

## TECHNOLOGIES FOR PEOPLE WITH COGNITIVE DISABILITIES : SMART HOMES

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Panel: CURRENT DEVELOPMENTS IN SMART HOME AND PERSONAL SUPPORT  
TECHNOLOGIES FOR PEOPLE WITH COGNITIVE DISABILITIES

Eight Annual Coleman Institute Conference on Cognitive Disability and Technology

Oct. 16, 2008, St. Julien Hotel, Boulder, Colorado

### ***Categories of Technology Supports (1)***

#### **Categorization**

market segment criteria (distribution, buying habits, tech factors)

Omits some categories: neuro-imaging, implants/BCI.

Some combine tech types

Handout listing these and other selected projects/products w web links

***Machines***: unique hardware components, sub-categories by technology

***Robots***: ASD therapy – **Robota** (Ecole Polytechnique Federale de Lausanne),

***Tangible Computing***: person interacts w physical computing objects

**therapy tiles (Playware)**, exercise, smart walkers/wheelchairs

***VR***: task training (**Virtual Playmate for Autistic**), phobia therapy,

***Pers Dev***: wear/carry, one pkg, opt external services sub-category by function

***Memory/Prompt*** – U of Tokyo **Cyber Googles**, **AbleLink Pocket Coach**...

***Body monitors***: brain activity, chronic disease, vital signs, movement

***AAC*** augmentative and alternative communication (handhelds, implants, ...)

***Smart-phone*** : integrates/extends commercial smart-phone, ext service

***Assisted Cognition***: Kautz, Attention Ctl SYs **PEAT** + activity sensing (daily tasks)

***Location-based info services***: **PARC Magitti** suggestions (nav/function Urban)

***Reality Mining***: MIT/Nokia LifeLog, nTag (longitudinal info for better care planning)

### ***Categories of Technology Supports (2)***

***Computing/networks***: value-added SW sub-category by scope

***SW apps*** daily planning aids,

**Brain Fitness programs** – Posit Science (make entertaining, eg games),

***Info Systems***: Therap care planning..., Imagine's MedSupport

**Web Apps**: email/browsing tools - AbleLink, **care communities** CarePages

***Situated***: sensors/actuators in physical environ, eg pervasive, sub-category by scope

***SmartHome***: e.g. **HealthSense** (monitoring), Rest Assured, QuietCare

***Facility***: **Elite Care Tech** (person tracking, building automation)

***Urban***: navigation - Boulder Bus, wandering - LifeLine

### ***Smart Home Definition***

What makes a smart home 'Smart' – my definition

Vs Home auto (already senses state of home systems & environ)

**Determining** resident activities ... is key

Else resident must control/program systems (impractical for our users)

**Action:** directly for resident or indirectly through family and/or caregivers

Types (home automation, 1<sup>st</sup> 2, not shown)

closed loop control (eg of home systems in response to resident activity)

open loop direct prompting (eg to resident for a task in response to “ “ “ “)

open loop indirect support (eg to caregivers in response to health state or activity)

### ***Smart Home Products and Projects***

Some 'leading' Products and Projects

1<sup>st</sup> two groups are commercial, 1<sup>st</sup> - people w cog dis (MRDD), 2<sup>nd</sup> seniors,  
3<sup>rd</sup> university R&D

lots of others – see handout

Simplified characterization of functions

**General benefits:**

Independence (system monitors risks, controls home)

QoL (social engagement, health warning, memory aid)

Costs (less labor, independent at home v higher care level)

1<sup>ST</sup> – three panelists

**ECT** (I've presented here, systems going into Imagine home),

**Quiet Care** (recent GE distribution, time in mkt, size)

### ***Universities***

**Aware Home** – early univ project

**U VA Medical Automation Research Center**, pilot for MRDD group home

**GatorTech** – W Mann collab/fieldTest w Honeywell ILSA

*U of Rochester, OHSU, Europe....*

*Many univ/corp doing home automation, e-home (Msoft, MIT, Duke, ...)*

### ***Smart Home Technology***

**Precursor**

HomeAuto-oldest,

security-1<sup>st</sup> w/ sensors & biz models,

e-home – recent (integrate home electronics, network std, comm, media, security)

Remote monitoring (\$400m 2012),

GreenHouse (energy, materials, ...)

# Smart Homes for People with Cognitive Disabilities: Presentation Notes



## Aspects not modeled

Platforms – LAMP/open, win, web  
Networks – home, personal?, I'net, proprietary,  
Std: home network, med (device, EHR)  
Accessibility – web,  
UD – home architecture

**Sensor** nets become primary input to situated systems, add manual data  
create knowledge, basis for smart action (measure to improve)  
person tracking, passive activity (motion, contact, heat, flow, ...),  
active physiology (body area net), house systems

**Capture** relevant info < persons other systems → comprehensive knowledge base

**Fusion** – correlate data (time/place/person/...) holistic

**Models** – eg, specific to predictive technique, adaptive ontology,

**Predict**, & mine for trends/patterns/...

**Inform** family caregivers - over web, local IS, POTS, email, ...

from simple warnings (urgent) to analysis of efficacy of care, specific to recipient

**Prompt** Resident – task, memory, reminder, ...

**Control** House – to suit resident needs

## R&D Challenges of Smart Homes

**Vision:** in 5-10 yrs, SH will integrate Communities of Care, using Data Commons

**Open** monolithic systems common now, but too costly, inflexible, limited –

**Share:** data commons <- proprietary data of providers, family, devices...

to get enough info for high-level analysis of needs

(more a legal & business challenge than technical)

**Sensor:** plurality, diversity (smart & dumb), passive v active, self-config mesh

**Prediction** of resident activities, cognition, health, learning technologies

**Interface** challenge for systems to engage persons with cognitive disabilities

**Prompt** adaptively by observe/monitoring resident reaction and changing

**Respond** Simplify resident control by intuitive interfaces: gestures, tangible

**Cognitive model** part of system or reflected in design

## Applying Smart Homes

**Biz Case:** (financial feasibility) reduce cost v. improve service, payer models

**Fit:** (Organizational Feasibility)

Ethics (privacy v. surveillance),

Social networks

**Leverage:** (technical feasibility) adapt, adopt, co-opt, ...

e-home, Internet, home automation, sensors, open Source

**Share:** business collaboration, web social network

**Evolve:** due to complex social setting

# Selected Technologies for People with Cognitive Disabilities



## **Smart Homes**

COACH - Dementia Prompting [http://www.ot.utoronto.ca/iatsl/projects/intell\\_env.htm](http://www.ot.utoronto.ca/iatsl/projects/intell_env.htm)  
Elite Care Technologies <http://www.elitecaretech.com/> <http://www.elitecare.com/>  
Georgia Tech Aware Home <http://awarehome.imtc.gatech.edu/>  
GrandCare <http://www.grandcare.com/>  
HealthSense <http://www.healthsense.com/>  
Home Free [www.homefreesys.com](http://www.homefreesys.com)  
Imagine <http://www.imaginesmarthomes.org>  
IntelligentInSites <http://www.intelligentinsites.com/>  
Night Owl Support Systems <http://nightowlsupportsystems.com/>  
ORCATECH Oregon Health Sciences Univ. <http://www.orcatech.org/>  
QuiteCare/GE <http://www.homecareautomationreport.com/article.php?id=776>  
Rest Assured <http://www.restassuredsystem.com/>  
Sound Response <http://cow.waisman.wisc.edu/soundresponse.html>  
Tunstall Telecare <http://www.caredirections.co.uk> [www.tunstall.co.uk/4\\_6telecare.htm](http://www.tunstall.co.uk/4_6telecare.htm)  
U of Florida Gator Tech – Smart House <http://www.harris.cise.ufl.edu/gt.htm>  
U of Virginia MARC [http://marc.med.virginia.edu/projects\\_smarthomemonitor.html](http://marc.med.virginia.edu/projects_smarthomemonitor.html)  
Vigil [www.vigil.com](http://www.vigil.com)

## **Software and Web Apps**

AbleLink [www.ablelinktech.com](http://www.ablelinktech.com) (also personal devices)  
CappsDATA [www.cappsdata.com](http://www.cappsdata.com)  
CaringFamily [www.caringfamily.com](http://www.caringfamily.com)  
CareNecton <http://impelcaresystems.com/carenection.html>  
It's Never 2 Late <http://www.in2l.com/>  
MedSupport <http://caresupportweb.com/>  
Posit Science <http://www.positscience.com/>  
Therap <http://www.therapservices.net>

## **Smart-Phone Based**

Neuropilot <http://www.notesnet.dk/websites/acj/neurosite.nsf>  
PARC Magitti <http://www.parc.com/about/pressroom/news/2007-09-26-dnp.html>  
PEAT <http://www.cs.rochester.edu/u/kautz/ac/PEAT/index.html> <http://www.brainaid.com/>  
Reality Mining <http://hd.media.mit.edu/reality.html>

## **Personal Devices**

CMU Lifelogging <http://www.cs.cmu.edu/~mllee/mem.html>  
Cyber Goggles <http://www.pinktentacle.com/2008/03/cyber-goggles-high-tech-memory-aid/>  
Pollack Assistive Tech for Cognition <http://www.eecs.umich.edu/~pollackm/research.htm>

## **Robots, Tangible Computing, and Virtual Reality**

Assistive Kitchen <http://ias.cs.tum.edu/projects/awarekitchen/>  
MIT Assistive Robots <http://robotic.media.mit.edu/projects/projects.html>  
Robota <http://www.slab.usc.edu/billard/robota.html>  
Therapy Tiles <http://www.e-robot.dk/therapy.html> <http://www.playware.dk/>  
USC Robot Playmate [http://www.eurekalert.org/pub\\_releases/2008-07/uosc-rpm072208.php](http://www.eurekalert.org/pub_releases/2008-07/uosc-rpm072208.php)  
VR Playmates <http://www.soc.northwestern.edu/justine/>