ICADI Planning Workshop

26-27 June 2003
Royal Academy of Engineering
London

Notes from Michael W. Vannier
ICADI Tracks

1. Low Technology Assistive Devices
2. High Technology Assistive Devices & Environments
3. Consumer Perspective
4. Home Modification and Universal Design
5. Injury Prevention
6. Business Perspective
7. Transportation
8. Telehealth
Meetings

- Washington – ICADI
- Tokyo – January 2004
- Publication – State of the Science in Smart Technologies to Assist Elders (June 2004)
The Need
Health and Healthcare Challenges

**Economic Reality**

- More than 14% of U.S. GDP is devoted to health care.

- Ratio of wage earners to seniors
  - 4/1 (now)
  - 2/1 (~2025)

- Average cost of assistive care
  - $60,000 / year / senior adult

- Seniors visit the doctor 6 x more often than younger people

**Demographic Trends**

- The ratio of caregivers for at-home disabled will decrease from more than 20:1 down to less than 6:1 in 2030.
The European ‘care gap’

Percentage of EU 50 population (2001)

... expressing a need for care

... actually receiving care

... thereof cared by professional service

Source: SeniorWatch, 2002
EYPD – European Year of People with Disabilities

- Rights to protection from discrimination
- Awareness
- Improve communication and image

- EYPD2003.org website
ICADI Meeting will be held on 4-6 December 2003 – Arlington, VA

* www.asa.org/icadi website
Hosts & Sponsors

- Host: University of Florida; many others
- American Society on Aging

ICADI supported by
- European Commission
- US NIDDR, VA, CDC, NSF, AARP
- And 40 others
ICADI Meeting Objectives

- Prepare a comprehensive account of state-of-the-art Assistive Technology R&D and Smart Home R&D in the U.S. and in Europe
  - Special issue of the IEEE Computer magazine
- Identify strategies for future research and development
- Prepare for Technical Program of the ICADI High Technology Track
  - Workshop outcomes will be integrated in the HTT track
Focus Areas

- Computing
- Sensors
- Service
- Design
- Smart appliances
- Interfaces
- Databases
- Tracking
- Robotics
Issues for Discussion

- Technology employed (infrastructure needs)
- Technology evaluation (user perspective; user acceptance; cost)
- Deployment status (prototype development; field evaluation serial production)
- Barriers and technology limitations
- R&D needs to overcome current barriers
- Public policy considerations (privacy issues; business models)
Differences

- Between technologies
- Between countries
  - Differing demographics; cultures; economics; social services and care
- Broad perspective; international
UK Department of Health

- Calls for applications
  - Co-funded by industry
  - Social care; user orientation
  - Health technology devices committee (with consumer advocate member)
EPSRC – Engineering and Physical Sciences Research Council

- Medical Engineering and Health
- Funding for Ageing and Disability research
- 7 UK research funding councils in DTI
- £ 498 77% spent on research and training
- 537 grants in healthcare – 2\textsuperscript{nd} greatest category is ageing; (#1 is cancer) – 38 grants in ageing
  - Healthcare panel – multidisciplinary
EQUAL – Extending Quality of Life program

- Address needs of ageing and disabled population
  - Multidisciplinary teams
  - Collaboration
    - Include industry, intermediaries, charities, …
  - Involve older and disabled people directly whenever possible
EQUAL areas

- Transport / mobility
- Accessible environments
- Inclusive design
- Assistive technology
- Smart homes
- Rehabilitation engineering
EQUAL funding

- 34 projects – £5.4M in first call
- £30K to £300K
- www.equal.ac.uk - launched Nov 2001
- 4 calls for additions to portfolio
Common themes

- Independence

- Support mechanisms
  - Visiting fellowship
  - Overseas travel grants
  - Bilateral research workshops
  - Postdoctoral mobility (inter-disciplines)
  - Partnerships for Public Awareness (PPA)
Gil Devey, NSF

- NSF Vision and Mission
  - Discovery, learning and innovation

- Strategic goals
  - People
  - Ideas
  - Tools
NSF areas of support

- Information technology research - $145M
- Nanoscale science and engineering
- Sensors and sensor systems
- SBIR
- Program for persons with disabilities
- Human-computer interaction; universal access
- Undergraduate design projects (for persons with disabilities)
NSF ITR projects

- The Aware Home – Sustaining the Quality of Life for an aging population (Ga Tech)
- MavHome – An intelligent environment home (intelligent agent)
- A distributed programming infrastructure for integrating smart sensors (Ga Tech)

Interagency Committee on Disability Research

- www.icdr.us - US Govt interagency
- “to promote coordination and cooperation among Federal departments and agencies conducting rehabilitation research programs.”
- Annual report is forthcoming; imminent

- Workshop - cell phone interference with hearing aids
- Website for all US funded disability research projects
- Report: US Assistive Technology Industry
Questions

- Effect on public policy
- Research project results are “left on the shelf”
- Interconnection – public policy for implementation of “smart home”, for example
- Review criteria – broader impact
The death of competence

- Edinburgh’s enfant terrible
- New technology may require changes to the “system”
- Not clear how to connect benefits with costs; overcome inertia
- Effectiveness and efficiency
- Hospital stay vs. smart home costs
  - There may be a tradeoff, but unclear any savings are real.
Aunt Millie

98th Birthday in 2003
Ga Tech – Aware Home

- How can your house help if it is “aware”
- How to construct such a house?

- Approach
  - Technology
  - Applications
  - Construction
  - Socio-legal, ethical
Smart structures, materials

- Sick building
- Radon daughters
- Most health problems are due to lifestyle; reflected in behaviors; risk factors
- Most health information on the internet is of doubtful value
Problem statement

- Healthy aging
- Rehabilitative assistance
- Preoccupied with interventions
- Good intentions, but not very specific about needs
- Few numbers; graphs of indicators
  - Not like economics, epidemiology
  - Epidemiology of healthy aging?
  - Screening studies of frail elderly
    - When stop screening mammography?
  - Piecemeal strategy; fragmented approach
    - Not like cancer (count the dead)
Assisted living

- How can independent adults live alone as they age?
  - Digital family portrait
  - Sense, measure, monitor?

- Need for interaction with others
- Meals?
- Smart floors
- Webs of cameras to track motion; ceiling sensors
- Room mapping
- Gesture pendant – simplified home control
- Eye tracking
Recognize what a person is doing

- Recognize complex interactions
- Relate human motion and object context
- Extend appearance-based representations
- Potential for abuse; loss of privacy, intrusive machines
- Behavior analysis – blackjack game
- Example – What was I cooking?
  - ADL = activities of daily living
2001 – A Space Odyssey

- The Cook's Collage

- Medical aids
  - Glucose meter
  - KISS
Millennium Homes

- A Foresight/Link project by a consortium of (Brunel Univ, British Telecom, Huntleigh Healthcare Ltd, Beaver Housing Assn, Plextek Ltd, Special Security Products)

- Metastatble people
  - No condition requiring constant nursing
  - Ability to manage the activities of normal life within the community with only minimal support
  - Possibly some deficiency in short term memory
  - Inability always to respond to challenges pose by domestic conditions
Goal

- Allow “metastable” people to be able to remain in their own homes for longer
- In appropriate circumstances to allow the community to operate the system
- To make it possible to fit the required technology in any home in one day
Floorplan for Millennium Home

- Typical arrangement of occupation, PIR and switch sensors, telephones and speakers, in a one bedroom flat
- Huntleigh Research Institute
Big difference

- The system is interactive and able to negotiate with the occupant, using speech, screens or other means to issue warnings and to accept responses from the occupant. These will acknowledge a warning, or modify the action taken by the system.

- Failure to remove the hazard after a warning, such as locking the back door, …
Sensors

- Real
  - Location, activity, state of doors, windows, domestic appliances, time, special actions, like taking of medication

- Virtual
  - Any combination of the state of any of the above, taken in conjunction with what has happened previously
Flexibility

- The system is not designed merely to detect a few pre-determined conditions, but is adaptable and extensible.

- Embedded computer

- Many similarities to automotive computers
  - That manage fuel system, emissions control, multiobjective optimization, monitors, safety, accidents, ...
  - And this is done with compliance to standards, modular components, real time software OS
Incentives

- Honor; money; discounts; access to training; access to exclusive facilities
- Entitlement to care or pension in the future for the supporters or their family
UFL – RERC - NIDRR

🌟 Sumi Helal, Ph.D.
Proactive Health
- Social performance: community, household, body
- Focus on behavior

Research at MIT
- Switch/bend sensors
- Wearable sensors
- Multi-purpose sensors

Simple messages
- Right time; right place; non-disruptive
- Translates to “big gains”
- Will behavior change persist?

Swappable sensors (store 2 weeks of data)
Monitors

- Shower, drawers, jars, etc.
- Fixed interval queries – PDA experience sampling
- MIT Changing Places Consortium
- Image-based experience sampling
- Heart rate / accelerometer-based context aware experience sampling
- Patterns of movement; comprehensive timelines
Activity link (product)

- Gadgets for “peace of mind” to monitor elderly parent
- Looks like the home monitor; ankle monitor for prisoner
- MIT PlaceLab – technology development is the “easy part”
- How can we develop effective strategies that people will accept into their lives
- Shared research facilities – study life in the home for real people
  - Test infrastructure
  - Test with people
Watch the Osbornes on MTV

- Reality TV
- PlaceLab is in a new condo bldg in Cambridge, MA
- Modular interior cabinetry with embedded technologies
- No walls; cabinets have sensors
- Service chassis links to cabinets and sensors
- Will be finished in October 2003
- Tools for identify and location of people, their activities, physiological and psychological states
Wireless and IR sensors; environmental sensors

- Communicating with directed audio – speakers and microphones
- Addressable LED 24 bit lighting
- Sensor networks in prefab cabinets
- Pixels everywhere to deliver messages
- PlaceLab attributes:
  - Common infrastructure
  - Smart occupants (not smart homes)
  - AI problems of a “smart home” are insurmountable
  - Volunteer subjects will live here for 1-2 wks
  - Context of life
  - Agile
Possibilities

- Techniques to encourage healthy behaviors
- Kill@mit.edu
What are the most important needs?

- Heinz Wolff – Must have a strong business case to succeed and overcome financial constraints.
- Compare alternative medicine to conventional medicine.
- Government isn’t the only customer.
- Where does the technology need to go?
  - Call a moratorium on tech devt and focus on applications.
Are there enough technologies already?

- NSF doesn’t want to develop products
- Where is the science in developed technologies? Doesn’t appeal to NSF
GE Global Research

- Expanding – 2100 employees worldwide (750+ PhDs)
- Chemistry / mechanical / physics / electrical / computer science / other
GE Businesses

- A diversified technology, manufacturing and services company with a commitment to achieving world leadership in each of its key businesses
  - Aircraft engines, commercial finance, consumer finance, consumer products, equipment management, industrial systems, insurance, medical systems, plastics, power systems, specialty materials, transportation systems, NBC
- GE sells long term care insurance
- There have been many telemedicine disasters, with deployment of systems before it is ready
Feasibility analysis

- Need to show that smart home technology is useful
- GE RM&D leveraging total GE diagnostics technology experience and over $100M of investments to date
  - Sensors for power systems, aircraft, medical systems, industrial systems
GE Interlogix

- Security and Life Safety
  - Magnetometer, transmitter and battery in compact package
  - Security; access control; CCTV, fire detection, residential and commercial
Security & Caregard

- Security system; wireless; cell modems
- Home monitoring systems
- Concern for reliability of cell networks
- Seek to create a new service market (business model) for home health care
Home monitoring by WWW

- North East Health – uses systems to monitor elderly at home over WWW
- Significant field testing – 20 homes serve as test systems
Home Assurance

- Remote monitoring caregiver
  - Motion, doors, kitchen
  - Web interface
- Interlogix wireless security
  - Wireless sensors and communications
  - Cost-effective
  - Easy to install
  - Tested and accepted
What is the price point for this type of technology?

- Liability concerns by MD’s who receive monitoring data
- AD Caregiver Study
  - 20 early Alzheimer’s or dementia
  - Living alone in their homes
  - Informal caregivers
  - Caregiver satisfaction & geriatric depression
  - Currently enrolling and installing
Current Users

- Caregivers of elderly who live alone
- Model: paid by their children
- Other research areas –
  - Detecting behaviors and trends
  - Cost-effective multi-person monitoring
  - Higher granularity activity monitoring
  - Effective medication compliance
  - Kitchen accident prevention