

On the Prototyping of an ICT-Enhanced Toilet System for Assisting Older Persons Living Independently and Safely at Home

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Introduction

Surprisingly, there is one very common appliance which we use several times a day which has not changed since its invention: our toilet

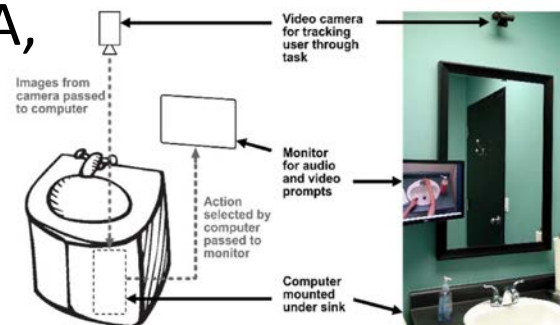
ICT-enhanced Toilet Supporting Active Life (AAL JP)

iToilet intends to bring benefit to:

- **primary end-users'** dignity and independence: enhancing body stability on the toilet (adjustable height, hands free for handles), supporting sitting down and standing up process (dynamic adaptation of tilt and height), and increased safety via emergency detection.
- **secondary users/care persons:** the burden when assisting the end user will be reduced by support by the toilet itself.
- **care institutions:** not only the care service offered to the clients will be enhanced but also health and well-being of the employees

State of the Art

- "Friendly Restroom" project (TU Delft, NL), 2002-05
- "The Future Bathroom" project (Univ Sheffield, UK) 2008-11
- "iToilette", vital parameter, RWTH Aachen, 2009-11
- "i-SUPPORT", robotic shower, h2020, started 2015
- "COACH", prompts for supporting hand washing, Univ Toronto, CA, started early 2000



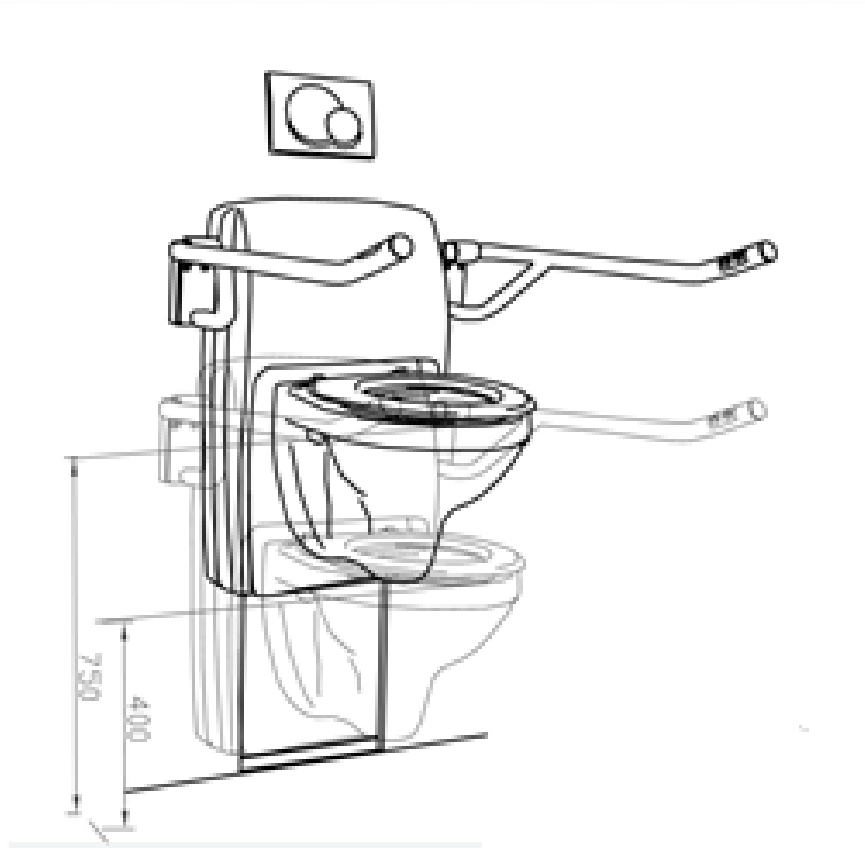
ICT Enhanced Toilet

- The **existing basic toilet** (adjustability of height and tilt) is **enhanced by** adding (optional) ICT modules
 - Speech control +
 - Automatic adjust of toilet bowl +
 - Alarm service / emergency recognition +
 - Care documentation +
 - Dynamic support for sitting down / standing up +

Also possible but not foreseen for full implementation:

- Guidance ?
- Vital parameter measurements ?

Lift WC & „Mobile“ Standing up support



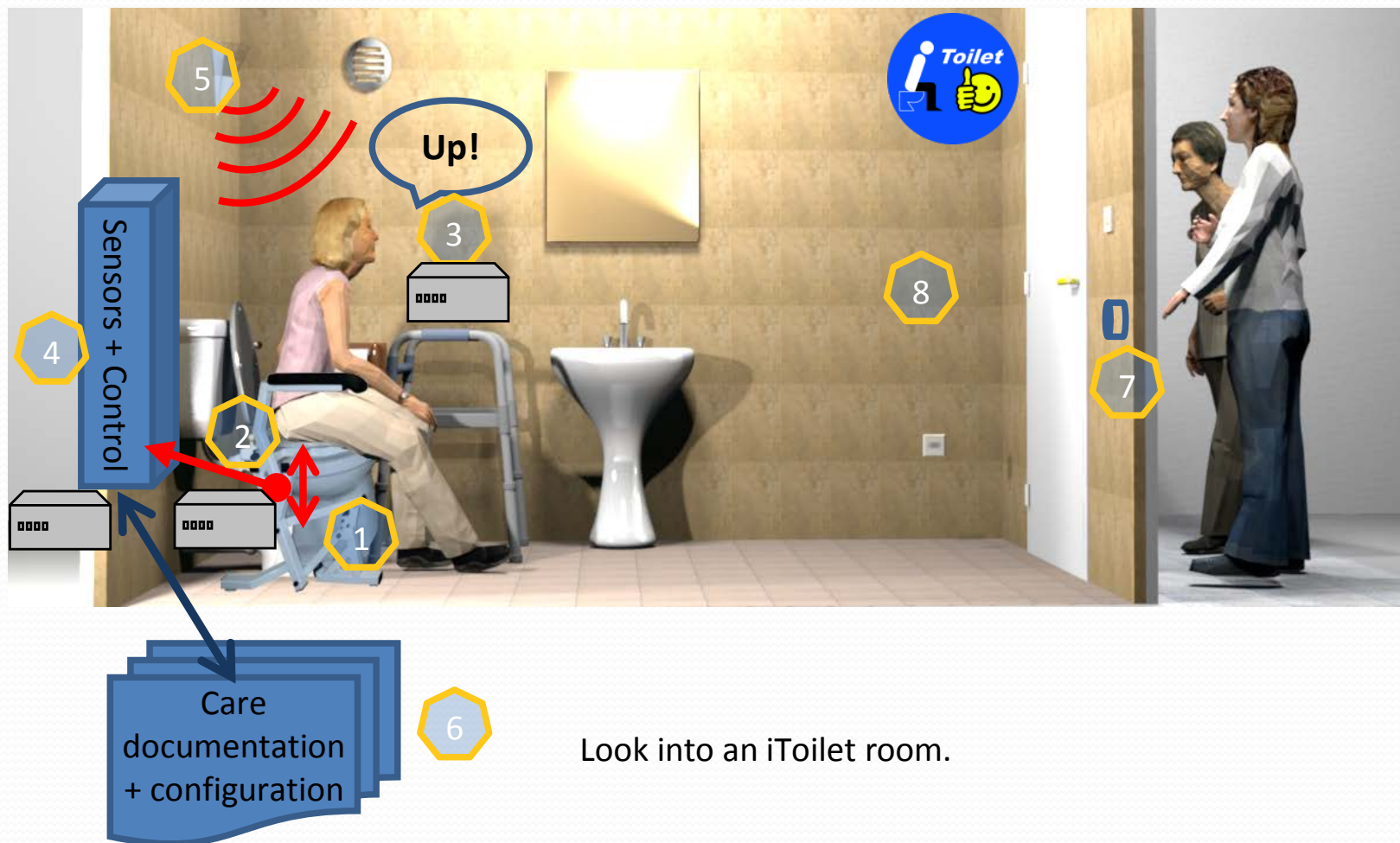
(Replaces existing toilet bowl)



(Works on top of existing toilet bowl)

Envisaged iToilet Room

Illustration of iToilet technical environment



Project Phases

- User Requirements
- Specification
- Implementation of Prototype 1 (PT1)
 - Participatory design
- ➔ • **Lab user testing PT1 (now)**
 - Business models, exploitation plan
 - Redesign for Prototype 2
- Field trials (2018)

Aims and specific target settings

- Aim: increase autonomy, self esteem, quality of life.... of older persons living at home
- For efficiency reasons we run user trials in 2 institutions (Budapest and Vienna)
- We want to demonstrate, measure and prove the impact of the iToilet for the users
- We have set up strong user involvement right from the beginning

Gathering User Requirements

Methods:

- Presentations
- focus groups
- interviews



User Requirements - Findings

	High priority user requirements
1	bilateral (general stability and support), removable/foldable handrails (wheelchair)
2	height adjustment (in a wide range) and tilt adjustment
3	fall detection, emergency recognition and emergency call
4	simplicity (few, straightforward buttons on both handrails)
5	fixed toilet paper holder (on both handrails)
6	sit down and stand up support
7	custom settings (tilt and height) w. user identification

#	Medium priority user requirements
1	self-sanitizing seat and bowl
2	shelf/tray area
3	upgradability, modularity
4	automatic or button operated flush
5	care documentation
6	spoken commands
7	individually formed toilet seat
8	voice guide
9	automatic dispensing of toilet paper
10	bidet with dryer and adjustable water jet
11	urine meter /analyser

Participatory Design

Initial topics

- Toilet paper dispenser,
- speech control,
- various mechanical buttons and
- remote controls and grip bars.

Photos: CS Caritas Socialis, Vienna



Preparing Lab Trials

- Ethics framework prepared
- Integration of Lab prototype
- Installation in toilet rooms and technical tests on site
- First Lab user trials currently (May 2017) carried out in AT and HU
- Main objectives:
 - Investigating actual support given by motorised chair
 - Usefulness & usability of other features
- Gathered feedback of users to guide development

Prototype 1 (PT1) for lab trials



Functionality

- Adjusting height and tilt of toilet chair via hand held remote control
- Speech control commands: higher, lower, stand up, sit down
- Moving chair in default position when room is empty
- Moving chair into previously stored position when individual RFID tag is read on entrance door
- Triggering emergency call via manual button, voice command or fall detector

Summary and Outlook

- iToilet: Modular architecture, individually adjustable
- Key concern: ensure relevance to user
 - Enable the user to experience the assistive toilet as useful and usable.
- Collected Comments from users are intended to guide development of improved PT1
- Continuing Participatory Design
- Development of PT2 for field trials in 2018

Some Publications

- T. Pilissy, A. Toth, G. Fazekas, A. Sobjak, R. Rosenthal, T. Luftenegger, P. Panek, P. Mayer (2017) Towards a Situation-and-user-aware Multi-modal Motorized Toilet System to Assist Older Adults with Disabilities: a User Requirements Study, accepted for 15th IEEE Conf on Rehabilitation Robotics (ICORR 2017), July, 17-20, 2017, London, UK.
- P. Mayer, P. Panek (2017) Involving Older and Vulnerable Persons in the Design Process of an Enhanced Toilet System, ACM CHI Conf on Human Factors in Computing Systems (CHI 2017 Extended Abstracts), May 6-11, 2017, Denver, CO, USA, doi: 10.1145/3027063.3053178, pp. 2774 – 2780.
- T. Lüftenegger, P. Mayer, R. Rosenthal, F. Sonntag, P. Panek: Partizipative Entwicklung einer assistierenden Toilette für ältere Menschen, Poster, Geriatriekongress, 20.-22. April 2017, Universität Wien, Austria.
- P. Panek, P. Mayer (2017) Initial Interaction Concept for a Robotic Toilet System, Proc of the Companion of the 2017 ACM/IEEE Intern Conf on Human-Robot Interaction (HRI 2017), March 6-9, 2017, Vienna, Austria, doi: 10.1145/3029798.3038420, pp. 249-250.
- P. Panek, P. Mayer (2016) IKT-unterstütztes Toilettensystem für ältere Menschen - Ein transdisziplinärer Ansatz verbunden mit partizipativem Design in einem Tabubereich des Alltagslebens, in: R. Weidner (ed.): 2. Transdisziplinäre Konf „Technische Unterstützungssysteme, die die Menschen wirklich wollen“, HSU, Hamburg, Deutschland, 12.-13. Dez. 2016, ISBN: 978-3-86818-089-3, pp. 139-146.

More information...

www.itoilet-project.eu

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