Independent LifeStyle Assistant

Home-Care Technology for Independent Living

A NIST Advanced Technology Program

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Independent LifeStyle Assistant

Agenda

ILSA Vision

Program Progress

Evaluation Plans

Concept Web Pages

Honeywell Businesses

120,000 employees in 95 Countries. Sales of $25B

Automation & Control Systems

Aerospace

Honeywell Labs

Specialty Chemicals

Transportation & Power Systems

ILSA in a Nutshell

Program Objective

Develop an intelligent home automation system with situation awareness and decision-making capability based on integration of diverse sensors, devices, and appliances to support caregivers and enable elderly users to function safely at home and live independently.

Programmatics:

- A NIST advanced Technology Program
  - » High risk research program
  - » 2.5 years (Nov 00 - Apr 03)
  - » $5 million (HW 60%, NIST 40%)
- Led by Honeywell
  - » University of MN School of Nursing
  - » United Health Group EverCare
  - » Behavioral Informatics, Inc.

Benefits:

- Support elder independent living
- Provide peace-of-mind to caregivers
- Support efficient quality care for caregiving organizations
- Cost savings for government and industry
- Market growth for in-home product producers

ILSA Vision

What will ILSA look like

- An invisible network of integrated sensors, devices, and "smart" appliances
  - Sensors - motion, contact, optical, acoustic, etc.
  - Devices - thermostat, speaker, telephone, medical, etc.
  - Smart Appliances - communicating refrigerators, stoves, etc.
- No computer control center or user interface needed. Users interact with the system through existing and familiar devices like:
  - Elders
    - » Telephone, Simple browser device, Speaker, Electronic Picture Frame
  - Caregivers
    - » WebSite, Telephone, Pager, eMail, PDA

ILSA Vision

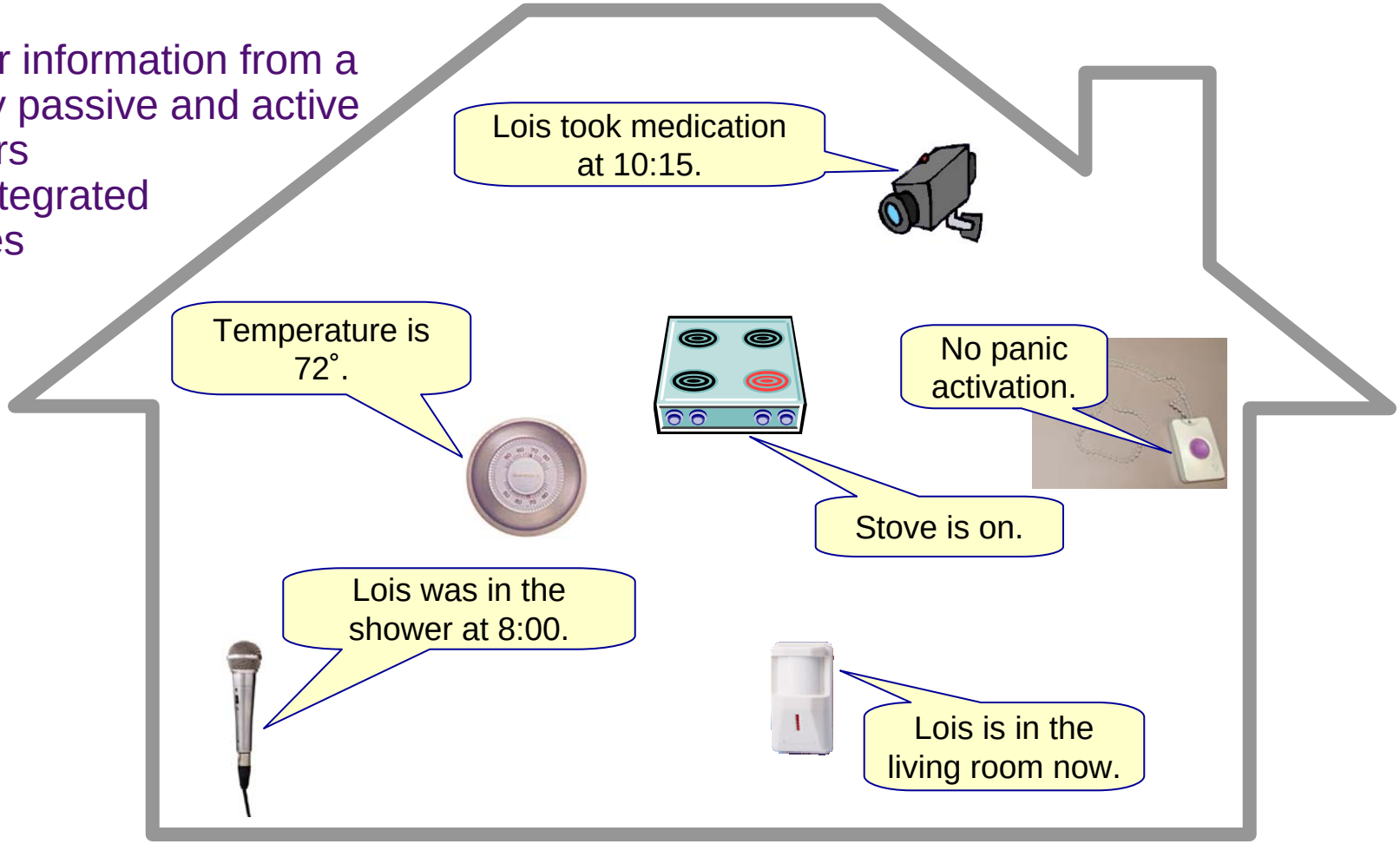
What will ILSA do

- Gather information about elder, activity, and home status by listening to the home and communicating with devices
- Assess the need for assistance based on the system's understanding the elder's condition and what activities are going on inside the home
- Respond to a given situation by providing assistance to the elder and getting help when necessary
- Share health and status information with authorized caregivers to help improve the quality and timely delivery of care

ILSA Vision

Gather Information

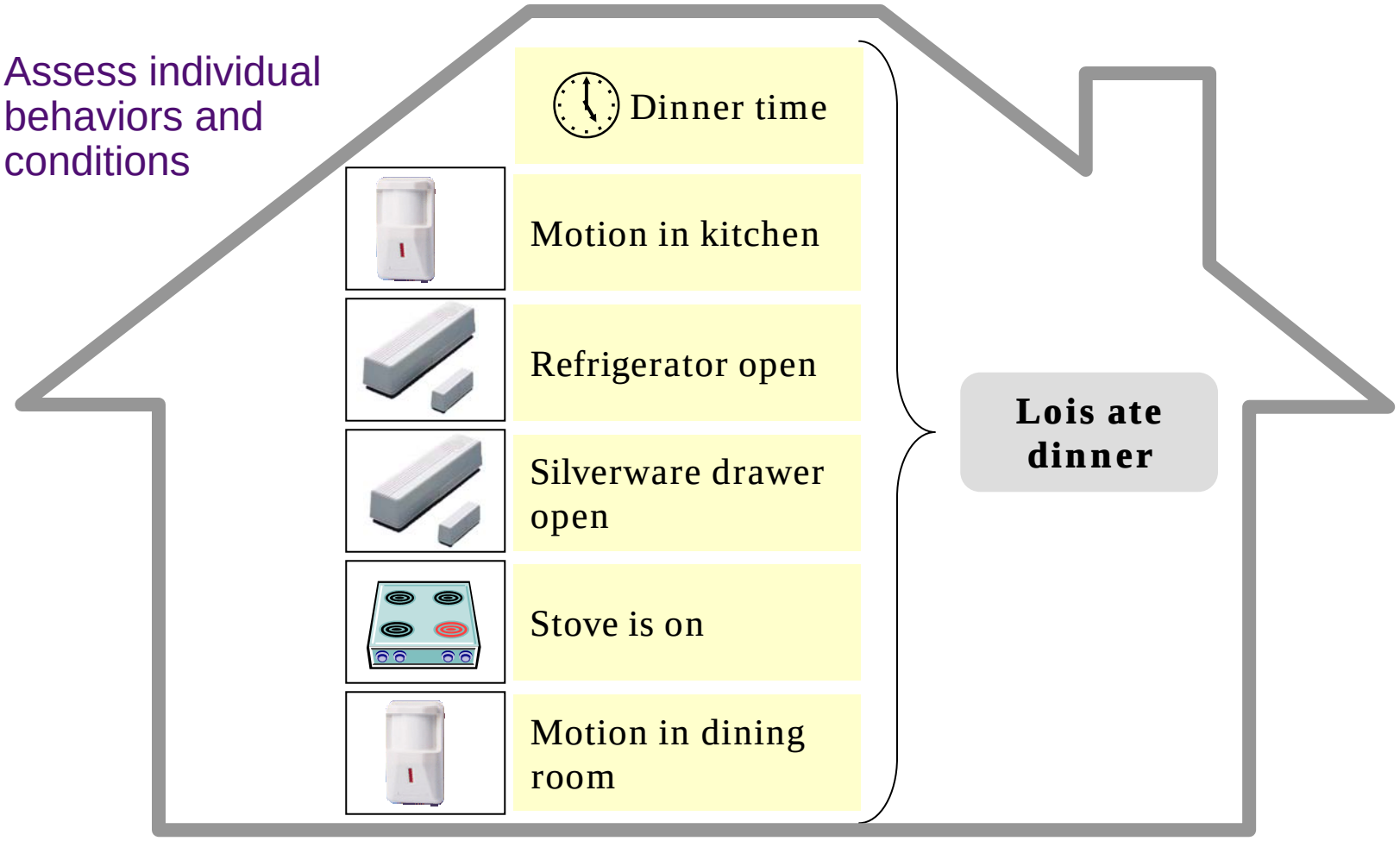
Gather information from a variety passive and active sensors and integrated devices



ILSA Vision

Assess Information

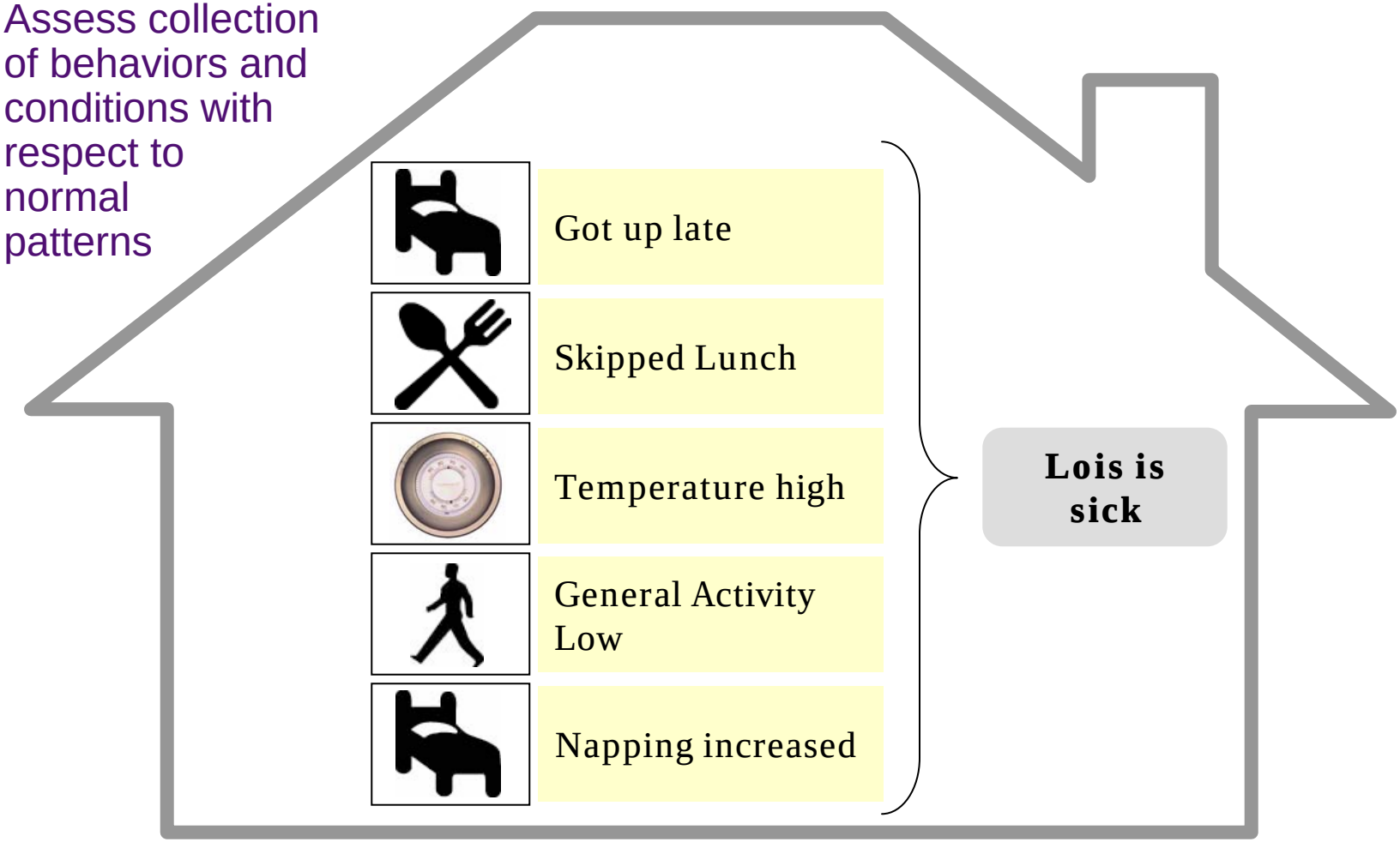
Assess individual behaviors and conditions



ILSA Vision

Assess Information

Assess collection of behaviors and conditions with respect to normal patterns



ILSA Vision

Respond to Situations

Prioritize conditions and formulate an appropriate response plan

ILSA Vision
Respond to Situations

Control situation so Lois' immediate needs are met

The Stove's been left on for 46.3 minutes!

ILSA Stove - turn yourself off.

I've fallen, and I can't get up!

Lois, are you all right? ILSA

Linda's calling.

It's time to take your medicine!

ILSA Reminders - be quiet for now.

Phone - disconnect Linda and call caregiver. I'll talk when you connect. ILSA

ILSA Vision

Share Information

Lois is doing fine.
I'll check on her again this afternoon.

Honeywell e-services Applications

Lois ate breakfast at 8:20.

Lois is fine.

It's time to take your medicine!

10:00 A.M.
Time for medicine

Mom's having a good day!

Lois is in the living room.

ILSA Vision

Example Assistance Scenarios

- Safety
  - Smoke is detected in home
    - » Alert elder and provide exit path lighting and instructions
    - » Notify caregivers and emergency personnel
- Functional Assessment
  - ADL/IADL monitoring - task completion, duration, and consistency
    - » Provide cognitive support for elder by offering reminders or task instructions
    - » Notify caregivers of changes in behavior
- Health Monitoring
  - Track vitals and ADL activity to detect and prevent health crises
    - » Query elders about how they are feeling daily
    - » Communicate with 3rd-party medical devices
    - » Share health data with caregivers to improve diagnosis and treatment

ILSA Vision

Technology Innovations

Technical challenges require innovations in:

- Home automation - Ability to centralize, automate, and/or integrate control of home functions like security, comfort, lighting, entertainment, etc.
- Situation Assessment - Ability to identify and infer specific behaviors and patterns of activity
- Machine Learning - Ability to recognize changes in patterns of behavior over time
- Adaptive Interaction Design - Ability to dynamically format content and presentation style for different devices, users, tasks, etc.
- Human-Centered Systems Design - Ability to design automated systems that match elder abilities & expectations

Program Progress

2001 Accomplishments

- Study users to identify what leads to institutionalization and what are the greatest monitoring & assistance needs
- Develop infrastructure to support hardware-software communications and speech recognition capabilities
- Develop system architecture, situation assessment capabilities, and begin learning capabilities
- Implement and test prototype systems in home settings

2002 Activities

- Address configuration and set-up issues
- Refine and enhance machine learning capabilities
- Expand system's ability to communicate with various types of sensors and devices
- Evaluate user interfaces and user interaction issues
- Evaluate overall system in field settings over extended period of time

Program Progress

Initial Functionality

Monitoring

- Intrusion detection
- Mobility (general activity level)
- Toileting
- Eating
- Sleeping
- Falls
- Verify medication taken
- Home and away
- Panic button activation
- Environmental conditions

Response

- Alarms, alerts, notifications, and reports
- Path lighting

Services

- Reminders
- To-Do lists
- Remote access to information
- Coordinate multiple caregivers
- Reduce false alarms

Usability Features

- Queries
- Operational modes (off, vacation, guests, sick...)
- Muting (cameras, reminders...)
- Password-free elder interactions

Evaluation Plans

Evaluation Areas

- **Interface & Interaction design**
  - Ease of use, organization and access to information
  - Intuitiveness, match with expectations
- **Attitudes and perceptions**
  - Trust, levels of monitoring, privacy
- **Patterns of behavior**
  - Accuracy of identification, inferences and learning from
- **System operation**
  - Integration and communication between components
  - Quality of data from various sources
  - Configuration and installation

Evaluation Methods

- **Interviews**
  - User needs, understand task, environment, and processes
- **Usability evaluations**
  - Interface and interaction design issues, some attitudes and perceptions
- **Intermediate and Long-term installations**
  - System operation, patterns of behavior, and higher-level interaction issues
- **Focus Groups**
  - Attitudes and perceptions

Evaluation Plans

Short-term

- **Usability Testing - focus on interface design**
  - Web browsers, telephones, pagers, speech systems
  - 1-2 Elder studies in 2002
  - 1-2 Caregiver studies in 2002

Intermediate

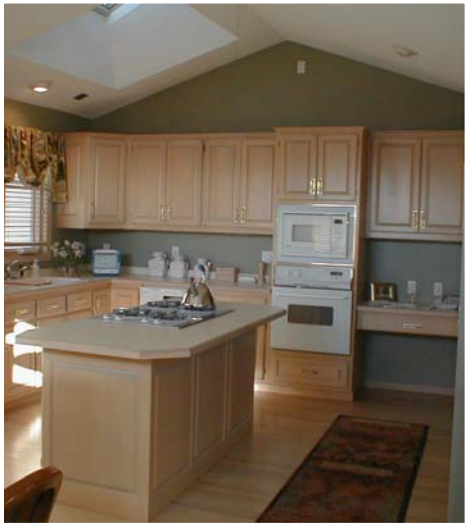
- **HW House Testing - focus on interaction design and patterns**
  - 1-2 evaluations in 2002
  - Elder understanding of system behavior
  - Usefulness of information for caregivers
  - Focus group to explore attitudes toward concept

Long-term

- **Pre-Alpha Testing - focus on data quality, pattern recognition, and device integration**
  - 4 sites
  - 1 ongoing evaluation in 2001-03
- **Field Testing - focus on patterns, interaction design, and system operation**
  - 1-3 evaluations in 2002-03
  - User understanding of system behavior, preferences, concerns
  - Accuracy of monitoring components, inferences, etc.
  - Integration of communication devices
  - Focus group to explore attitudes toward concept

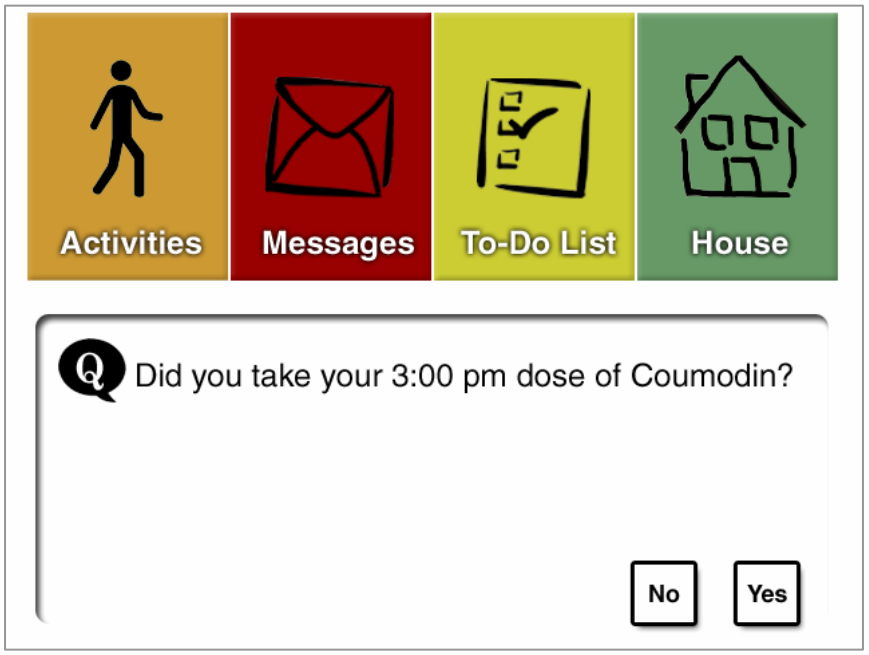
Evaluation Plans

Honeywell House Laboratory



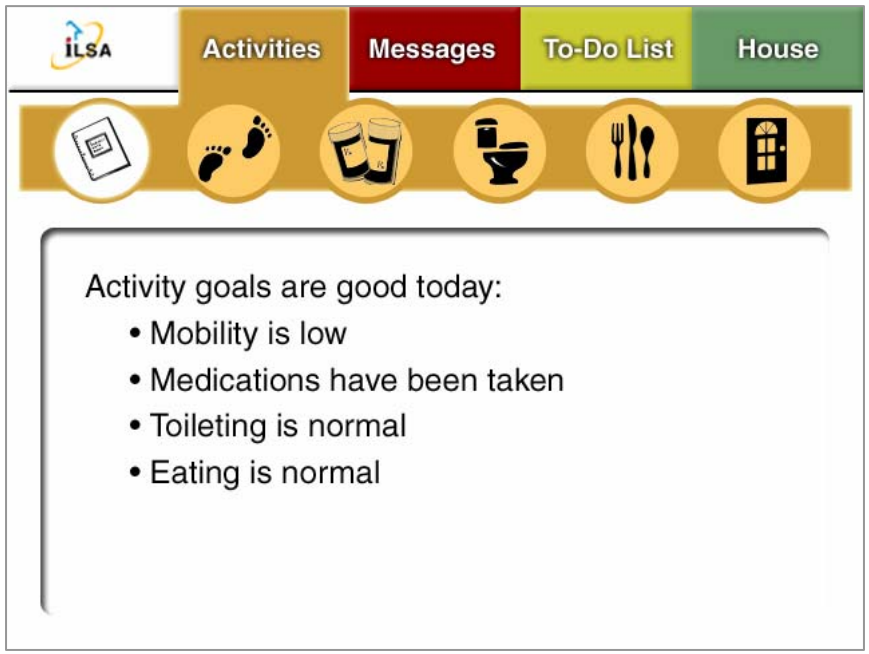
Concept Web Site

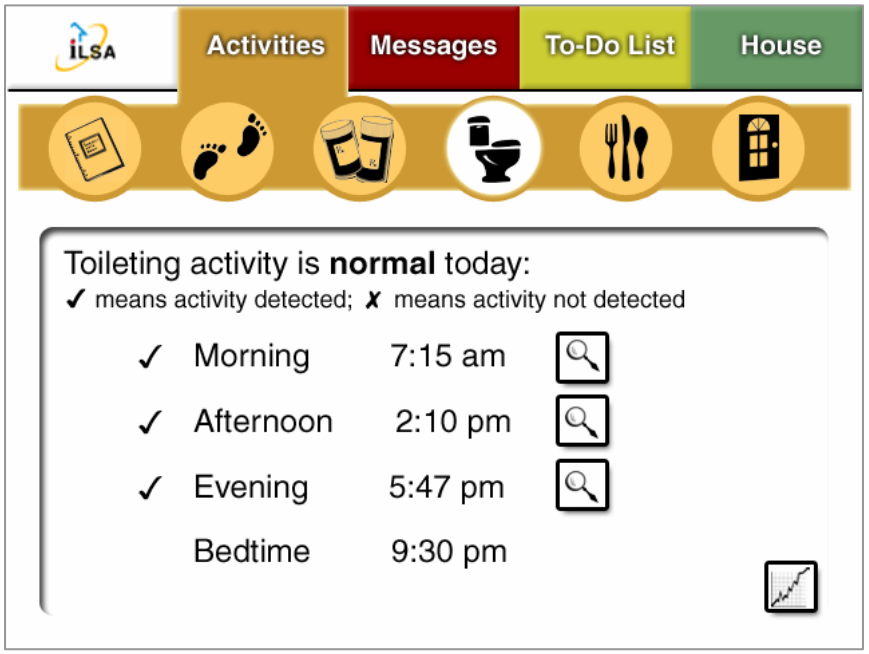
Home Page with Reminder and Query Dialogs



Concept Web Site

Activity Pages





Concept Web Site

Activity Details

Eating Details

Sensor activity associated with eating between 10:00 am and 2:00 pm. Hit **OK** when done.

OK

Lunch

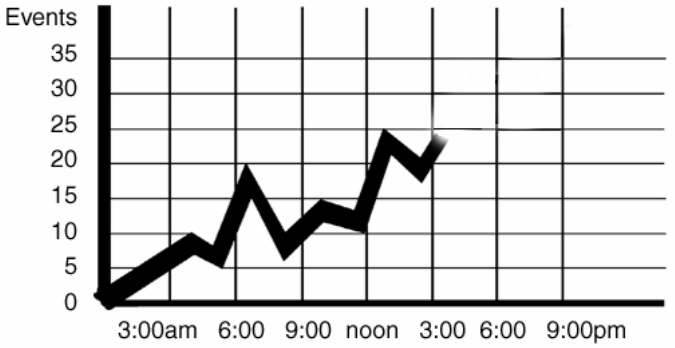
Motion in kitchen	12:05 pm
Silverware drawer open	12:09 pm
Stove on	12:15 pm
Motion in dining room	12:30 pm

Mobility Level Trends

Select desired time period to view mobility levels over time. Hit **OK** when done.

OK

Monday, January 21
Average movement for **today**: 10 events



Day

Week

Month

Year