Honeywell's LifeCare Research Directions

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Honeywell

Outline

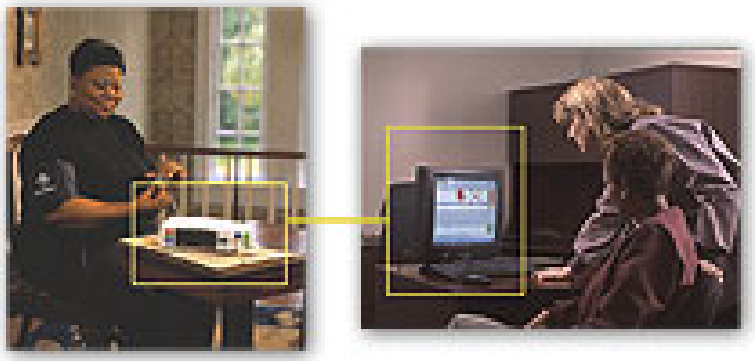
Honeywell

- **Currently Available Products**
- **Research Activities**

Honeywell HomMed

Honeywell

- **Telemonitoring systems for healthcare**
- **Over 22,000 systems currently in use; over 300,000 patients monitored—**more than all other providers of home telemonitoring combined
- **Customers include managed care organizations, disease management organizations, hospital specialty clinics, home healthcare agencies, senior and assisted living facilities**
  - ROI within 6 months typically
- **40-67% reduction in hospitalizations and 40-65% decrease in ER visits for patients with CHF, diabetes, COPD, CAD**
  - HomMed monitored patients versus matched nonmonitored cohort
- **Other benefits: patients can live in their homes, clinical personnel can make in-home visits only when required, greater nursing efficiencies**



Telemonitoring Unit and Parameters

Honeywell

- **The Honeywell HomMed Health Monitoring System has two main components.**
  - **telemonitoring unit:** in home or clinical environment; collects and transmits health status information
  - **central station:** receives data and presents it to clinical personnel for monitoring and tracking
  - **both FDA Class II medical devices (hospital grade)**

- **Five key parameters monitored**
  - blood pressure
  - heart rate
  - weight
  - oxygen saturation
  - temperature

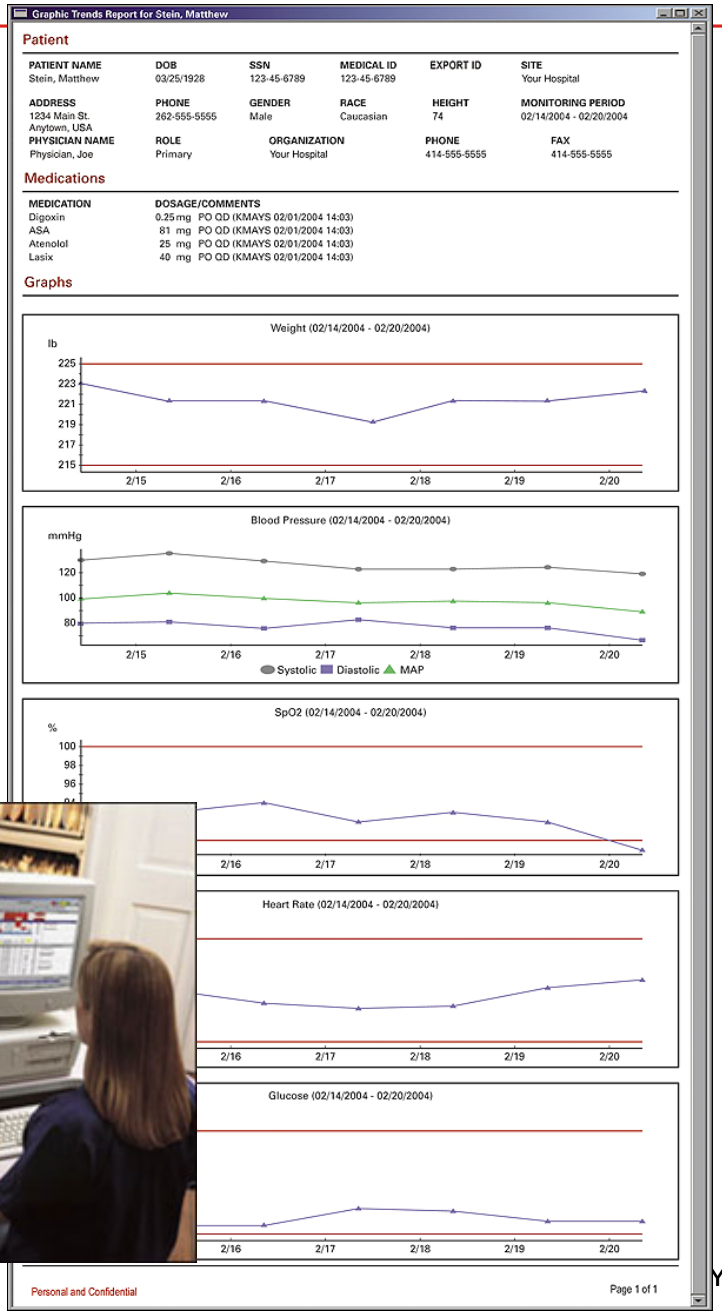
- **Additional medical peripheral devices can be added**
  - glucose meter
  - pocket size ECG device
  - spirometer
  - peak flow meter/FEV1
  - PT/INR device

- **Plus yes/no questions**
  - “Are you feeling any dizziness?”

- **3-5 mins, once or twice a day**

Clinical Oversight

Honeywell


Graphic Trends Report for Stein, Matthew

Patient

PATIENT NAME	DOB	SSN	MEDICAL ID	EXPORT ID	SITE
Stein, Matthew	03/25/1928	123-45-6789	123-45-6789		Your Hospital

ADDRESS	PHONE	GENDER	RACE	HEIGHT	MONITORING PERIOD
1234 Main St. Anytown, USA	262-555-5555	Male	Caucasian	74	02/14/2004 - 02/20/2004

PHYSICIAN NAME	ROLE	ORGANIZATION	PHONE	FAX
Physician, Joe	Primary	Your Hospital	414-555-5555	414-555-5555

Medications

MEDICATION	DOSAGE/COMMENTS
Digoxin	0.25 mg PO QD (KMAYS 02/01/2004 14:03)
ASA	81 mg PO QD (KMAYS 02/01/2004 14:03)
Atenolol	25 mg PO QD (KMAYS 02/01/2004 14:03)
Lasix	40 mg PO QD (KMAYS 02/01/2004 14:03)

Graphs

Weight (02/14/2004 - 02/20/2004)

lb

225 223 221 219 217 215

2/15 2/16 2/17 2/18 2/19 2/20

Blood Pressure (02/14/2004 - 02/20/2004)

mmHg

120 100 80

2/15 2/16 2/17 2/18 2/19 2/20

Systolic Diastolic MAP

SpO2 (02/14/2004 - 02/20/2004)

%

100 98 96

2/16 2/17 2/18 2/19 2/20

Heart Rate (02/14/2004 - 02/20/2004)

2/16 2/17 2/18 2/19 2/20

Glucose (02/14/2004 - 02/20/2004)

2/16 2/17 2/18 2/19 2/20

Personal and Confidential

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- **Nationwide network of selected home healthcare agencies and skilled clinicians**
  - **covers 95% of the US population**
  - **agencies undergo extensive training**
- **Several reports and applications available at central station**
- **Capabilities to track and trend data, record and view nursing / physician notes, generate printed or faxed reports, etc.**

“Health and Wellness Kiosk”

Honeywell

- Targeted to corporations, health clubs, senior living communities, etc.
- Allows multiple users to securely monitor their health in less than three minutes.
- HIPAA compliant. Information sent securely over telephone lines. No user identifiers attached to data.
- Local healthcare agency reviews the healthcare data and communicates any changes to pre-set levels to the individual and their physician.

Medication Compliance

Honeywell

Provide Reminders & dose instructions

No handling of pills – uses bottles from the pharmacy

Prompts for the correct bottle, warns when wrong bottle accessed

Tracks expected pill count based on bottle accesses & dose

Reports once per day

Honeywell HomMed
MedPartner™

Research Activities

Honeywell

(Big) Remaining Technical Hurdles

Honeywell

- **Sensing**
  - **Passive, easy to install, accurate**
- **Coordination of sensing & response**
- **Multiple users with differing needs and goals**
  - **Elder client, family members, Formal Caregivers**
- **Ongoing configuration**
  - **Configuration parameters can be expected to change over time both for the client and the home**
    - user entered changes
    - dynamic adaptations based on living patterns
- **User Acceptance**
  - **Privacy**
  - **Usability**
  - **Reliability**

Sensing Devices

Honeywell

Sensing

- Medication
- Up at Night
- Activity
- Location

Medical Records

- CAST

Usability

- Trust
- Socialization

Demonstrations

- **Easy Installation, Portability & Reliability**
- **Usability**
- **Remote configuration & control, e.g. update algs, turn off stove**

Need	Promising Approaches
UI devices	
Unique Identification	Alwan
Falls (& gait?)	Alwan (U Virginia) seismic/acoustic approach
Location	Labs (Kolavennu)
Entry/Exit	Door monitoring – Modified Hwl sensors
Temperature	Labs - Modified Hwl sensor
Activities	RFID (Intel)
Medical	Labs (Cabuz)
Safety (smoke, CO, stove)	Labs - Modified Hwl sensors

Emerging Sensing Technologies

Honeywell

Sensing

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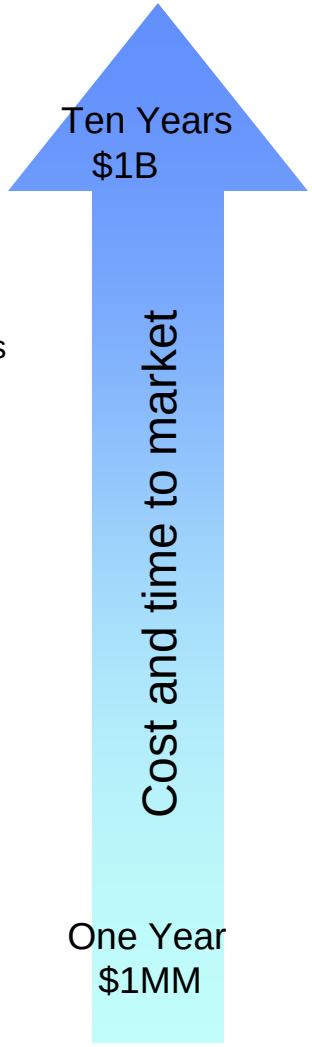
Demonstrations



- **Nanotechnology**
  - Nanotech describes the smallest bits of matter than humans can fashion into a device. Nano-devices are measured and studied on the same scale as single atoms a human hair is 50,000 nanometers in diameter

    biosensors, drug delivery, molecular motors, revolutionary electronic systems
- **MEMS**
  - **Micromechanical devices**
    filters on a chip, engines, robots, measured in microns (1000 nanometers)
  - **Handheld micro bolometer**
- **Video processing**
  - **Reliable and cost-effective facial recognition**
  - **Diagnostics**
- **Sensing advancements**
  - **Smart sensors (embedded intelligence – fall sensor)**

Medication Compliance

Honeywell

Sensing

Medication

Up at Night

Activity

Location

Medical Records

CAST

Usability

Trust

Socialization

Demonstrations

- **Design new caddy: leverage I.L.S.A. findings, address limitations of MedPartner**
- **Thinking about doing a controlled field study of (existing) products**

ILSA med caddy: Flexible, Portable

Well liked by seniors, but finer-grained info would be appreciated by caregivers

Honeywell HomMed

MedPartner™

MedPartner Limitations:

- Large footprint
- Designed for home-bound population – not portable
- Requires home nurse to set up reminders (only provided through an HHA)

Formal CG interviews suggest Pareto's 80-20 rule applies:

4% of elders need complex sensing

16% of elders need verification that they touched the device

80% of elders need only reminders

Medication Compliance

Honeywell

Sensing

Medication

Up at Night

Activity

Location

Medical Records

CAST

Usability

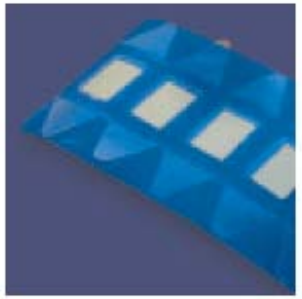
Trust

Socialization

Demonstrations

- **Improved devices and techniques for self-management**
- **ACLAR™ film from Honeywell Specialty Materials**
  - **New modes of delivery**
  - **Superior protection for humidity sensitive medication**

  - **Supporting new concepts in compliance packaging**



CareWatch©

Honeywell

Sensing
- Medication
- **Up at Night**
- Activity
- Location

Medical Records
- CAST

Usability
- Trust
- Socialization

Demonstrations

- **Honeywell Ademco working with Meredeth Rowe (UFL)**
- **Goal: Prevent unintended exits of persons with cognitive impairment (e.g., Alzheimer's patients and children with autism)**
- **To improve caregiver QoL: wakes the caregiver when patient wanders**

Photos used with permission of Meredeth Rowe
More info: http://nursing.ufl.edu/dementia/resources.html

Activity Sensing

Honeywell

Sensing
- Medication
- Up at Night
- **Activity**
- Location

Medical Records
- CAST

Usability
- Trust
- Socialization

Demonstrations

- **Goal: Employ a variety of sensors for detecting action, motion, or physical presence to recognize normal activities and identify potential symptoms of decline.**
  - Traditional security sensors (motion, door switches)
  - Pressure pads
  - Weight detectors
  - Water flow, heat, other home safety
  - Practical only for those living alone

Wireless devices

Current Shortcomings:
- Accurate configuration to individual living patterns is problematic. Makes systems expensive to deploy.
- Need many sensors and other types of evidence to confirm what motion sensor data really means
- Difficult to filter out evidence associated with visitors vs. the occupant
- Simple reliable means of tracking individuals

Method 1: Coarse Location

Honeywell

Sensing
- Medication
- Up at Night
- Activity
- **Location**

Medical Records
- CAST

Usability
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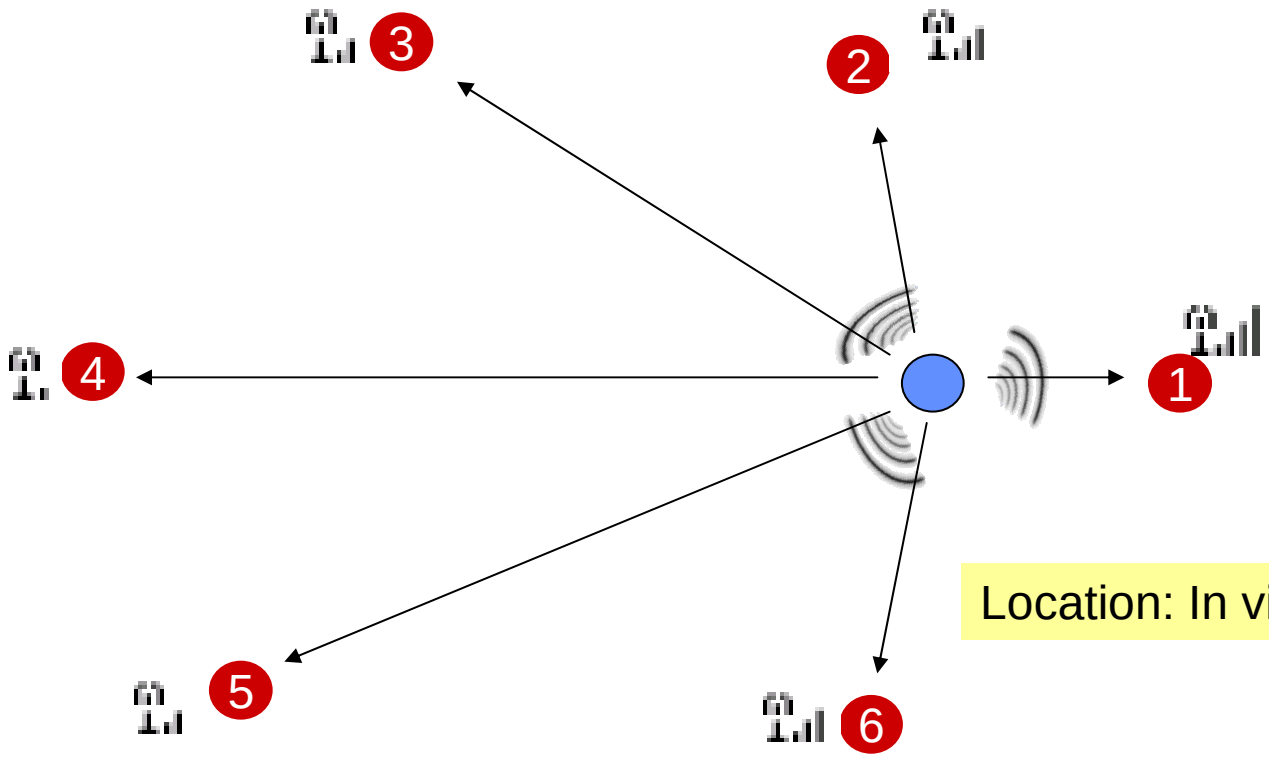
- Socialization

Demonstrations



- The Beacon's transmission is heard at some or all of the beacon receivers
- All signal strengths are reported to a central location
- The Location is determined as in vicinity of the Beacon receiver with strongest signal strength

Method 2 : Multilateration

Honeywell

Sensing

- Medication
- Up at Night
- Activity
- **Location**

Medical Records

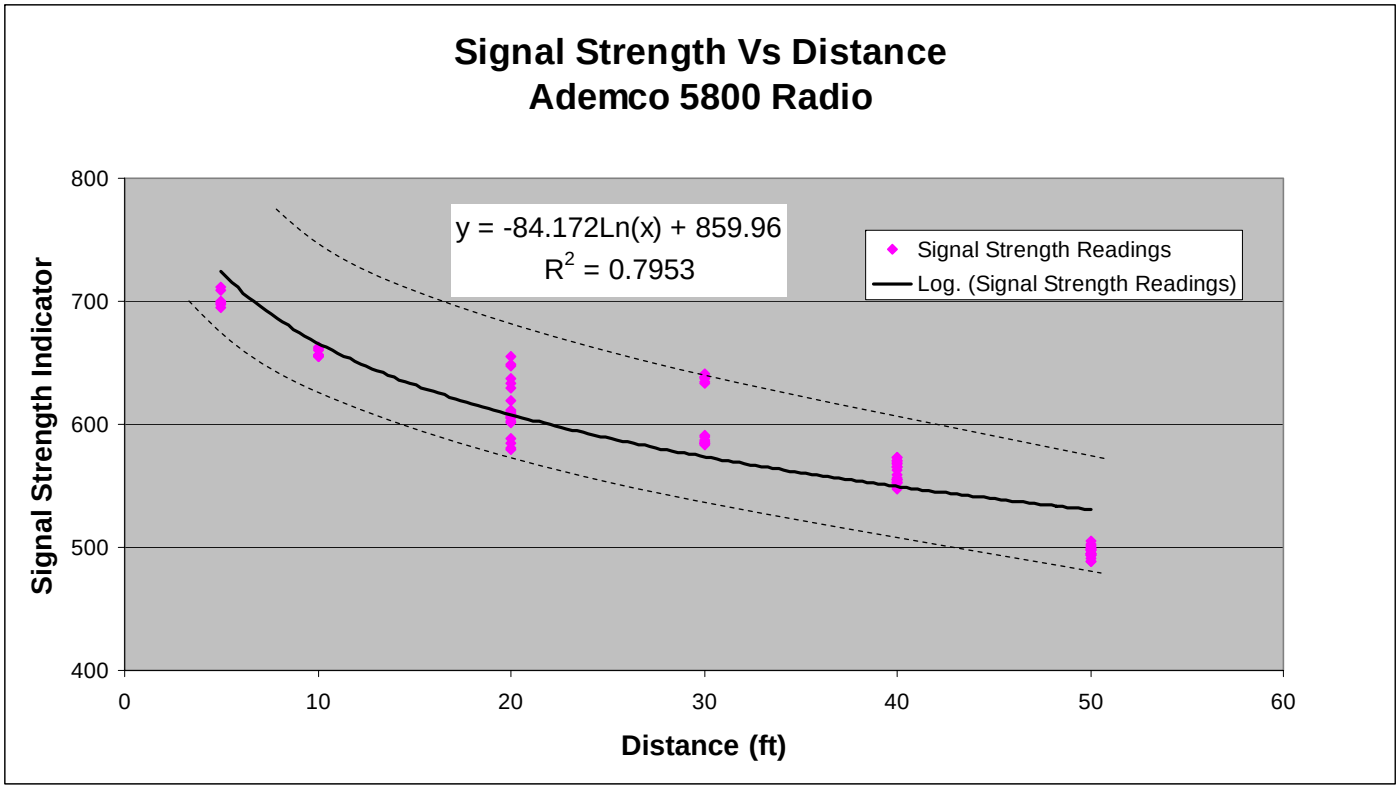
- CAST

Usability

- Trust
- Socialization

Demonstrations

- **Motivation : How can we use the signal strength measurements at all points.**
- **Can we get a "rough" estimate of distance from signal strength ?**



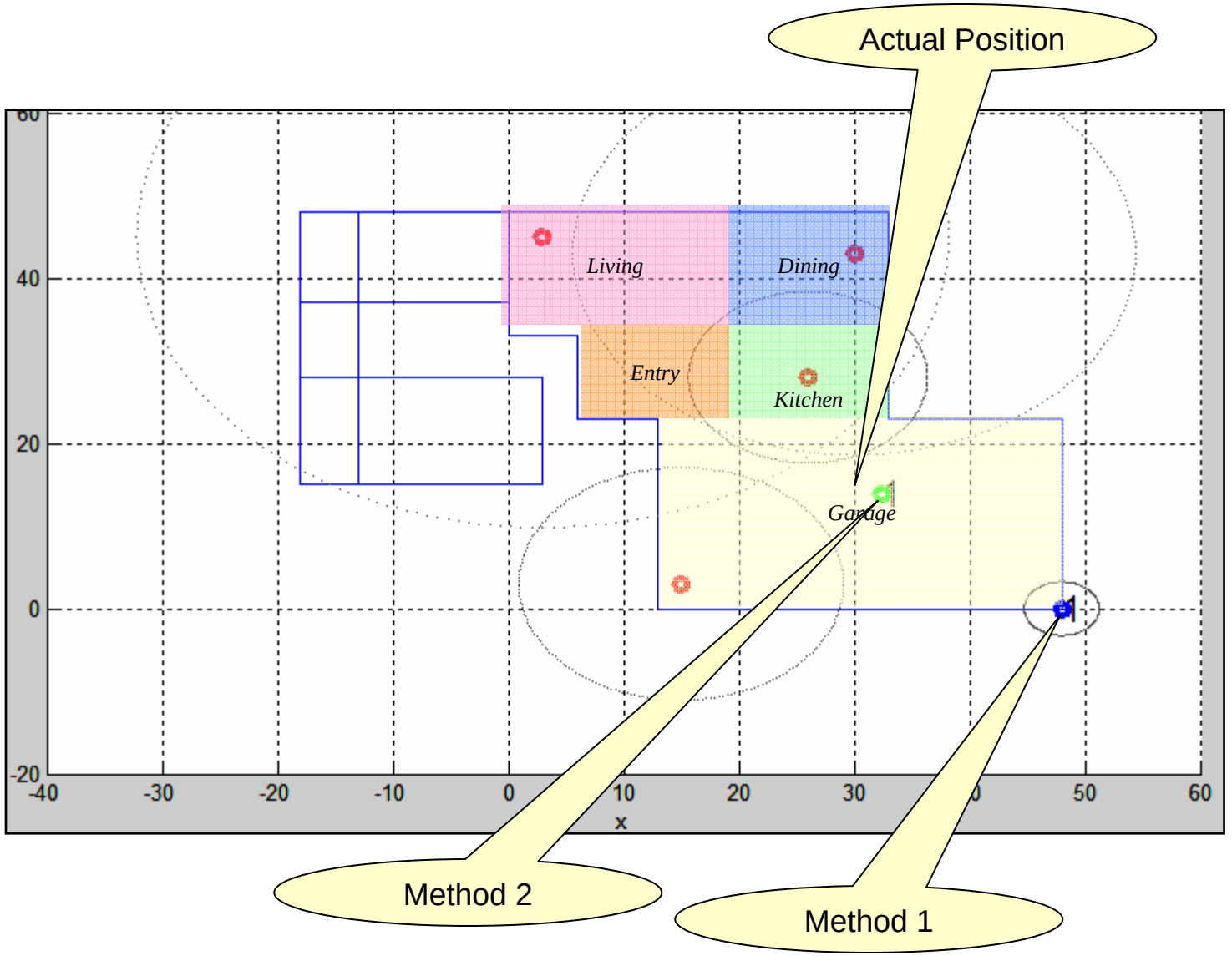
Note : Fit Equation Compatible with:

$$S_{Rx} = \frac{g * S_{Tx}}{d^{\alpha}}$$

Results (Honeywell House - Garage)

Honeywell

- Sensing
  - Medication
  - Up at Night
  - Activity
  - **Location**
- Medical Records
  - CAST
- Usability
  - Trust
  - Socialization
- Demonstrations



Results (Bedroom 1 – Honeywell House)

Honeywell

- Sensing
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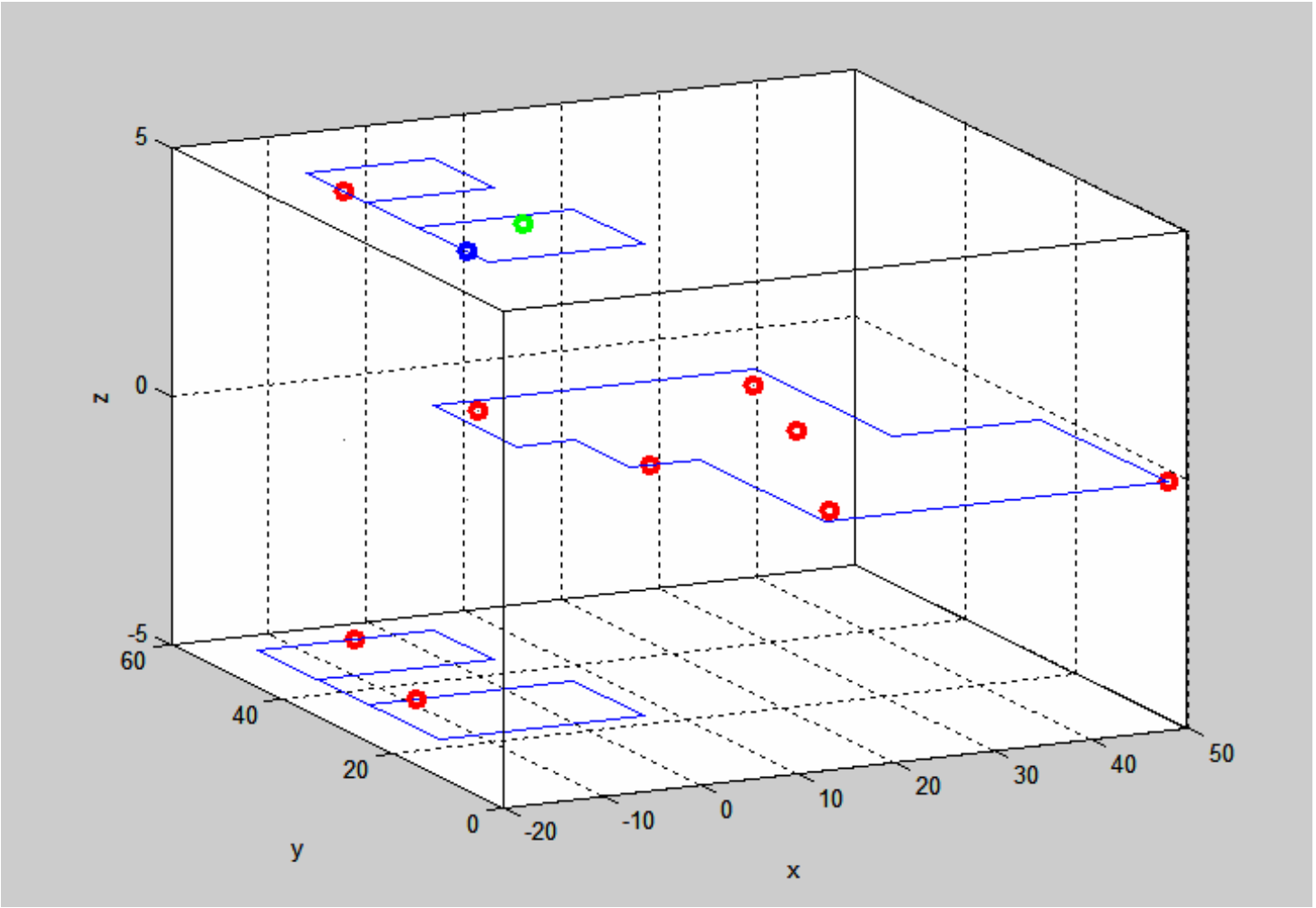
  - Up at Night
  - Activity
  - **Location**
- Medical Records
  - CAST
- Usability
  - Trust
  - Socialization
- Demonstrations



Split level House – Bedrooms are in upper level , office lower level, living main level

Summary and Path Forward

Honeywell

Sensing
- Medication
- Up at Night
- Activity
- **Location**

Medical Records
- CAST

Usability
- Trust
- Socialization

Demonstrations

- **Tests conducted using Honeywell's Ademco Security products.**
  - **Key fob moved to different places to record the signal strength from different locations.**
- **Simple signal strength comparison (method 1) works well for coarse location**
  - **Incorporating PIRs**
- **Multilateration seems to be promising for more accurate location.**
  - **Accuracy within 4 to 5 feet**
  - **Ademco has a good signal strength vs distance map**
  - **Installations issues with this method**

Medical Records: CAST participation

Honeywell

Sensing

Medication

Up at Night

Activity

Location

Medical Records

CAST

Usability

Trust

Socialization

Demonstrations

CAST Upcoming Events we plan to participate in:

- White House Conference on Aging Exhibit Dec 11-14
- CAST/NIST Symposium February 14, 2006

Business Economics Task Group

- Economic impact model for telehealth technology on **CHF** treatment costs
  - Completed lit review on this topic/reviewed CMS data on sources of costs
  - Working with a technical writer to document our findings as a white paper.
- Expanding technology impact analysis to consider additional technologies (like med management)
- Will be featured on a poster presentation at the WHCOA
- Currently conducting **diabetes** lit review and econ impact analysis which also will come out as a CAST white paper;
- Currently conducting **COPD** – econ impact lit review

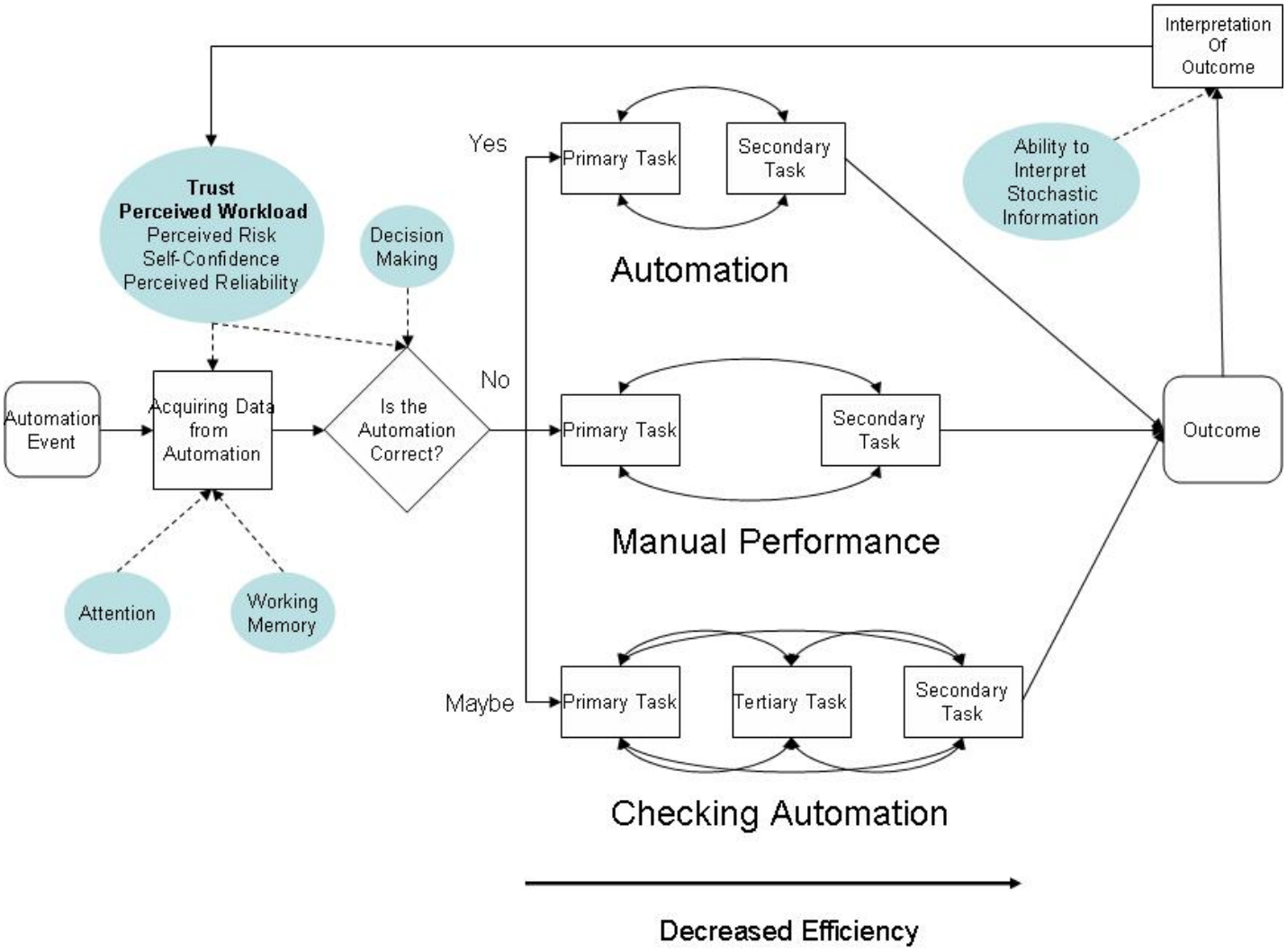
EHWR Task Group

- AHIMA HIT Summit kick-off event for this team
- Hiring IT consultant to further CAST consortium interests in HIT standards (HL7 top priority) CAST

Model of Technology Use

Honeywell

- Sensing
  - Medication
  - Up at Night
  - Activity
  - Location
- Medical Records
  - CAST
  - Walker?
- Usability
  - **Trust**
  - Socialization
- Demonstrations



Trust

Honeywell

Sensing
- Medication
- Up at Night
- Activity
- Location

Medical Records
- CAST

Usability
- **Trust**
- Socialization

Demonstrations

- **People need to be able to determine whether technology is helpful.**
  - **Older adults are less able to keep a mental record of outcomes**
  - **Older people may miss relevant cues that tell them that the technology is not behaving correctly.**
- **As technology improves and reliability improves, there is a danger that older adults will rely too much on technology.**
- **As user interfaces become more human-like, there is a danger that older adults will also place too much trust on technology.**

- **Currently, we are far from this goal, but as our technologies improve, we need to be mindful of other problems that need to be addressed concerning older clients.**

Socialization

Honeywell

Sensing
- Medication
- Up at Night
- Activity
- Location

Medical Records
- CAST

Usability
- Trust
- **Socialization**

Demonstrations

- **How do we find out what is engaging and fun to elders?**
- **Discover what activities seniors who are still independent like to do (gardening, knitting, golfing, fishing, games….)**
- **Find or invent virtual analogues for these activities that scale to the mental and physical limitations of older, more frail seniors.**
- **Discover and characterize their current social circle and how they can maintain social contact through technology.**

Interview ➔ Prototype ➔ Focus group or test ➔ Refine Concepts

Group Interviews With Seniors

Honeywell

Sensing
- Medication
- Up at Night
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- Location

Medical Records
- CAST

Usability
- Trust
- **Socialization**

Demonstrations

- **Strong recurring themes (topics that raised the decibel level in the group discussion)**
  - **Volunteer activities** (organizing and doing) are a major source of social interaction and occupy a great amount of their time. Seniors also believe that these are among the first activities they would have to stop if they became homebound.
  - **Sharing personal perspectives** on history is a way they connect with their peers and with younger generations.
  - **Games and puzzles** are great if they provide the opportunity to interact with other people (by means of organizing the game or playing the game)

Socialization technical challenges

Honeywell

Sensing
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- CAST

Usability
- Trust
- **Socialization**

Demonstrations

- **Do our analogue forms of interaction really capture the essence of social interaction? What's good? What's missing? Does audio help? Does video help?**
- **Need to replicate some of the dynamics of social interactions in much the same way as happens spontaneously in real life.**
  - e.g. Provide users the ability to turn down invitations to join an activity or event, contingent on who else is invited; automatic matching with people of similar interests; provide capability to initiate and organize activities with others.
- **User interfaces need to be adaptable to the changing psychomotor and cognitive abilities of aging people**
  - UI's need to be simple
  - Games need to be "decelerated"
- **Auditory interface may be necessary**
- **Screen size is issue for some applications**
- **Security for vulnerable participants**

The Virtual Community Center

Honeywell

- Sensing
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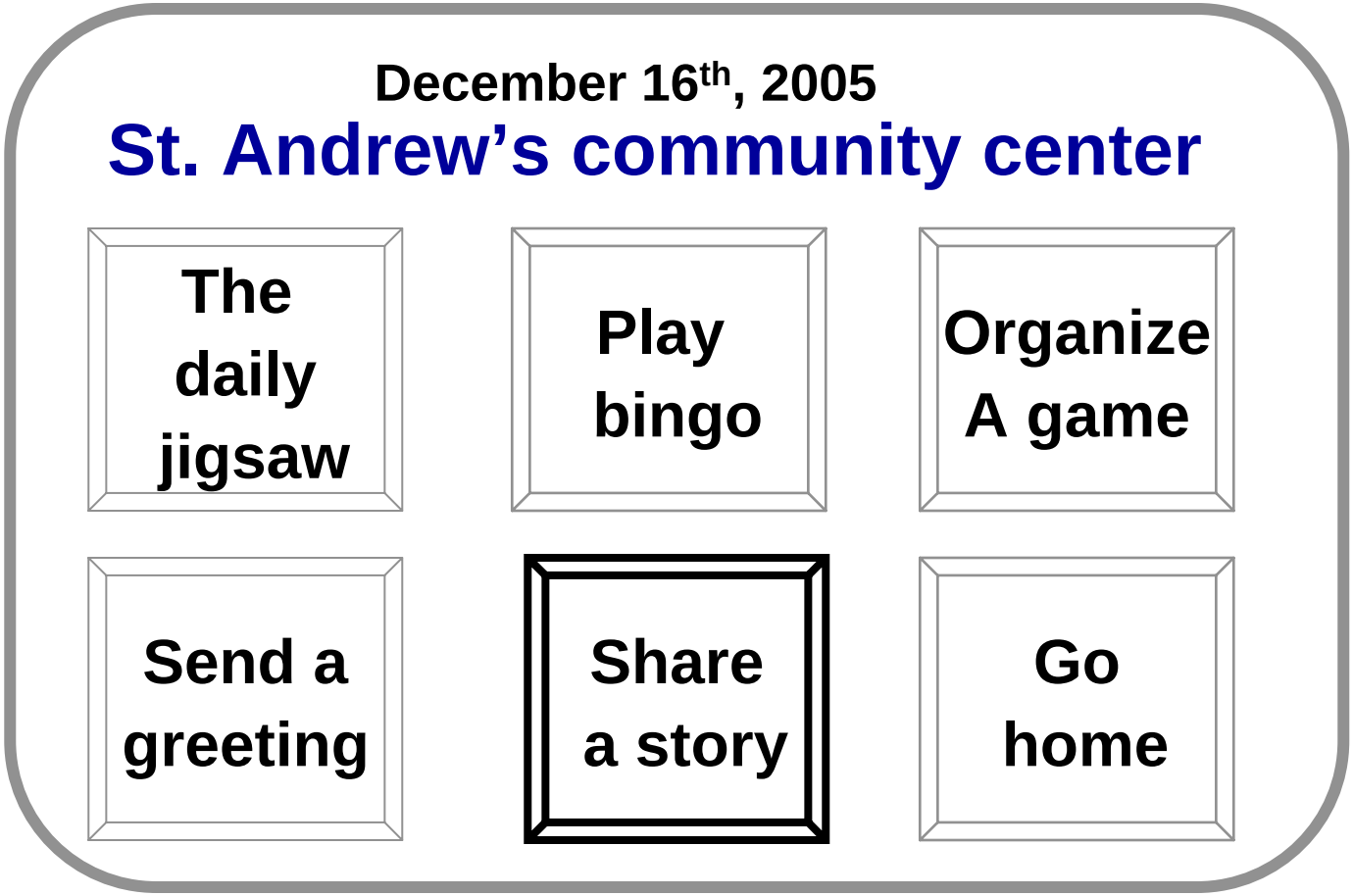
- Demonstrations



Virtual Community Center

Honeywell

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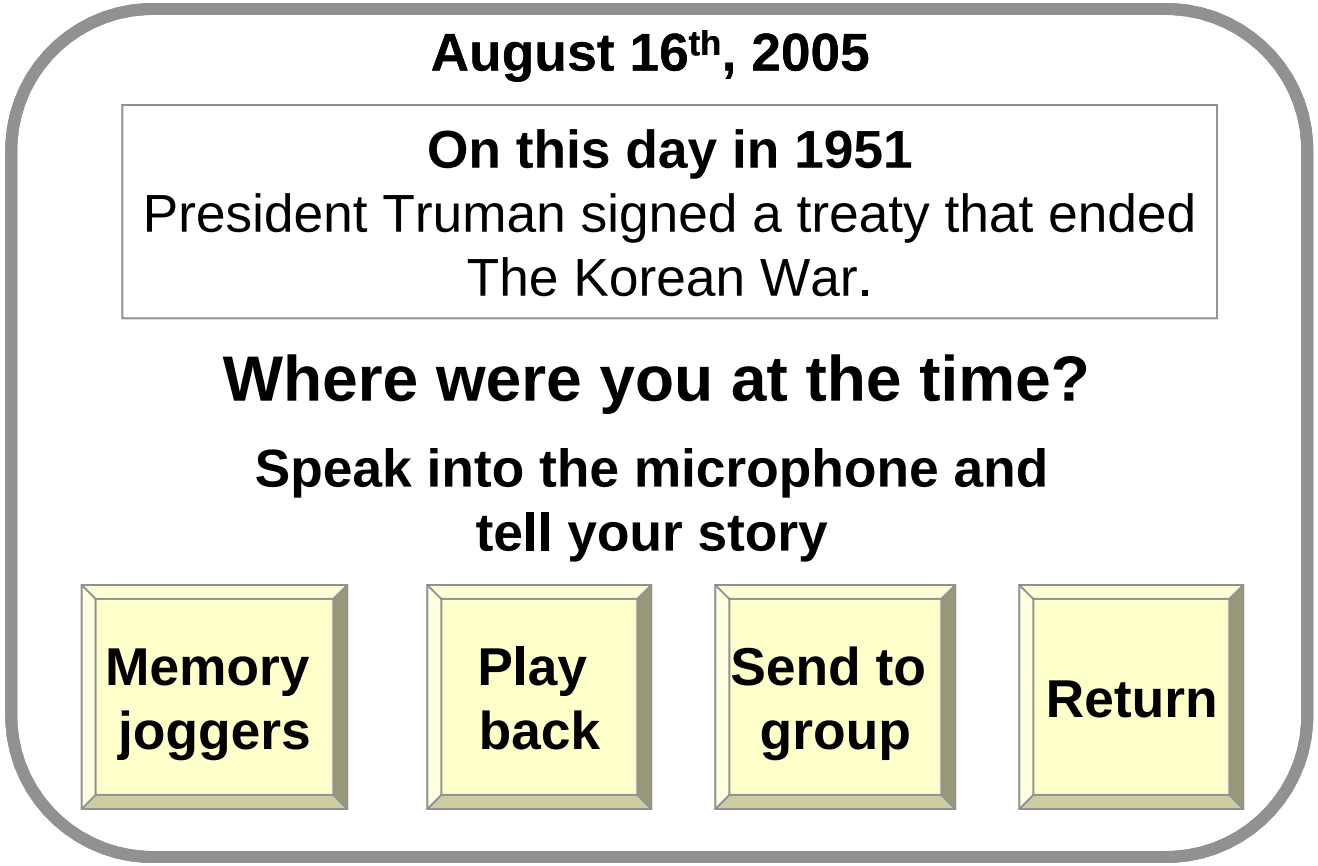

Virtual Community Center

Honeywell

- Sensing
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- Medical Records
  - CAST
- Usability
  - Trust
  - **Socialization**
- Demonstrations

The daily Jigsaw

December 16th, 2004

Here is what Mabel did today

Start

Send to Friend

Puzzles can be solved jointly

Increased Connectivity (CAST demo 2004)

Honeywell

- Sensing
  - Medication
  - Up at Night
  - Activity
  - Location
- Medical Records
  - CAST
- Usability
  - Trust
  - Socialization
- **Demonstrations**

Connecting the Support Network

- Simplified internet-enabled communication for the elderly
- Concise reports for concerned family members
- Direct connect to primary professional caregivers
- 24x7 remote monitoring

WHCOA

Honeywell

Sensing

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Medical Records

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Usability

- Trust
- Socialization

Demonstrations

- **We will have a demonstration at the White House Conference on Aging, December 2005 in Washington**
  - **HomMed biometrics products**
  - **Meredeth Rowe's "Up at Night" concepts**
  - **Socialization concepts**
  - **Localization concepts**

Conclusion

Honeywell

- Need better sensing technologies
  - Passive, reliable, accurate
- Need better inference technologies
  - Situation assessment, behavior modelling
- Need better interface technologies
  - Engaging interfaces & Socialization
- Need to solve the installation & configuration issue
  - Cheap, fast, accurate. Can a nurse do it in an hour?
  - Ongoing changes.
- Need *good* clinical studies to determine cost savings & quality of life improvements
- Need to figure out how to market & sell the ideas
  - Privacy
  - Who will pay?
  - Who will service?
  - Where are the incentives now, what will change them in the future?

Honeywell

Honeywell	**www.honeywell.com**
I.L.S.A.	**www.htc.honeywell.com/projects/ilsa/**

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