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

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I.L.S.A. Program

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)

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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

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Correlates of Elder Institutionalization

- **Safety**
- **Dementia**
- **Caregiver Burnout**
- **Medication Management**
- **Medical Monitoring**

- **Toileting**
- **Mobility**
- **Eating**
- **Transportation**
- **Isolation**
- **Managing Money**

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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

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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

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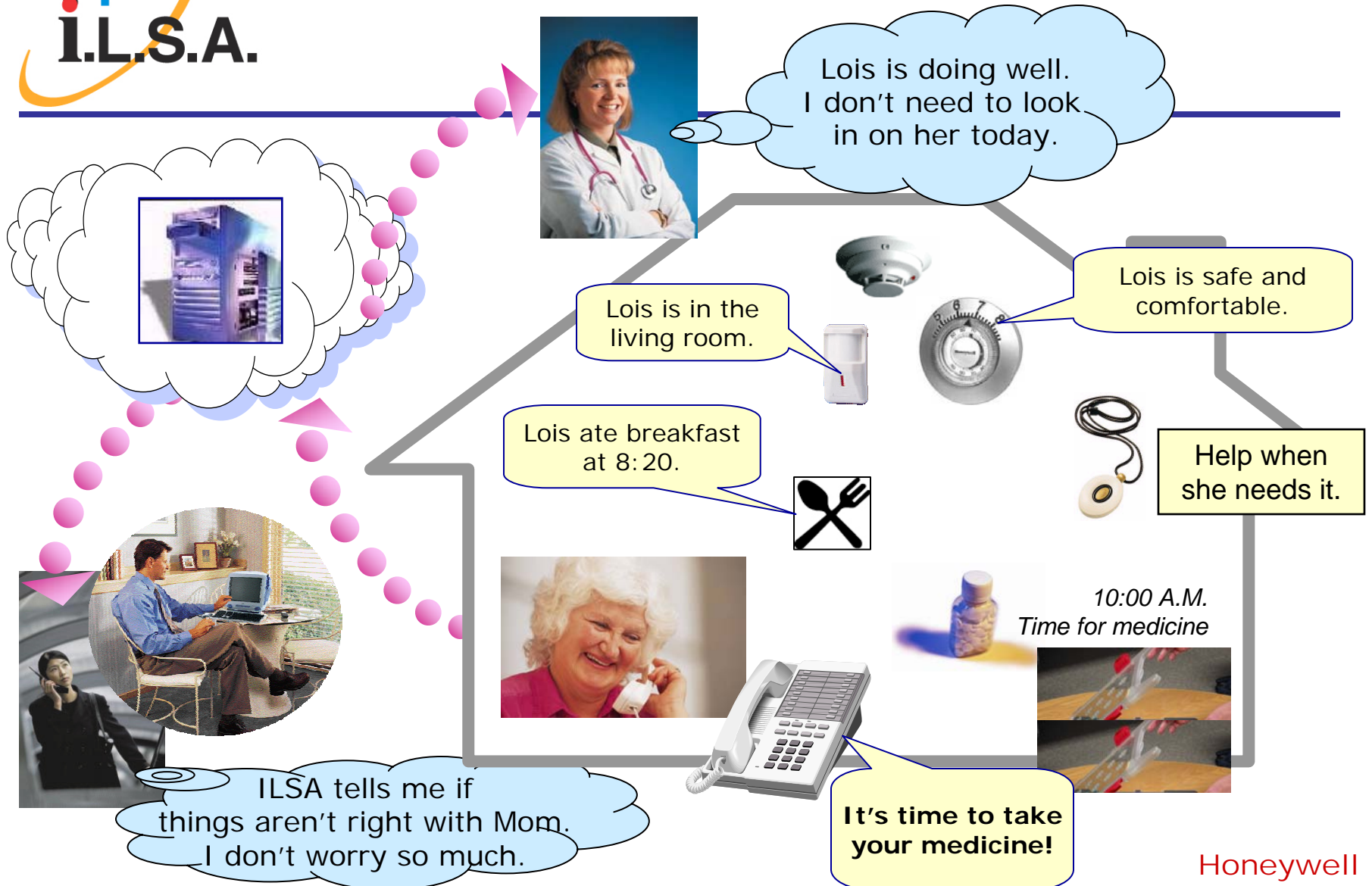
Field test aims

- 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

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Field Test Functions

Functions[1]

- **Reminders:** Notes to help elder remember what to do today
- **Mobility[2]:** Summary of elder activity level for each time period of the day
- **Medicine[2]:** 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**

[1]*Critical to have accurate information*
[2]*Thresholds have been established to issue alerts for these functions*

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What ILSA Looked Like

Control Boxes

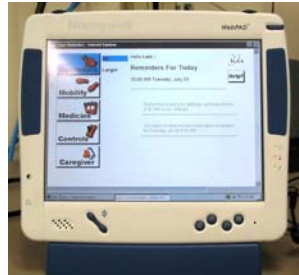- Wireless base station - Hidden in closet, talks to sensors
- Telephone - I.L.S.A can call elder with a message
- WebPad - Elder able to get information from I.L.S.A.

Sensors

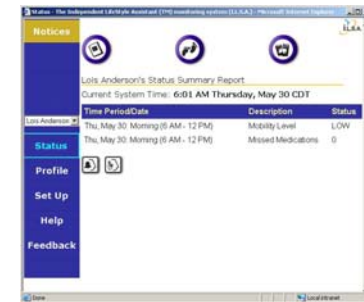- Motion Sensors - Sense motion in a room
- Call Button - Same as elder's current call button
- Medicine Caddy - Tells I.L.S.A. when medications taken

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I.L.S.A. System

Client Interface
Honeywell Webpad™
anywhere in client's home

Wireless Sensors
monitor general or
specific activities

Caregiver Browser
From any internet connection

Broadband
internet

Hidden **control and
communication** components

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

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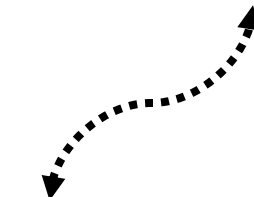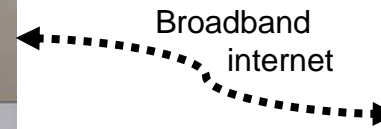
Installation

Example apartment layout with sensor locations
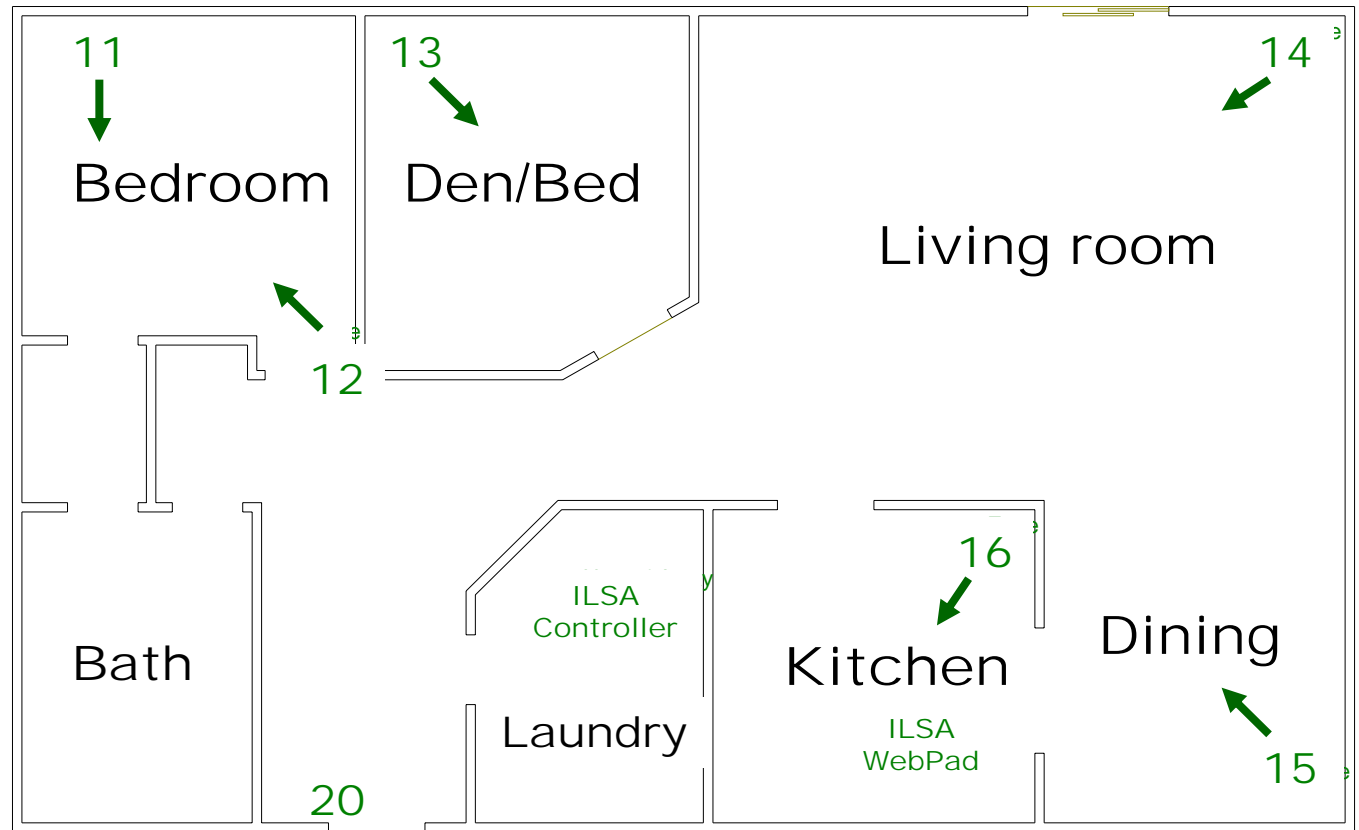
- Zones 11-16 IR motion detectors

- Zone 20 Entry Door contact switch

- Zone 21 Hallway Pressure Mat

- Zone 10 med caddy contact switch

11

13

14

Bedroom

Den/Bed

Living room

12

ILSA Controller

16

Bath

Kitchen

Dining

Laundry

ILSA WebPad

15

20

21

I.L.S.A. Client Interface

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Messages/Alerts

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.

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Field Test Design

Longitudinal, single group repeated measures

Sites:

- **Minnesota: 7 Assisted Living Apartments**
- **Florida: 4 Independent homes**

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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

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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

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Demographics

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

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Test Subject Demographics

Location	N	Situation	Gender	Age
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

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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

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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

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Scores

Field Test Results: SF-36

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

(Standard Deviation)

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Scores

Field Test Results: SF-36

SF 36 FACTORS	T1	T2	T3	p
Vitality	52.9 (24.8)	58.6 (20.3)	49.3 (15.4)	.29
Social Function	87.5 (17.7)	91.1 (15.7)	75.0 (22.8)	.21
Role-Emotional	83.3 (27.9)	90.5 (25.2)	76.2 (46.0)	.75
Mental Health	82.9 (11.9)	86.9 (6.8)	76.6 (14.7)	.09

(Standard Deviation)

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Mini Mental Results

Mini Mental Status Exam Results
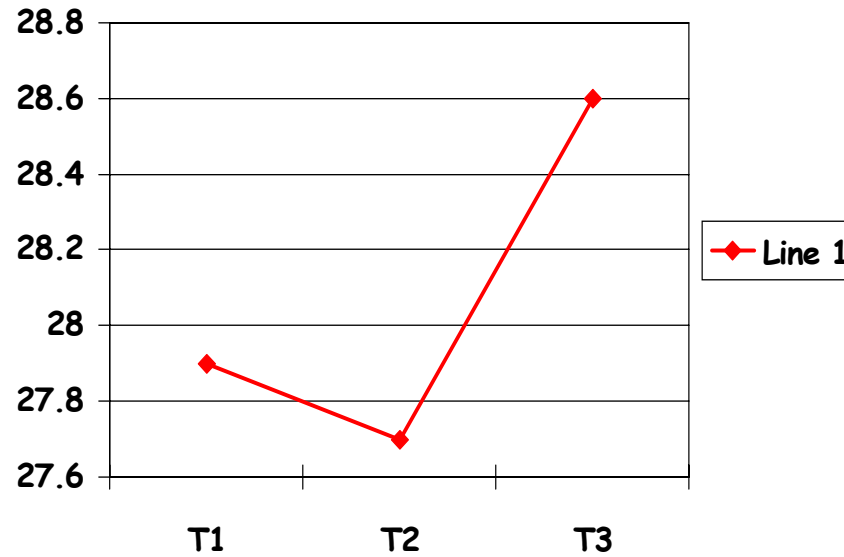
Correlations

Age with general health	.245	.487	.721
Age with pain (p=.023)			.823
Gender (f)with PF	-.618	-.612	-.618
Gender (f) with MMSE	.683	.642	.642
Comfort with MH	-.430	-.731	-.542

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

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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

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Thank You for sharing your time with us.

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