **Position sensors:** For measuring the seat height and tilt, wire-actuated optical transducers were used. The actual seat height was directly derived from the digital sensor reading, tilt was calculated indirectly by the measuring software from the linear signal of the sensor for the tilt displacement.
- **Force sensors:** Deliver the distribution of forces due to a person's activities like sitting down, shifting on seat for better comfort or standing up. High-precision load cells were integrated into the frame of the toilet, mounted along the axis of the motors for picking up the vertical load (total weight) and the load on the tilting mechanism (centre of gravity) when the user moves forward and backward. Additional cheap strain gauge sensors were used to pick up signals on the frame of the toilet (related to tension in vertical and tilting direction) for comparison with the load cell readings. These different force sensors can also be used to provide information about the user's position and intention (e.g. to stand up) so that the system can

react to this (e.g. by moving the toilet seat into a higher position together with increasing the tilt).

- **Safety sensor:** Provides means for recognising falls. A prototype of an optic sensory system was tested. When a person falls, the output signal of this system is used to first request a response from the user and trigger alarm calls in case of a classified fall emergency. In this way the safety of fragile persons can be improved and undetected critical situations can be avoided. Obviously this approach is complementary to fall prevention [2].
- **RFID system:** To recall user preferences (e.g. preferred height, tilt etc) RFID smart card technology was used. A long-range reader module working at 125kHz with a single antenna was used to detect ISO card transponders worn by the users of the system. When the user enters the toilet room he/she is detected by the system (without the need to manipulate the smart card or any other device) and his/her preferred settings can be recalled. In this way the toilet prototype can presents itself in very different ways to different people.

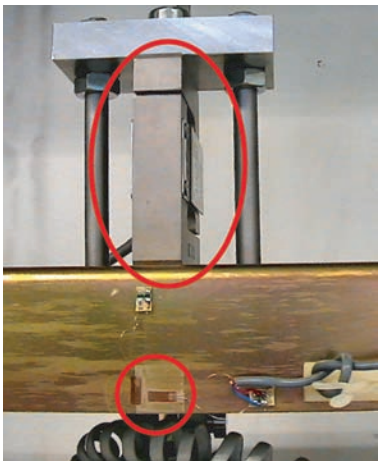

Figure 2: Load cell (upper red circle) and strain gauge sensors (lower red circle) mounted on upper part of toilet frame.

Test with users

The user tests of the system presented above have been carried out in a laboratory setting. Additionally a real life test with a selected number of smart toilet components was carried out in a day care centre for multiple

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sclerosis (MS) patients and it verified that the system is actually able to improve the patient's quality of life. It is necessary to consider the fact that a smart assistive toilet will bring direct and indirect benefit to all the stakeholders involved. Being more independent and autonomous in using the toilet is not only important for the individual's quality of life but also for the wider society.

Figure 3: Height and tilt changes to support standing up.

By introducing innovative technologies in the area of toilet and especially by providing a complete solution for the whole toileting area, the FRR consortium has contributed to empowering old and/or disabled persons to use public restrooms throughout Europe even if the individual has an increasing level of disability, and to supporting secondary users by providing an innovative, user-friendly and highly adaptable, smart toilet system. For more information regarding the different activities and outcome of the FRR project, please contact the web site of the consortium at www.frr-consortium.org and the site www.fortec.tuwien.ac.at/frr.

Acknowledgements
FRR was partially funded in 2002-2005 by the European Commission as project QLRT-2001-00458 under the Quality of Life programme. Project partners: Industrial Design Engineering - TU-Delft (NL), fortec - Research Group for Rehabilitation Technology, TU-Vienna (AT), Certec - Department of Rehabilitation Engineering, Lund Univ. (SE), EURAG - European Federation of Older Persons, Graz (AT), Laboratory of Health Informatics – Univ. of Athens (GR), Applied Computing – Dundee Univ. (UK), Landmark Design Holding, Rotterdam (NL), Clean Solution Kft, Debrecen (HU), SIVA - Centro IRCCS S.Maria Nascente, Milan (IT), HAGG – Hellenic Association of Gerontology and Geriatrics, Athens (GR). Ethical Review Team: Institute for Design & Assessment of Technology, Vienna (AT)
We gratefully acknowledge the intensive contributions to the FRR project provided by the members of the user boards and by the persons who have participated in the iterative cycles of prototype testing.

References

[1] Manufacturing Partner of the FRR Consortium: Clean Solution Kft, Hungary, www.cstechnologie.com/ and www.conplan.org
[2] P. Panek, G. Edelmayer, C. Magnusson, et al.: Investigations to develop a fully adjustable intelligent toilet for supporting old people and persons with disabilities - the Friendly Rest Room (FRR) Project, in: K. Miesenberger et al. (Eds.): Computer Helping People with Special Needs, ISBN: 3-540-22334-7, LCNS 3118, Springer, pp. 392-399, 2004.
[3] R. de Bruin, J. FM Molenbroek, T. Groothuizen, M. van Weeren: On the development of a friendly rest room, Proc. of INCLUDE Conf., Inclusive Design for Society and Business, 2003
[4] N. Gentile, et al.: Concept, Setting up and first Results from a Real Life Installation of an Improved Toilet System at a Care Institution in Austria, to be published in [5]
[5] J. Molenbroek et al. (Eds): Developing adaptable toilets of the future for disabled and elderly people, to be published by IOS press in 2005
[6] C. Dayé: The FRR-questionnaire - Assessing Who Needs What Where, to be published in [5]
[7] C. Dayé and M. Egger de Campo: User-Driven Research - How to integrate users' needs and expectations in a research project, to be published in [5]

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Sensoric Textile Bed Cover

Klaus Richter and Mario Möbius

ITP GmbH aims to develop textile products based on high tech – innovations, developments of several sciences and businesses with the technological potential of the textile industry. Together with Fraunhofer Gesellschaft e.V., SCAI and the companies Suess Medizin-Technik and theTelematik-Center TMD GmbH, ITP developed a telematic patient surveillance system based on a textile sensoric bed cover.

Elderly bedridden persons have a tendency to decubitus, incontinence, unconsciousness, sweating, high heartbeat and similar conditions. Persons with dementia tend to escape from bed. A regular surveillance makes it possible to find out about a patient's current state. If necessary, an appropriate response can be activated. Quick measurements of several parameters (surface pressure, temperature, humidity etc.) serve as a basis for the required decisions.

The modular structured bed cover consists of several systems to register the parameters measured by integrated textile sensors.

The systems consist of the sensoric bed cover, an electronic device to process signals and a computer to process and store the data. All information is processed for further use via standard interface.
In the telematic solution the information is transferred to a central da-

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Dear Readers,

If you have already leafed through this new issue of mstnews you may have got the impression that you're holding the wrong magazine in your hands: A lot of social topics instead of reports about new achievements in micro- and nanotechnologies… Indeed, this issue is a little bit different from the usual kind of mstnews.
The phenomenon of an ageing population in Europe is a huge challenge, not only for social politics but also for the high-tech industry and for service providers. You may know from your own experience that up to now product design, fashion, services market etc. are usually focused on and designed for young, active, communicative, flexible, sporty and highly capable people. It seems that the rapidly increasing share of people at the age of 65++ is simply ignored, and therefore it is high time to call to mind that this part of the European population will account for 50% of the population of working age in 40-50 years already (see article on pages 10-12).
Why should this situation affect the development of micro- and nanotechnologies and related products of all technologies? The very general reason for that is the essential role played by micro-nano integration in the development of comprehensive smart systems, including communication, information processing, automation (incl. robotics) and bio- and medical functions. This issue of mstnews is dealing in detail with the challenges of an "ageing society" and pointing out first technical approaches and solutions for creating a comfortable environment for the daily life of elderly and/or disabled people. Some of the solutions are admittedly not so "high-tech" yet and lack real micro technology, but at least they show development trends in an exemplary way. We hope that they will give you some ideas of what micro- and nanotechnologies can be used for in future.
I'd also like to remind you of the coming mstnews issue on "Integrated Microsystems for Biomedicine" to be published in February 2006 (the deadline for abstracts is October 15, 2005). That issue is intended to provide a deeper insight into the medical application fields of MST that are surely relevant to "ambient assisted living" too.

Bernhard Wybranski
Chief editor of mstnews

Embedded graphical object "SKeeper": See article on pages 42 -44; Source: Tadiran Spectralink Ltd., Kiryat Shmona, Israel Embedded graphical objects Pills and "iPAQ" from Compaq: See article on page 12 – 14; Source: Fraunhofer IMS, Duisburg, Germany

Main Topics of mstnews until 6/05

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Feb. 06	Integrated Microsystems for Biomedicine	Oct. 15, 2005
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Jun. 06	Fun and Recreation with MST	Feb. 15, 2006
Aug. 06	Micro-Nano-Integration	Apr. 15, 2006
Oct. 06	Sustainable Developments with MST	Jun. 15, 2006
Dec. 06	Remote Training and Engineering in MST	Aug. 15, 2006

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mstnews 6/05 on „Technology Programmes and Initiatives" in December 2005
Presentation of the efforts to promote and accelerate MST, in particular micro-nano-integration, in Europe on national level and international level.

Deadline for press releases, short news, event announcements and advertisement orders: Nov. 10, 2005

Date of distribution: Dec. 01, 2005

mstnews 1/06 on „Integrated Microsystems for Biomedicine" in February 2006
Report on new applications for nano- and microsystem technologies and new exemplary system solutions in the application field of medical equipment that works close to living organisms.

Deadline for abstracts: October 15, 2005

Date of distribution: February 07, 2006