Honeywell

Independent LifeStyle Assistant™ (I.L.S.A.):

Deployment Lessons Learned

A NIST ATP Program

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i.L.S.A.

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In a Nutshell

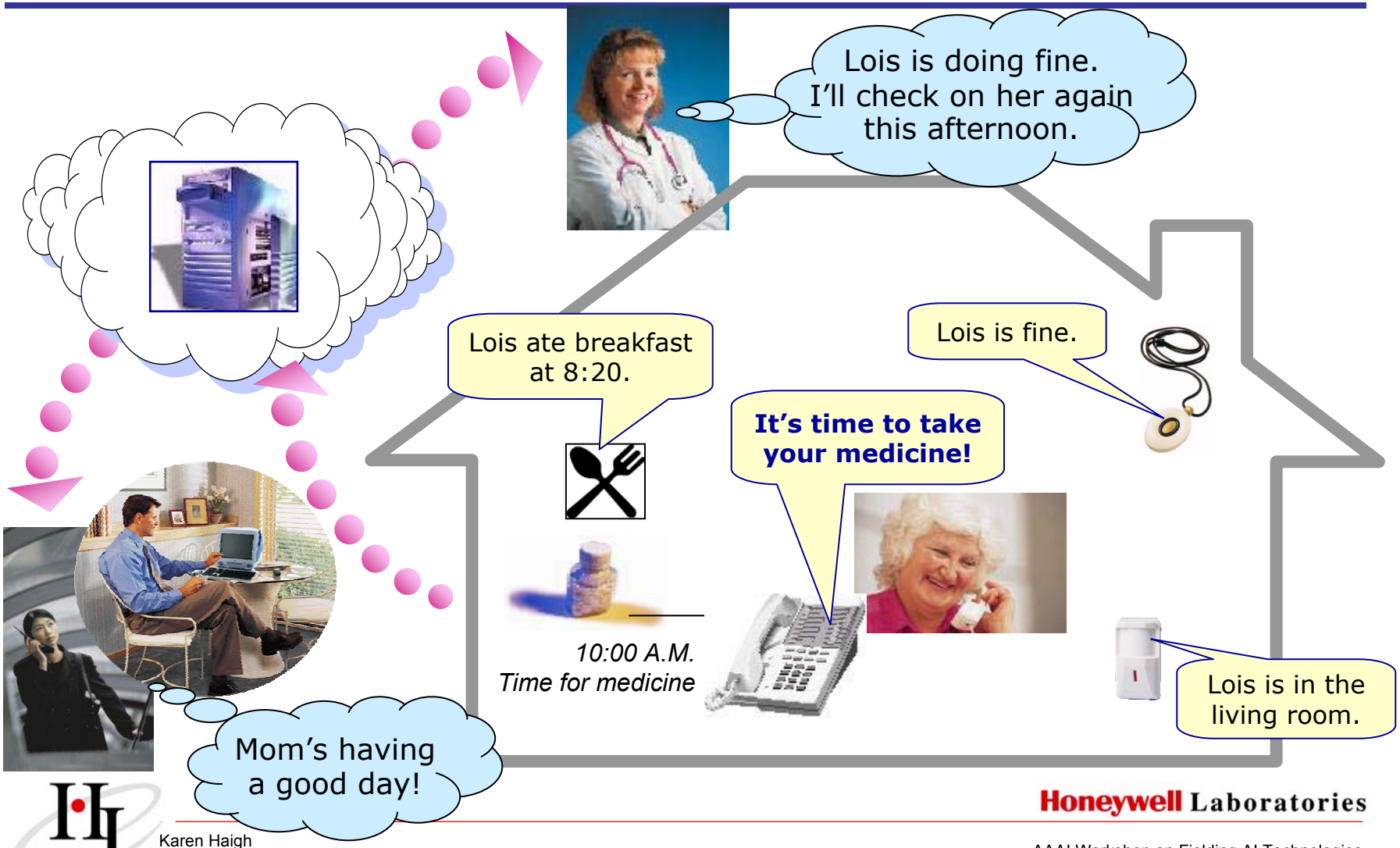
Program Objective

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 live independently at home.

Expected 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

The Vision


Lois is doing fine.
I'll check on her again
this afternoon.
Lois ate breakfast
at 8:20.
Lois is fine.
It's time to take
your medicine!
10:00 A.M.
Time for medicine
Lois is in the
living room.
Mom's having
a good day!

Factors Precipitating Institutionalization

Literature reviews, interviews with adult children caregivers, and discussions with geriatric experts identified the most significant factors that pose a threat to the independence of elders.

- **Mobility**
- **Medication Management**
- **Eating**
- **Toileting**
- **Isolation**
- **Medical Monitoring**
- **Cognitive Decline**
- **Safety**
- **Caregiver Burnout**

Existing monitoring systems often focus on a single function – little or no integration

Feature Set

Monitoring Functions
- Mobility (general activity level)
- Medication caddy monitoring

Response Functions
- Alerts
- Notifications
- Activity Reports

Service Features
- Reminders
- Internet & phone access

Usability Features
- Password-free elder interactions
- Operational modes (on/off)

User Interfaces
- Elder: Phone, webpad
- Caregiver: Web, phone

Design Philosophies:

Passive
- Allow elders to follow regular routines without imposing new ones
- No worn devices

Minimal intrusions
- Only reminders and alerts
- No requirement to use web interface for proper system behaviour

I.L.S.A. Field Study System

Client Interface
Honeywell Webpad™
anywhere in client's home

Caregiver Browser
From any internet connection

Wireless Sensors
monitor general or
specific activities

Hidden **control and communication** components

Broadband
internet

I.L.S.A. Server
Modular agent-based System

Software Architecture Requirements

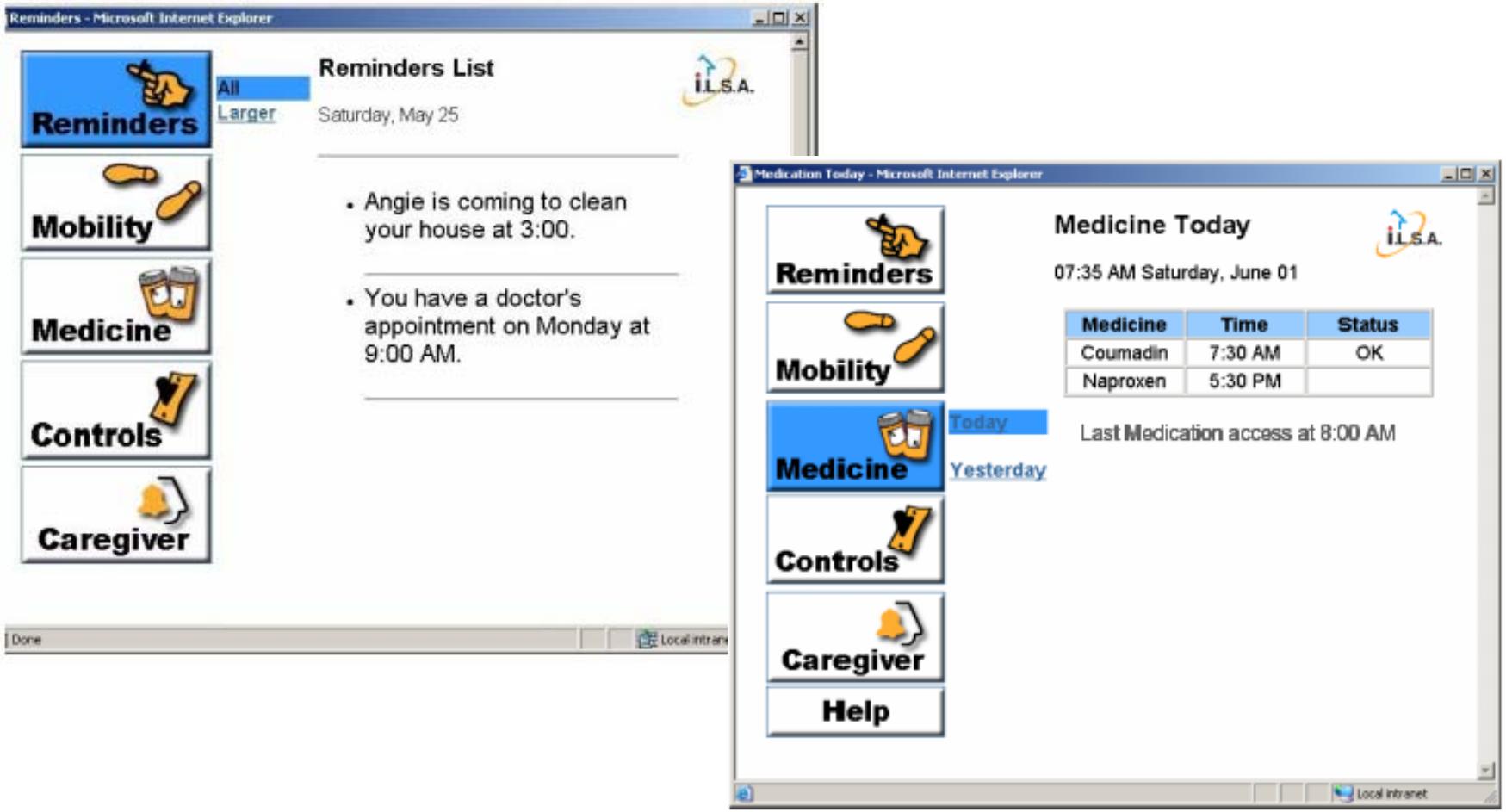
Each ILSA client and home will be very different and have specialized needs, so the system must be:

- rapidly deployable,
- easily configurable,
- highly modular, and
- adaptive to the environment.

Modularity is critical both to functionality as well as expandability for a number of reasons:

- Integrate 3rd party functional units
- Flexibility of sensor and actuator suites
- Expansion of ILSA capabilities over time

I.L.S.A. Client Interface



I.L.S.A. Agents

Agents group functionality, e.g.

- Mobility monitor
- Medication monitor
- Client interaction module
- Device controllers

Agents group technical capability, e.g.

- Machine Learning
- Task tracking
- Response Planning

Configuration

- Hardware installation is never easy
  - Wireless, broadband, and hardware all conspired to make it difficult
  - Suggestions:
    - » Broad installation base
    - » Appropriate hardware
    - » Validation tools
- Lifestyle Configuration Information
  - Much of the info is subjective, or mutable
  - Suggestions:
    - » Be objective wherever possible
    - » For subjective information, reconfigure based on actual observations
    - » Use Machine Learning to update

User Interface

Web page design

- Elders are more interested, and more capable than we expected.
  - » Numerous requests for interactive system
- Caregivers are less interested than expected. Make *really* short summaries.

Web page architecture

- Security is very important
- Make the web pages fully integrated (aka synchronized) with data

User Interface

Telephone Interface

- Hated by both elders and caregivers
  - » Cited as a reason for being compliant!
- Use other mechanisms (e.g. email, pager, web) wherever possible

Speech Recognition

- Avoid for elders.
  - » Too cognitively difficult for the elder
  - » Too difficult to understand the elder and to generate ‘intelligent’ conversations

Client Selection

Selecting Participants

- We could not gather data on system effectiveness – elders too capable
- Select elders who are *in need* of a system, not *interested*.

Obtaining Feedback

- Get regular, detailed feedback, including what worked and didn't.

Reactions to I.L.S.A.

Privacy

- The number one barrier to finding willing participants
- Initial concerns about privacy were forgotten within a day or so of installation
- Caregivers often had more significant negative reaction to privacy than the elders did
- Having access to the information shared with caregivers may have made elders feel less spied upon.
- Salesmanship is key: misunderstanding and mistrust of technology is common

Reactions to I.L.S.A.

Clients were engaged and interested

- Most clients checked their page at least once a day, even in the last month of testing

Clients did not appear to become dependent on reminders

- In fact, avoiding telephone reminders helped them exercise their memory

Clients liked the minimal disruption to their normal routine.

Summary

Involve users in system design

Deploying a real system is hard, but worth it.

AI is necessary for this domain, but don't forget the other problems you'll encounter

(AI lessons – see IAAI proceedings)