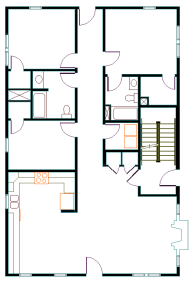
Georgia Tech's Aware Home

Georgia Tech's Aware Home

- How can our house serve us, if it knows its state and the states of its occupants?
  - 1998 Georgia Research Alliance Grant
  - Completed in 2000
  - Authentic testbed for prototype development

Georgia Tech's Aware Home

- 2 identical floor plan apartments
  - 3 bedroom / 2 bath
  - Kitchen, Dining Room, Living Room
- Basement
  - Meeting space
  - Research space
  - Server Space
  - Work bench
  - Facilities
- Attic



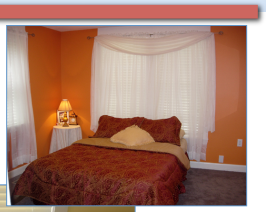
Georgia Tech's Aware Home

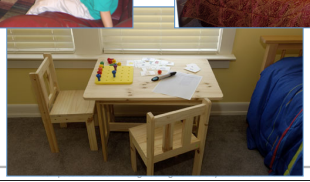
- Accessible
  - Wide halls and doors
  - Bathroom rails
  - Push to open cabinets and drawers
  - Easy open door handles
  - *Elevator cut*

Georgia Tech's Aware Home

- Special features to facilitate research
  - Drop Ceiling
  - Wire trays in halls
  - Wide walls – 4" conduit from basement to attic
  - Indirect and soft lighting
  - Low sheen flooring

Aware Home Laboratory





Research Areas

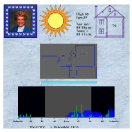
- Designing Applications for People
  - Aging in Place
  - Tools for busy families
- Designing Technology "Building Blocks"
  - Infrastructure
  - Sensing

Aware Home Application Themes

- First Floor - Aging in Place
  - Grandma Burdell (or Mom)
- Second Floor – Busy Family
- (~2k miles away)
  - The Burdell family
    - "Sandwich generation" parents
    - Aging parent(s)
    - Children with social or behavioral disorders

Digital Family Portrait

- Supports family communication
  - Peace of mind for remote family members
- Share just enough data
  - Activity detection using motion sensors
  - Weather conditions
  - Sunrise / Sunset

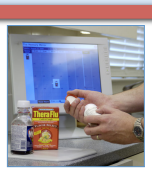


Activity Characterization

- Using vision to produce high-resolution motion data
  - More accurate information
  - Better understanding of activity

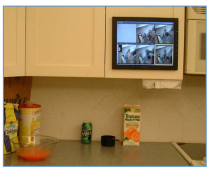
Memory Mirror

- Medication management
  - When last taken
  - Interactions
  - Reminders
  - Read label
  - Multi-user tracking
  - Caregiver connection
- RFID technology
  - Retailers requiring on all items in near future
  - Pharmacies next?



Cook's Collage

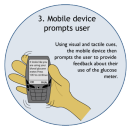
- Record of recent past
- Mitigate interruption and distraction



What Was I Cooking?

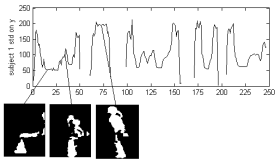
Monitoring Access to Health Information

- Automatically log user interactions with a blood glucose meter
- Facilitates the capture and transfer of experience sampling data based on those interactions



Get Up and Go

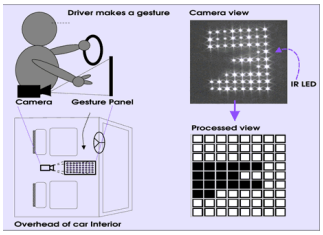
- Using computer vision to estimate senior's risk for falling in natural situations



Uses privacy sensitive recording techniques

Gesture Technology

- Use gestures to control devices
- For people without dexterity to use typical remote



Gesture Panel

FETCH

- Lost item tracking for those with poor vision
- Allows people to use mobile phone to make tags attached to lost objects beep
- Implementation
  - Nokia cell phone with screen reader software
  - Bluetooth tags

Privacy

- Background:
  - Aging adults are faced with increasing mental and/or physical limitations
  - May benefit from smart homes and use of sensing devices that capture some kind of image-based information
  - Image-based information capture elicits privacy concerns among users and may lead to misuse.
- Goal: to explore the privacy concerns that older adults have about a home equipped with visual sensing devices.

Technology Acceptance

- Often the success rate of new product and technology development (concept to launch) is relatively low.
- Objective: to develop a predictive model to help improve the quality of the decision-making process and reduce the uncertainty when considering new technologies for product development programs.

Adaptive Computer Assistant for Self-Care

- Objective: evaluate whether older adults can make use of a computer assistant and to compare an adaptive computer assistant with a fixed one.
- Developed an adaptive computer assistant that supervises diabetics' self-care activities, limits need for acute treatment, and improves health literacy.
- Outcome: older adults were able to use the adaptive computer assistant and use of the system had a positive effect on the development of health literacy.

Older Adults' Use of Technology

- Goal: To gain in-depth understanding of older adults' acceptance of and opinions about different technologies
- Use focus groups and surveys to understand
  - the range of technologies that older adults use,
  - the likes and dislikes for different technologies,
  - potential demographic and domain differences
- Evaluating data from adults across age spectrum, geographically separate and ethnically diverse
- Considering marketplace introduction, level of technology sophistication, and complementary technologies.

Understanding Intuitive Human Computer Interactions

- The term 'intuitive' is often used in high tech ads to attract buyers to new products
- Goal: to provide explicit definition for *intuitive* Human Computer Interactions so designers may be better able to develop products that meet this requirement.
- Conducting empirical studies to identify critical characteristics of products and systems that can and will be used intuitively
- Determine if there are age-related differences in elicitation of intuitive usage

DETECT

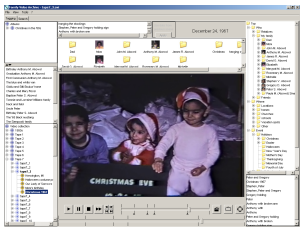
- IMTech – Immersive neuropsychological Alzheimer's Disease screening device
  - Test time drastically reduced from 60-90 minutes to 7 minutes
  - Produces more consistent and accurate results than today's best practice
- Zenda Technologies, Inc

Personal Audio Loop (PAL)

- Near-term audio-based memory aid
  - Constantly recorded buffer of audio
- Investigation
  - Usability: How should the service deliver functionality
  - Usefulness: What situations do people recognize a need
  - Acceptance: Social and legal concerns

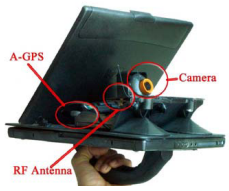
Family Video Archive

- Enables the quick tagging and searching of large home movie collections



Context Cam

- Allows tagging of metadata on videos at the point of capture to save time in Family Video Archive

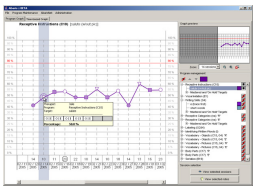


AudioNotes

- Message Center for the family

Abaris

- Streamlining methods for autism therapists



Experience Buffers

- Video experience buffers
  - Elderly
  - Behavior and Social Disabilities
    - Behavior Review
  - Children

Baby Steps

- Helping parents track their child's developmental progress

Pervasive Dietary Advisor (PDA)

- Monitor the health of individuals with type 2 diabetes after they leave the hospital.
- Connection to healthcare teams assisting in the management of diabetes

Pervasive Asthma Monitoring System (PAMS)

- Monitors health of asthma patients after they have left the hospital.
- Utilizes commonly available inexpensive portable music players to transfer the patient's respiratory data to their healthcare professionals

Two Studies

- **Acceptance of Technologies**
  - Attitudes – barriers to adoption
    - Intrusiveness, privacy, security
    - Conditional adoption

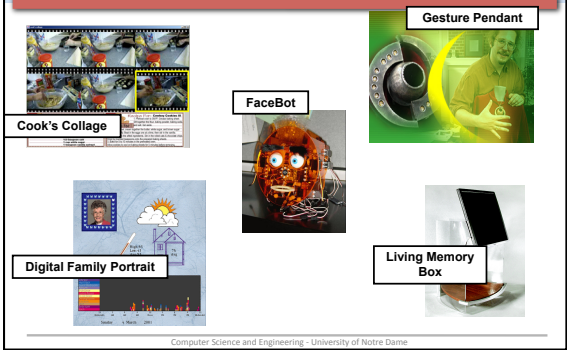
- **Field Trial of Digital Family Portrait**
  - Experience – barriers to use
    - Technology performance
    - Emotional experience
    - Catalyst for change
      - family dynamics

Acceptance of Technology

Participants and Stimulus Material

- 44 older adults aged 65-75
  - living independently
  - 15 men and 29 women
  - mixed ethnicity (Afr. American/ Caucasian/ Hispanic)
- Aware Home Tour (5 selected devices)
  Selection criteria for technological devices:
  - Different levels and types of **intrusiveness**
  - **Diversity** of devices (e.g., 'luxury' or 'needed')

Selected Devices



Data Collection and Analysis

- Structured interview after the tour
  - impression in general & opinions of devices
  - likes/dislikes
  - concerns
  - why
- Verbatim transcripts yielded 1783 participant quotes containing a motivated judgment about the 5 devices
- Analyzed with a coding scheme by 2 coders

The Coding Scheme

Coding categories:

I. Value Judgment
  - positive
  - absent negative
  - absent positive
  - negative

Conditionality
  - unconditional (judgment without a precondition)
  - conditional (judgment with an "if" or an "unless")

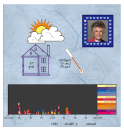
II. Motivation
  - motivations and reasons for the value judgment

Intrusion Type (%)

	physical	privacy	security	% of total motivations
CC	0.04	6.0	0.06	7% of 220
active DFP	0	15.0	2.00	17% of 367
passive DFP	0	25.0	5.00	30% of 272
FB	20.0	6.0	1.00	27% of 323
GP	10.0	4.0	3.00	17% of 316
LMX	4.0	8.0	2.00	16% of 285
Averages	*6.0*	*10.0*	*3.0*	*19%* of 1783

When Might Intrusiveness Affect Technology Acceptance?

- **Being monitored**



30% intrusion comments,

48% of which were ***conditional***

- **Just a little company**

27% intrusion comments,

11% of which were ***conditional***

Intrusion Statements

- **Being monitored**

- Don't like it, **BUT…**

If this would keep me independent longer, I wouldn't mind as much

If it's only my daughter who monitors me, it's alright

If you really need it, privacy becomes secondary

- **Just a little company**

- Don't like it, **PERIOD.**

I don't care for a chat. Talking back to me, can you imagine!

Damn robot watching me, I don't need that

It would scare me to death at night

Digital Family Portrait Field Study

- Measure actual acceptance and attitudes within context of use.
- Do impressions of "awareness" and "connectedness" change during deployment?
- Older woman and adult son
  - Over one hour drive distance
  - 3+ months sensor data

Awareness and Connectedness

- Joe's "awareness" appears to have increased as anticipated. Validated by interviews.
- Marge's "connectedness" varied dramatically but interview provide further insights.
- Joe's "connectedness" appears to have increased

Marge's attitude

- "I don't feel imposed upon, or spied upon or anything."
- "I would say that I feel more comfortable knowing that he knows that I'm moving around."

Marge's attitude

- "But… if I'm feeling lonesome, I think, oh well, Joe knows and so then I don't feel so lonesome."

Marge's attitude

- "I wish it had been available when my mother was living and I lived in all these other towns while she was back in Illinois. It would have been nice because she lived alone for 25 years and went down hill over that period of time. It would have been nice to know that she was up and around and moving but… the telephone got a lot of use."

Unexpected Uses

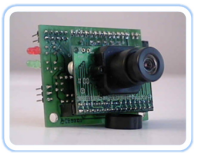
- When Marge was away for 3 weeks Joe used the DFP to discover when she had arrived home… (the sensors began firing) avoiding the need for phone tag to determine when he should call to find out about her trip.

Support for Functional Independence

- Will be accomplished through at least:
  - Understanding the older adult as a whole person including sensory, motor, and cognitive capabilities
  - Considering the older adult in a broad context as part of a larger social unit
  - Evaluating older adults in relation to their environment
  - Developing user-centered advanced technologies
  - Understanding acceptance and adoption issues

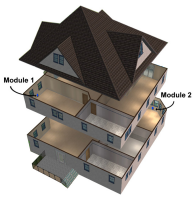
Technology Building Blocks

- Enabling implementation of applications
- Providing an infrastructure for new applications



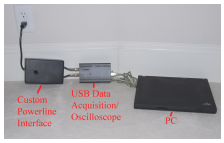
PowerLine Positioning

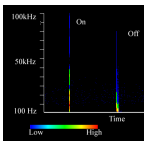
- Low-cost, easy to deploy indoor sensing using powerlines



Power Event Detection

- Detecting use of electrical appliances and light switches using a single plug-in module





TrackSense

- Infrastructure-free location system using projected patterns