Maintaining Elder Independence: The Independent LifeStyle Assistant™
I.L.S.A.

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Honeywell
Goal:
Develop an intelligent home automation system with situation awareness and decision-making capability based on integration of diverse sensors to support enable elderly users to live independently at home and to support family caregivers.

I.L.S.A. was Co-funded by
Honeywell and
The U.S. Department of Commerce
National Institute of Standards and Technology (NIST)
Advanced Technology Program (ATP)
Program Aims

- Support elder independent living
- Provide peace of mind to caregivers
- Support efficient quality of care for caregiving organizations
- Provide cost savings for government and industry
Correlates of Elder Institutionalization

- Safety
- Dementia
- Caregiver Burnout
- Medication Management
- Medical Monitoring
- Toileting
- Mobility
- Eating
- Transportation
- Isolation
- Managing Money
Home-Care Analysis and Opportunities

- Functional Assessment and Monitoring
  - Medical, as well as physical / mental function

- Managing Information
  - Medical history accessible to all caregivers and medical professionals

- Coordinating Care
  - Address the disconnect between the medical community, professional caregivers, family caregivers, and elders

- Educating the Care Community
  - train informal caregivers to recognize signs of dementia
  - train geriatricians to better recognize environmental factors contributing to dementia, especially in behavior outside the home
  - train physicians to better communicate medication strategies
The I.L.S.A. Vision

- **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 and the elderly client to help improve the quality and timely delivery of care
ILSA tells me if things aren’t right with Mom. I don’t worry so much.

Lois is in the living room.

Lois ate breakfast at 8:20.

Lois is doing well. I don’t need to look in on her today.

Lois is safe and comfortable.

Help when she needs it.

10:00 A.M.
Time for medicine

It’s time to take your medicine!
Field test aims

- Assess design of interface and interaction
- **Assess attitudes and perceptions of elders and family caregivers**
- Assess patterns of behavior
- Evaluate system operation
- Evaluate system effects

For wider coverage of I.L.S.A. results, please visit our official website at http://www.htc.honeywell.com/projects/ilsa
Field Test Functions

Functions

- **Reminders**: Notes to help elder remember what to do today
- **Mobility**: Summary of elder activity level for each time period of the day
- **Medicine**: List of the medications elder should take and whether he or she opened the caddy at the correct time
- **Controls**: The status of I.L.S.A. in elder’s home (on/off)
- **Help**: What to do in an emergency and who to call if elder required assistance

Support

- Caregiver/family member, user guides, and technical support

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1Critical to have accurate information
2Thresholds have been established to issue alerts for these functions
What ILSA Looked Like

Control Boxes

- **Wireless base station** - Hidden in closet, talks to sensors
- **Telephone** - I.L.S.A can call elder with a message
- **WebPad** - Elder able to get information from I.L.S.A.

Sensors

- **Motion Sensors** - Sense motion in a room
- **Call Button** - Same as elder’s current call button
- **Medicine Caddy** - Tells I.L.S.A. when medications taken
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

Broadband internet

I.L.S.A. Server
Modular agent-based system
Example apartment layout with sensor locations

- Zones 11-16
  IR motion detectors
- Zone 20
  Entry Door contact switch
- Zone 21
  Hallway Pressure Mat
- Zone 10
  med caddy contact switch
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.
An alert suggested that the caregiver may want to check on the parent at his/her convenience. Caregivers were called with alerts, and saw them on the web browser.

- No Mobility for more than 5 hours during normal wakeful times
- A 50% increase or decrease in mobility (activity) from normal levels over the course of three days.
- Missed medications for a period of at least 24 hours.

NOTE: For this field test, personal emergency alarms were handled by separate equipment and providers.
Field Test Design

Longitudinal, single group repeated measures

Sites:
- Minnesota: 7 Assisted Living Apartments
- Florida: 4 Independent homes
Test Subjects

Inclusion criteria:

1. Takes one or more medications daily
2. Independent in ADLs
3. Needs assistance with one IADL
4. Has family caregiver who provides regular support
5. Family caregiver willing to participate
Field Test Measures

- Usability questionnaires-weekly, monthly
- Motion sensors
- Medication caddy sensors
- Elder health: SF-36
- Elder cognition level: MMSE
- Elder comfort with technology
- Focus groups: elders and caregivers
Demographics (Minnesota only)
n=7
Age: 83.42 (range 76-96)
Gender: 1 male, 6 female
Marital status: 6 widowed, 1 married (f)
Level of education: 4 HS, 2 College grads, 1 masters’ degree
Test Subject Demographics

<table>
<thead>
<tr>
<th>Location</th>
<th>N</th>
<th>Situation</th>
<th>Gender</th>
<th>Age</th>
</tr>
</thead>
</table>
| Minnesota    | 7  | 1 assisted apartment
6 independent apartment | 1 male,
6 female   | Ave: 83.42
Range 76-96 |
| Florida      | 4  | All in own homes                   | 1 male
3 female   | Ave: 70
Range (56-76) |

- Relatively high education, High School to PhD
- Relatively high acceptance of technology
- “Early Adoptors” who want to influence technology

Identifying willing elder/caregiver teams was more difficult than anticipated.
Test Subjects

Comfort with technology:
40.29 (range 37-45)

Mobility
• One uses wheelchair for long distances, walker in apt.
• Others very active; all but two still drive

Med Adherence:
• One has meds set up
• Others set up own weekly
• Number of meds range from 1-16 per day
Test Subjects

- Elders are living independently
- All were physically active
- All were “healthy” with at least one chronic illness
- All were comfortable with remotes, programmable appliances
- Five had some computer literacy-wide variation in abilities
Caregiver Profile

• I.L.S.A. test subjects required to have at least one family caregiver
• Total of 17 caregivers registered for 11 clients
  ■ 8 Men, 9 Women
  ■ Access to web was a criteria for our test
• Professional caregivers were not targeted in this study
SF-36

Short Form-36 (SF-36)

Physical Health
  Physical functioning
  Role-physical
  Bodily pain
  General health

Mental Health
  Vitality
  Social functioning
  Role-emotional
  Mental health
## Field Test Results: SF-36

<table>
<thead>
<tr>
<th>SF 36 FACTORS</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Function</td>
<td>62.9 (21.6)</td>
<td>59.3 (22.9)</td>
<td>50.7 (20.3)</td>
<td>.38</td>
</tr>
<tr>
<td>Role-Physical</td>
<td>53.6 (44.3)</td>
<td>53.6 (36.6)</td>
<td>57.1 (34.5)</td>
<td>.97</td>
</tr>
<tr>
<td>Pain</td>
<td>76.8 (25.4)</td>
<td>84.9 (19.2)</td>
<td>72.3 (27.8)</td>
<td>.51</td>
</tr>
<tr>
<td>General Health</td>
<td>71.6 (35.9)</td>
<td>66.9 (21.0)</td>
<td>65.9 (23.8)</td>
<td>.76</td>
</tr>
</tbody>
</table>

(Standard Deviation)
## Field Test Results: SF-36

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<th>T3</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitality</td>
<td>52.9 (24.8)</td>
<td>58.6 (20.3)</td>
<td>49.3 (15.4)</td>
<td>.29</td>
</tr>
<tr>
<td>Social Function</td>
<td>87.5 (17.7)</td>
<td>91.1 (15.7)</td>
<td>75.0 (22.8)</td>
<td>.21</td>
</tr>
<tr>
<td>Role-Emotional</td>
<td>83.3 (27.9)</td>
<td>90.5 (25.2)</td>
<td>76.2 (46.0)</td>
<td>.75</td>
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<tr>
<td>Mental Health</td>
<td>82.9 (11.9)</td>
<td>86.9 (6.8)</td>
<td>76.6 (14.7)</td>
<td>.09</td>
</tr>
</tbody>
</table>

(Standard Deviation)
Mini Mental Results

Mini Mental Status Exam Results

<table>
<thead>
<tr>
<th>T1</th>
<th>T2</th>
<th>T3</th>
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</thead>
<tbody>
<tr>
<td>27.6</td>
<td>27.8</td>
<td>28</td>
</tr>
<tr>
<td>28</td>
<td>28.2</td>
<td>28.4</td>
</tr>
</tbody>
</table>

Line 1
## Correlations

<p>| | | | |</p>
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<tbody>
<tr>
<td>Age with general health</td>
<td>.245</td>
<td>.487</td>
<td>.721</td>
</tr>
<tr>
<td>Age with pain (p=.023)</td>
<td></td>
<td></td>
<td>.823</td>
</tr>
<tr>
<td>Gender (f) with PF</td>
<td>-.618</td>
<td>-.612</td>
<td>-.618</td>
</tr>
<tr>
<td>Gender (f) with MMSE</td>
<td>.683</td>
<td>.642</td>
<td>.642</td>
</tr>
<tr>
<td>Comfort with MH</td>
<td>-.430</td>
<td>-.731</td>
<td>-.542</td>
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</tbody>
</table>
Client Feedback

- Enjoyed interactivity—desired more
- Disliked telephone reminders—tried to “beat the system”
- Able to tolerate multiple devices
- Liked medication caddies
- Challenged by ILSA
- Greatest fear is falling, then safety
Conclusion

Our experience with I.L.S.A. highlighted topics for further study:

- System interaction concepts for elderly users
- Further study of machine learning algorithms in this domain
- Revised models of activity monitoring and sensor selection/placement
- Reminder behavior and adaptability
- Market questions: how to overcome barriers to acceptance of “invasive” technologies
Acknowledgements

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- Honeywell ACS Labs thanks LifeLine Systems, Inc. for providing emergency personal response coverage for the Florida-based clients.
Thank You for sharing your time with us.

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www.honeywell.com

http://www.htc.honeywell.com/projects/ilsa