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

A NIST ATP Program

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

Lois is in the living room.

It’s time to take your medicine!

10:00 A.M. Time for medicine

Lois ate breakfast at 8:20.

Mom’s having a good day!

Lois is fine.

Mom’s having a good day!

Lois is in the living room.

It’s time to take your medicine!
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

Wireless Sensors
monitor general or specific activities

Client Interface
Honeywell Webpad™
anywhere in client’s home

Caregiver Browser
From any internet connection

Hidden control and communication components

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

- Angie is coming to clean your house at 3:00.
- You have a doctor’s appointment on Monday at 9:00 AM.

<table>
<thead>
<tr>
<th>Medicine</th>
<th>Time</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coumadin</td>
<td>7:30 AM</td>
<td>OK</td>
</tr>
<tr>
<td>Naproxen</td>
<td>5:30 PM</td>
<td></td>
</tr>
</tbody>
</table>

Last Medication access at 8:00 AM
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)