Rehabilitation Engineering Research Center on Technology for Successful Aging

University of Florida

Funded by National Institute on Disability and Rehabilitation Research

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Brief Overview of Center
RERC / RERC RELATED AREAS

Home Monitoring
Communications
Smart - Technology
RERC / RERC RELATED AREAS

Home Monitoring
Communications

Telehealth
RERC / RERC RELATED AREAS

- Home Monitoring
- Communications
- Smart Home
- Telehealth
Partners: RERC-Tech Aging
University Partners

- University at Buffalo
- University of Wisconsin (Trace)
- University of California, Irvine (Ranchos)
Corporate Partners

- **Projects**
  - Honeywell
  - Motorola
  - General Electric
  - Hexamite

- **Advisory Board**
  - IBM
  - Phillips
  - Lifeline
Key Concepts of RERC-Tech-Aging
Defining Key Concepts in the Priorities:

Home Monitoring

- Home automation - comfort, safety, security
- Remote monitoring of health
- Remote monitoring of behavior
Defining Key Concepts in the Priorities:

Communications Technologies - used as assistive devices / assistive environments

- Wired phones
- Wireless phones
- Internet
- Integration of wireless, web connectivity and PC capability into one device – Smart Phone
RERC-Tech-Aging Research Projects

- Needs and Barriers to Home Monitoring/Communications Technology
- Effectiveness of home monitoring – today’s technology
- Effectiveness of home health monitoring with rural-living elders
- Effectiveness of home monitoring for people aging with disability
Development Projects

- **D1: Cognitive Assistance**
- **D2: Smart Phone – Carry Anywhere Assistance**
- **D3: Partnerships with Industry:**
  - Honeywell’s Independent LifeStyle Assistant Program
  - Motorola’s iDEN Smart Phones
  - GE Smartwave
Expanding on the base: RERC Related Projects
Home Monitoring Related Projects

SmartWave (GE Research)

Field-Based Deployment (VA)

Smart Home Project (RERC/UF/Doner)

ILSA (RERC/Honeywell)

Indoor Location Tracking (RERC/Hexamite)

Elder-Phone (RERC/Motorola)
Veterans Health Admin. Projects

Case Comparison With RERC Subjects

Project LAMP

Evaluation of Impact of Tele-Homecare

National Cancer Institute – Model Of Care
Facilities
Indoor Infrastructure

- X10 Powerline Home Network
- High-speed Home LAN Network
- TINI Internet Interface (Micro-controller)
- Wireless Local Connectivity
- Wireless Cellular Packet Network
- Appliance or home device

Internet (services)
Home Broadband Service Provider

- Wireless, ad-hoc appliances, devices, or information sources: (e.g.: TV remote control, door knob, Smart Tags, Garage door opener, Java rings, etc.)
Gator-Tech Smart House
February, 2004
Part 1

Management Processes
Procedures

- Choice of investigators
- Monthly meetings (teleconference)
- Research Core
- Statistics Core (through Brooks Center)
- Monthly / quarterly reports
- Annual reports
- Consumer Advisory Board feedback
- National Advisory Board feedback
Part 2

Outcomes, Activities, Output Targets
Research
Development
Education / Capacity Building
Dissemination
Research Outcomes:

- Long term: Wide use of home monitoring and computing/communication technologies
- Intermediate: Demonstrate effectiveness of today’s technologies (RCT’s)
- Short-term: Identify barriers to using home monitoring and communications technologies; Short term studies, weaker designs that suggest effectiveness of technologies.
Research
Program of Activities

- Initial study of needs and barriers
- Two RCT’s
- Matched pairs study of VA tele-homecare demonstrations
- Additional related research with funds beyond RERC
Research
Problems and Actions

- Some target numbers for studies not yet achieved.
  - Increasing recruitment of subjects
- Some start-up time with setting up RERC at UF (first RERC at UF) – projects did not initiate work on Oct 1, 2001
  - Worked to “catch-up”
Research Progress

- Very good progress
- Have secured funds for additional studies to build on RERC research
Development
Overview

- Push the Envelope of the emerging “Assistive Environments” Technology by utilizing recent advances in Pervasive Computing
- Create an anytime, anywhere elder digital assistant by utilizing recent advances in Mobile Computing.
- Enable key applications in the Assistive Environment and using the elder digital assistant
- Technology streamlining through open framework development
Assistive Environments
Smart Homes

Internet
(services)

Home Broadband
Service Provider

Wireless Access
Point

X10 Powerline
Home Network

TINI
Tini Internet
Interface
(Micro-controller)

High-speed Home
LAN Network

X10 Module

Wireless Local
Connectivity

Wireless Cellular
Packet Network

Appliance or
home device

Wireless packet
data (cellular)

Proxy
Software
for X10,
TINI, &
Internet
Services

Static IP

Networked
Home Server

X10 Controller

Client

App

TINI

RF1

Static IP

Dual Interface

Smart Phone

RF2

Wireless Local
connectivity
(802.11x, or
Bluetooth)

Wireless, ad-hoc appliances, devices, or
information sources: (e.g.: TV remote
control, door knob, Smart Tags, Garage
door opener, Java rings, etc.)
Ultrasonic Positioning System

Ultrasonic waves are passed between stationary pilots (Figure 1) and mobile beacons (Figure 2).

- The time of arrival (TOA) of the waves between the devices is used to calculate position (Trilateration)

- Accuracy:
  - We have achieved 3cm accuracy.
Ultrasonic Location Positioning/Tracking System
Digital Downtown/Campus
UF Wireless Campus
Anytime, Anywhere Elder Digital Assistant
Smart Phones

- Code reader (Smart ID, RFID, ...)
- Full-day battery
- Wider phone keypad
- Wider screen
- Back-lit & contrasting colors
- Wider vertical key spacing
- Larger fonts
- Back-lit audio feedback
- Voice input/output
- Larger horizontal key spacing

Smart Phones
Smart Phones for the Elders – Special Ergonomics + Mobile Sensor Network Platform

- Code Reader
- Electronic Nose (Chem. Sensor)
- GPS
- Ultrasonic Receiver
- Wireless Local/Body connectivity
Enabling Key Applications
Applications

- Locating elders & objects (e.g. Car in parking garage, TV remote)
- Home appliances and device control (e.g. switching functions & A/C control)
- Smart Microwave Ovens, Talking Food, etc
- Alerts and alarms (e.g., medicine reminders & postal mail notification)
- Grocery shopping assistant
- Weather Awareness
Applications

- Integrated indoor/outdoor location tracking
- Map maker and navigation
- Security Alerts (doors, windows, water leaks)
- Access Control (lock/unlock doors, windows)
- Next generation Lifeline
- Home Entertainment for the elders
- Push to Eat (and other automated services)
- Dictation
- Others…
Framework
Framework

- Smart Phone/Smart Space Integration
- Open service Gateway Initiative (e.g. OSGi) & other universal interfaces
- Zero Configuration (Service Discovery)
- Wireless Sensors

- 3D Ultrasonic indoor location services
- Applications as service composition
Outcomes

- Technology Research, Concepts, Demos
- Research publications, Prototypes, Demos
- Framework, Standards, Prototypes, Products, communities
Engineering Team

- Faculty
  - Sumi Helal, Computer Science & Engineering
  - Joachim Hammer, Computer Science & Engineering
  - John Harris, Electrical Engineering
  - Mark Schmaltz, CISE
  - James Oliverio, Digital Arts Institute

- Postdoctoral Associates:
  - Choonhwa Lee, Ph.D. Computer Engineering

- Research Scientists:
  - Steven Moore, MS. Computer Engineering
Engineering Team

- **Ph.D. Students**
  - Youssef Kaddourah – Location positioning
  - Carlos Giraldo – Elder Phones
  - Hicham Zabdani – Remote Monitoring Infrastructure & Elder Entertainment
  - Andi Sukojo: Devices and wireless interfacing

- **Research Assistants:**
  - Wenzheng Gu: Remote Monitoring Infrastructure
  - Choonhwa Lee: Networking and Service Discovery

- **Masters Thesis Students**
  - Satish Kumar: robotics (Matilda)
  - Pinkesh Desai: Sensor Networks
Engineering Activities

- Industry and Government Interactions
  - Demo Visits by NSF, Toyota, General Electric, Motorola, Intel, others
- Community Interactions – demos
- Participation in major engineering, computer science, and aging conferences
- Organizing conferences & Workshops
- Related Research Proposals
Dissemination

- Publications
- Conferences & Workshops
  - Int’l Conf. on Aging, Disability & Independence (ICAD) – DC, Dec 03
  - Preparatory Workshop for the ICAD High Technology Track – London, June 03
  - Possibility – ICAD follow-up meeting in conjunction with IEEE/IPSJ SAINT Conference – Tokyo, Jan 04
- Web Site
- Application Flash Demos
- Patenting and Technology Transfer
Leverage

- Pervasive Computing Laboratory
  - 950 sq. ft – UF College of Engineering
  - $36K renovation grant – UF CoE
- Full Scale Elder Home
  - Located on edge of UF campus at a Continuous Care Retirement Community
  - Will serve as a living lab
  - $350,000 project
- Motorola funded research to prototype smart phones for the elders
  - $85K, Motorola iDEN Group
Education / Capacity Building

Outcomes:

- **Long term**: More investigators working in the area of aging and technology
- **Intermediate**: 6 dissertations by end of current RERC funding cycle; 12 more beyond 2006 – on applications of technology for successful aging
- **Short-term**: Enroll 15 Ph.D. and 3 post-docs during current cycle
Education / Capacity Building
Program of Activities

- Research assistantships in Engineering and Rehabilitation Science
- Post-docs – NIDRR and VA
- Junior faculty mentoring
- Senior faculty collaborations
- Internships, work with corporate partners, and international exchanges
Internships have not yet proven to be a practical option for graduate students. Students work with corporate partners, but not at their facilities.
Education / Capacity Building
Progress

- Excellent progress, excepting internships
- Have secured additional funds to support more graduate students in engineering and rehabilitation science, and more post docs.
Dissemination
Outcomes:

- Long term: Wide use of home monitoring and communications technologies
- Intermediate: More informed consumers
- Short-term: Dissemination products: video, web-site, Project Link, conferences, popular press and peer reviewed articles
Dissemination
Program of Activities

- 12 areas of focus for dissemination
- More web-based delivery
- Partnerships with consumer and professional organizations
- Additional funds secured for wider dissemination
Dissemination
Problems and Actions

- Initially under direction of UF Institute on Aging, which underwent administrative change

  - Moved dissemination directly under RERC Director (Mann), hired person with disability to implement dissemination plan
Dissemination Progress

- Good progress
- Conferences are very strong
A Conference
Integrating Research, Practice, Business & Consumer Perspectives

The conference is financially supported by the National Institute on Disability and Rehabilitation Research, Veterans Health Administration, National Science Foundation, European Commission, private foundations and corporate sponsors. The conference program has been developed in cooperation with the European Commission.

Conference Partners
American Association of Homes and Services for the Aging (AAASH) • American Medical Association Program on Aging and Community Health (AMACH) • American Occupational Therapy Association (AOTA) • American Physical Therapy Association • Association on Geriatric Education in Nursing (AGEIN) • Association of Rehabilitation Nurses (ARN) • Case Management Society of America (CMSA) • Center for IDEA, SUNY at Buffalo (IDEA) • Center for International Rehabilitation Research Information and Exchange (CIRRIE) • Elderly Issues • International Association of Homes and Services for the Aging (IAASHA) • Lighthouse International (LI) • National Asian Pacific Center on Aging (NAPCA) • National Association for Hispanic Elderly (NAHE) • National Association of Home Builders Research Center (NAHBRC) • National Association of State Units on Aging (NASUA) • National Council on Aging (NCOA) • National Gerontological Nursing Association (NGNA) • National Resource Center on Supportive Housing and Home Health • National Rehabilitation Engineering & Technology (NRETC) • National Rehabilitation Information Center (NCRIC) • National Rehabilitation Engineering Society of North America (RESNA) • Rehabilitation Engineering and Training Center on Technology for Successful Aging (RERC-TSA) • Rehabilitation Engineering Research Center of University of Illinois at Chicago (RECC) • Rehabilitation Engineering Research Center of University of Texas at Austin (RECC) • Rehabilitation Engineering Research Center of University of Washington (RECC) • Rehabilitation Engineering Research Center of Washington University (RECC) • Rehabilitation Engineering Research Center of Wisconsin (RECC) • Rehabilitation Engineering Research Center of Virginia (RECC) • Rehabilitation Engineering Research Center of California (RECC) • Rehabilitation Engineering Research Center of New York (RECC) • Rehabilitation Engineering Research Center of Pennsylvania (RECC) • Rehabilitation Engineering Research Center of Texas (RECC) • Rehabilitation Engineering Research Center of Ohio (RECC) • Rehabilitation Engineering Research Center of Maryland (RECC) • Rehabilitation Engineering Research Center of Illinois (RECC) • Rehabilitation Engineering Research Center of Massachusetts (RECC) • Rehabilitation Engineering Research Center of Michigan (RECC) • Rehabilitation Engineering Research Center of New Mexico (RECC) • Rehabilitation Engineering Research Center of Oregon (RECC) • Rehabilitation Engineering Research Center of Tennessee (RECC) • Rehabilitation Engineering Research Center of Utah (RECC) • Rehabilitation Engineering Research Center of Virginia (RECC) • Rehabilitation Engineering Research Center of Washington (RECC) • Society for the Advancement of Disability Studies (SADS) • World Congress on Disability (WCD)

Conference Location:
Hyatt Regency Crystal City
Arlington, VA
Tel: (703) 418-1234

Conference Fees:
(Includes reception & luncheon)
Early Registration: $325 US

Also possible to participate through the WWW.

Conference Sponsors
University of Florida Rehabilitation Engineering Research Center on Technology for Successful Aging
www.rerc.ufl.edu
American Society on Aging
www.asaging.org
European Commission (EU)
www.europa.eu.int

2003
The European Year of People with Disabilities

December 4-6, 2003
Washington, D.C., USA
www.asaging.org/icadi

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