



Ambient Intelligence Applications in Healthcare

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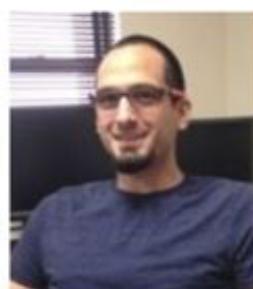
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Outline

- Our Research Group
- Ambient Intelligence
- Ambient Intelligence in Senior Healthcare
- *Always Near*

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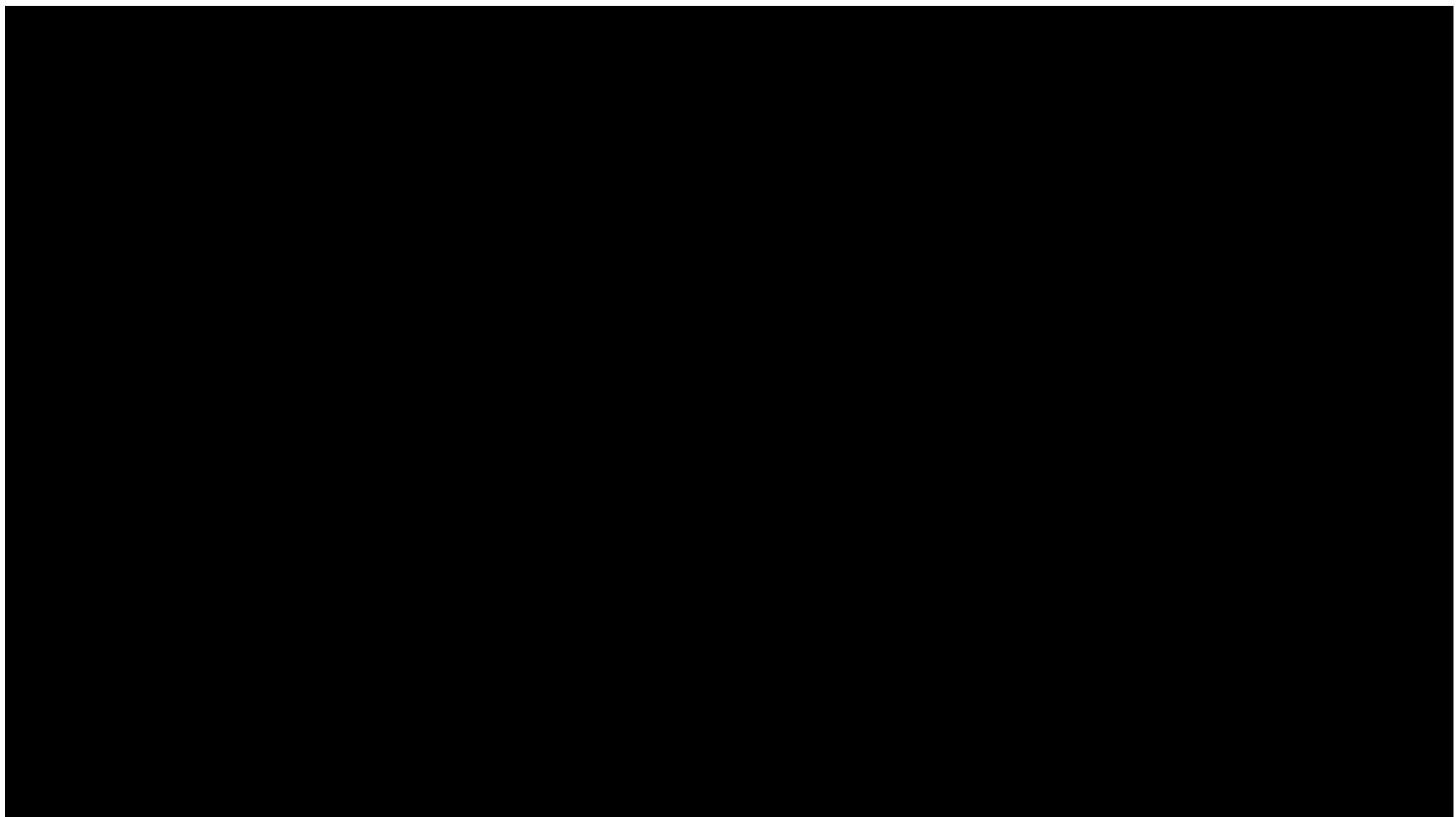


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Our Research



<http://bit.ly/tech-helps-indep-seniors>

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Ambient Intelligence

In Healthcare

Ambient Intelligence

Integrates

- Ubiquitous (pervasive) computing
- Smart environments
- Artificial intelligence and machine learning

Aarts (2004)

- *Environments that are sensitive and responsive to the presence of people*
- *Improve quality of life [with] intelligent, personalized, interconnected systems and services*
- *Ambient, distributed, ubiquitous, transparent, intelligent*

5 Key Features

Embedded	Many networked devices
Context aware	Recognitions of situational context
Personalized	Learns users' needs and habits
Adaptive	Changes in response to user behavior
Anticipatory	Anticipates actions and needs

Aarts (2004)

Aml System Process



Aztiria, Izaguirre, Augusto (2010)

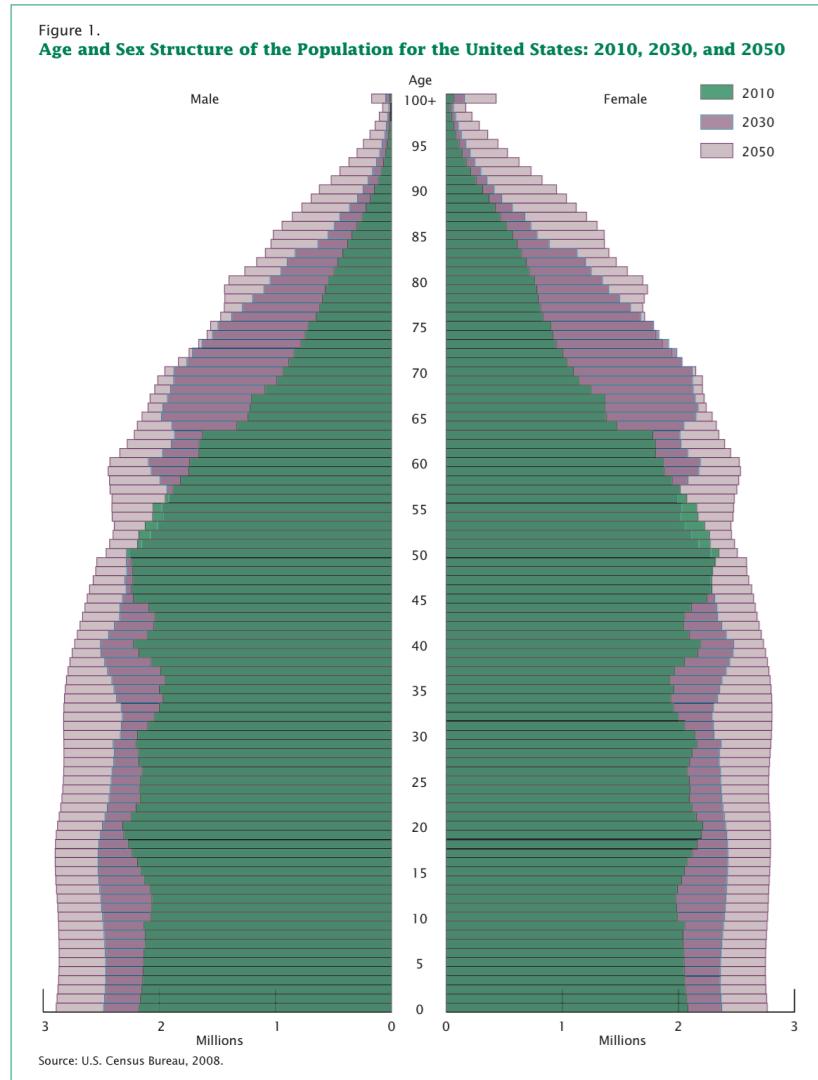
Ambient Intelligence

In Senior Healthcare

Ambient Assisted Living

- Ambient Assisted Living
 - *Ambient Intelligence + Assisted Living*
- Generontechnology
 - *Generontology + Technology*
- In essence, assisted living technologies for older adults

A Growing and aging population...

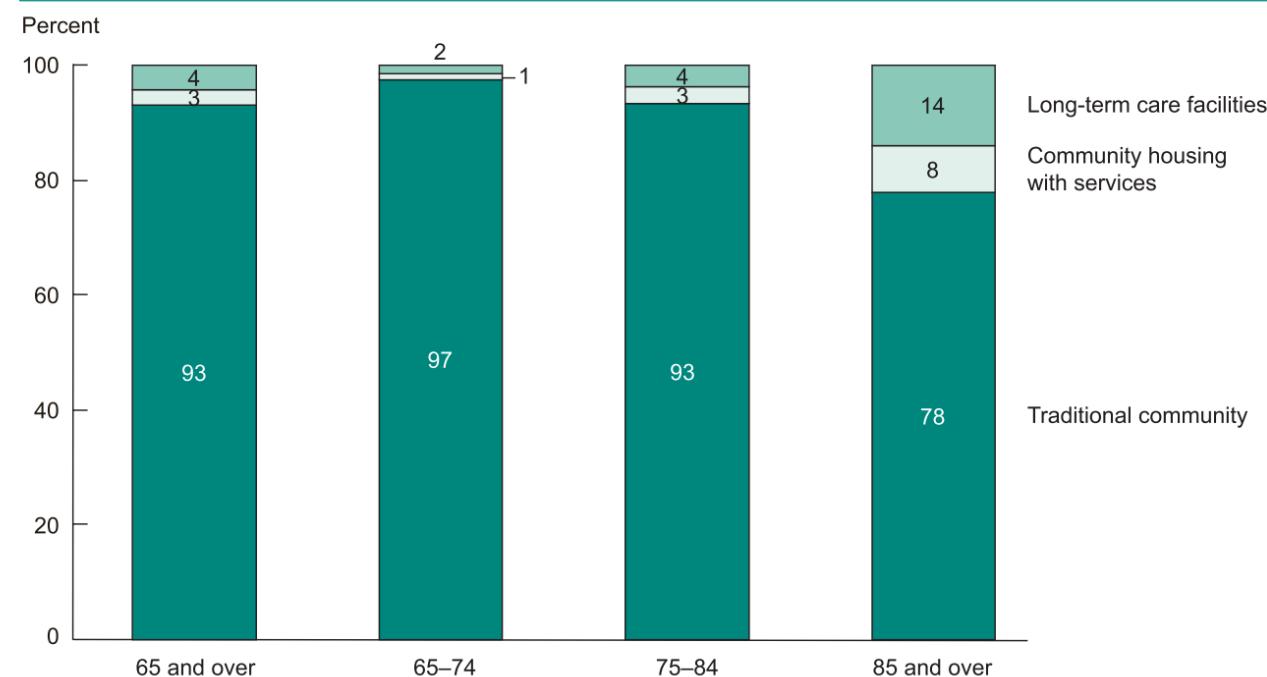


- By 2030
 - 1 in 5 Americans will be 65+
- By 2050
 - 1 in 5 in the world will be 60+
 - 88.5M Americans 65+, double from 2010
- Dependency
 - 22% in 2010 to 36% in 2050

U.S. Census Bureau, 2010.

Living independently...

Percentage of Medicare enrollees age 65 and over in selected residential settings, by age group, 2009



NOTE: Community housing with services applies to respondents who reported they lived in retirement communities or apartments, senior citizen housing, continuing care retirement facilities, assisted living facilities, staged living communities, board and care facilities/homes, and similar situations, AND who reported they had access to one or more of the following services through their place of residence: meal preparation; cleaning or housekeeping services; laundry services; help with medications. Respondents were asked about access to these services, but not whether they actually used the services. A residence (or unit) is considered a long-term care facility if it is certified by Medicare or Medicaid; or has 3 or more beds, is licensed as a nursing home or other long-term care facility, and provides at least one personal care service; or provides 24-hour, 7-day-a-week supervision by a non-family, paid caregiver.

Reference population: These data refer to Medicare beneficiaries.

SOURCE: Centers for Medicare and Medicaid Services, Medicare Current Beneficiary Survey.

U.S. Census Bureau (2010)

With chronic & age-related disease

- 8.5 million seniors require some form of assistive care
- 80% of older adults live with at least one chronic disease
- Care for elderly has significant costs
 - Nursing home care costs: \$70,000 to \$80,000 annually
 - Significant costs to informal caregivers: family and relatives
- Insufficient professional caregivers and facilities for the coming “age wave”

Challenges for Older Adults

- Age-related challenges
 - Physical limitations
 - Perceptual
 - Cognitive
- Chronic age-related diseases
 - Alzheimer's Disease, Dementia
 - Arthritis
 - Hypertension
 - Cardiovascular disease
 - Diabetes

Role of AAL for Older Adults

- Continuous health monitoring
- Emergency detection
- Cognitive orthotics
- Persuasive applications
- Therapy
- Emotional well-being

Role of AAL for Older Adults

Continuous health monitoring

- ADL monitoring
- Vital signs
- Sleep monitoring
- Communicate with caregivers, doctors, families
- Guide behavior and compliance
- Early warning

Emergency detection

- Fall detection
- Medical emergency
- Hazard/critical situations

Role of AAL for Older Adults

Cognitive orthotics

- Daily reminders
- Medication reminders
- Navigation
- Wandering prevention
- Planning

Persuasive applications

- Well-being promotion
- Medical compliance

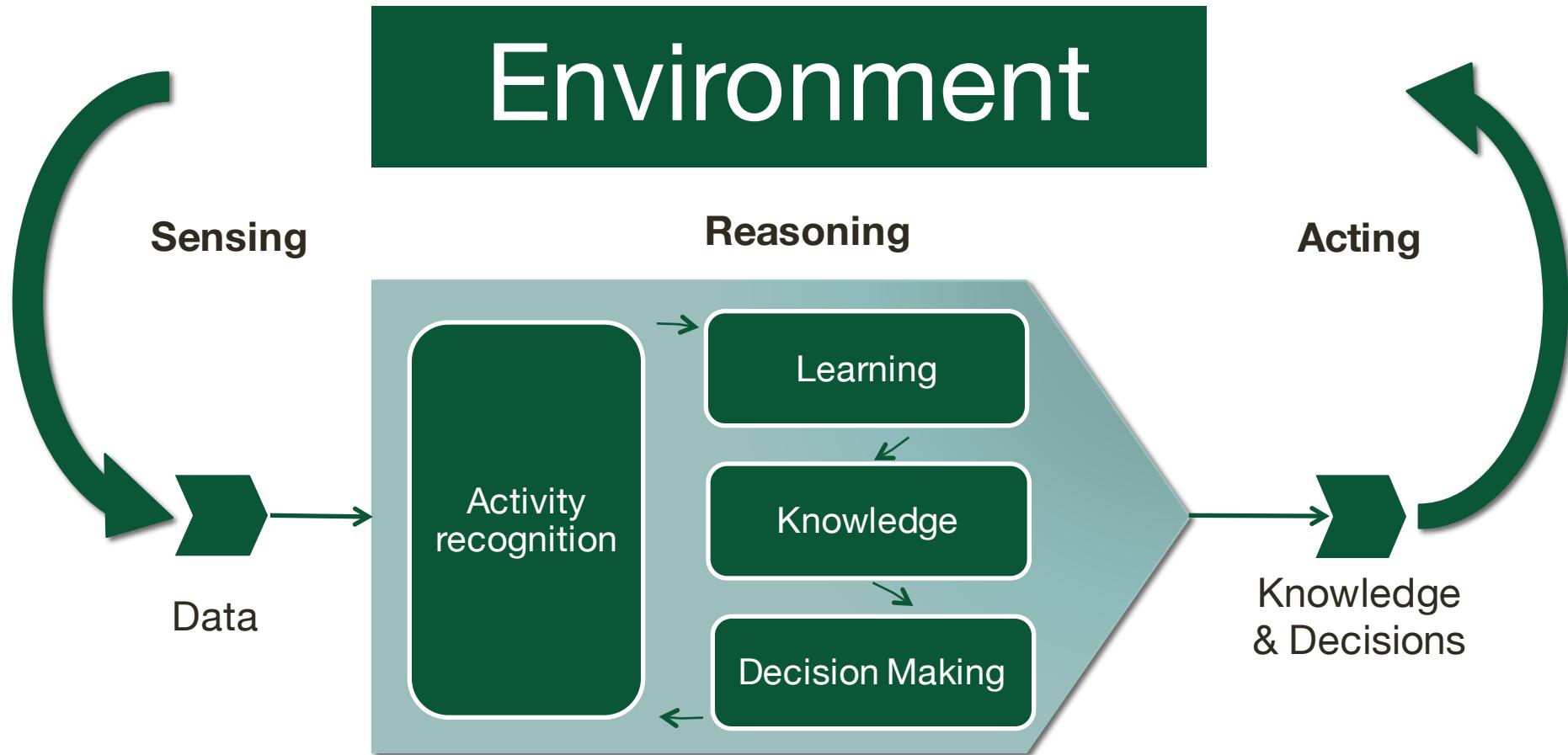
Therapy

- Tele-health/rehabilitation

Emotional well-being

- Social connectedness
- Communication facilitation

Aml System Process



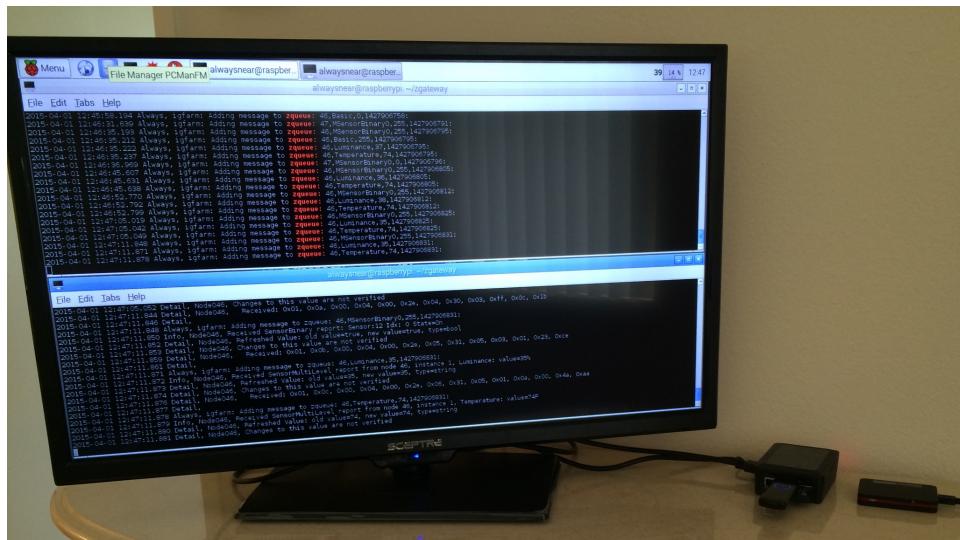
Aztiria, Izaguirre, Augusto (2010)

Always Near

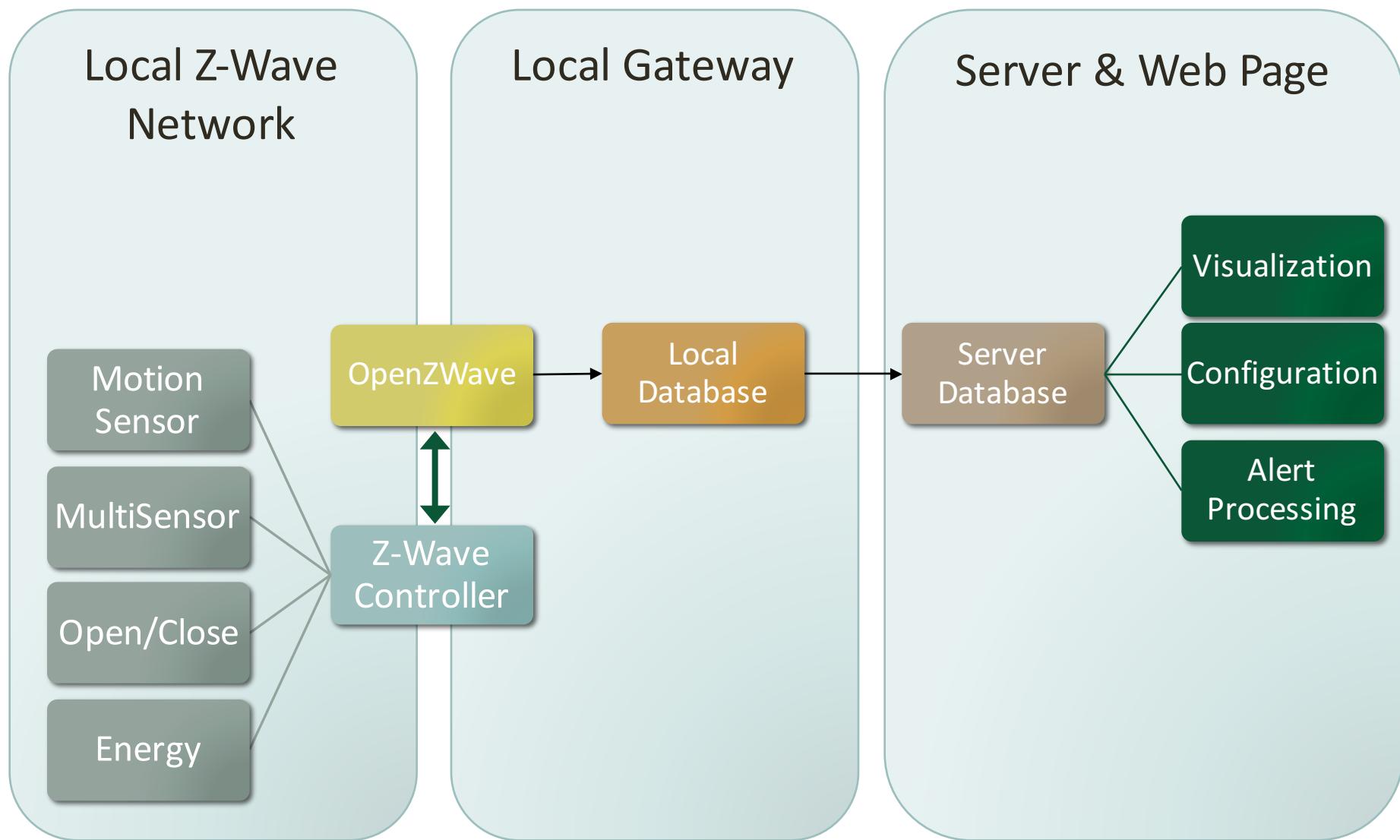
The Always Near System

- Integrated ambient sensors for in-home monitoring with case management and community-based alert response
- Sensors
 - Presence, motion, contact, pressure, medication usage, panic button
- Web-based dashboard for monitoring by care managers and caregivers

In-Home Passive Sensing



System Architecture





Always Near

Status Contacts Reminders Notifications Sensors Users Logoff

Daily Activity For Thursday April 2, 2015

[← Previous Day](#) [→ Next Day](#) [Today](#) [Back to Weekly Activity Summary](#)





Always Near

Status	Contacts	Reminders	Notifications	Sensors	Users	Logoff
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Daily Activity For Friday April 3, 2015

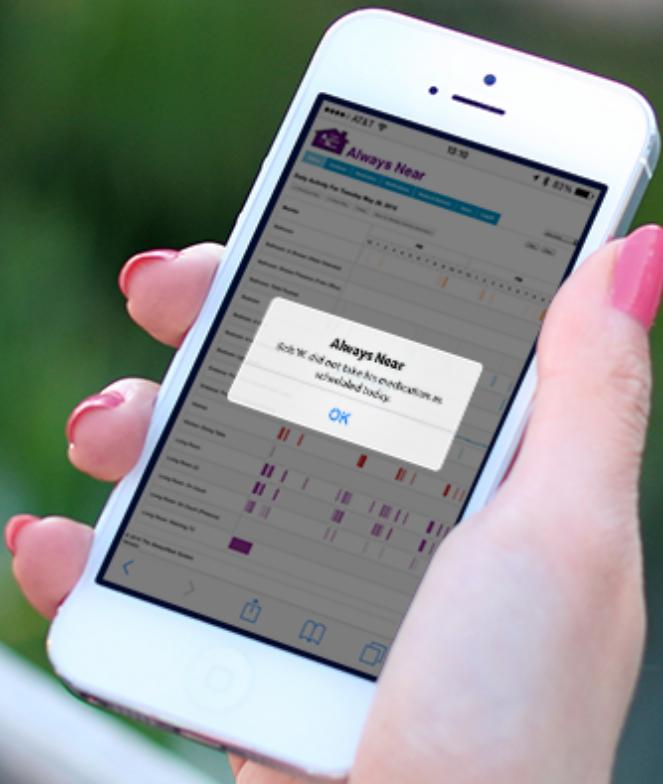
 Previous Day

→ Next Day

Today

[Back to Weekly Activity Summary](#)

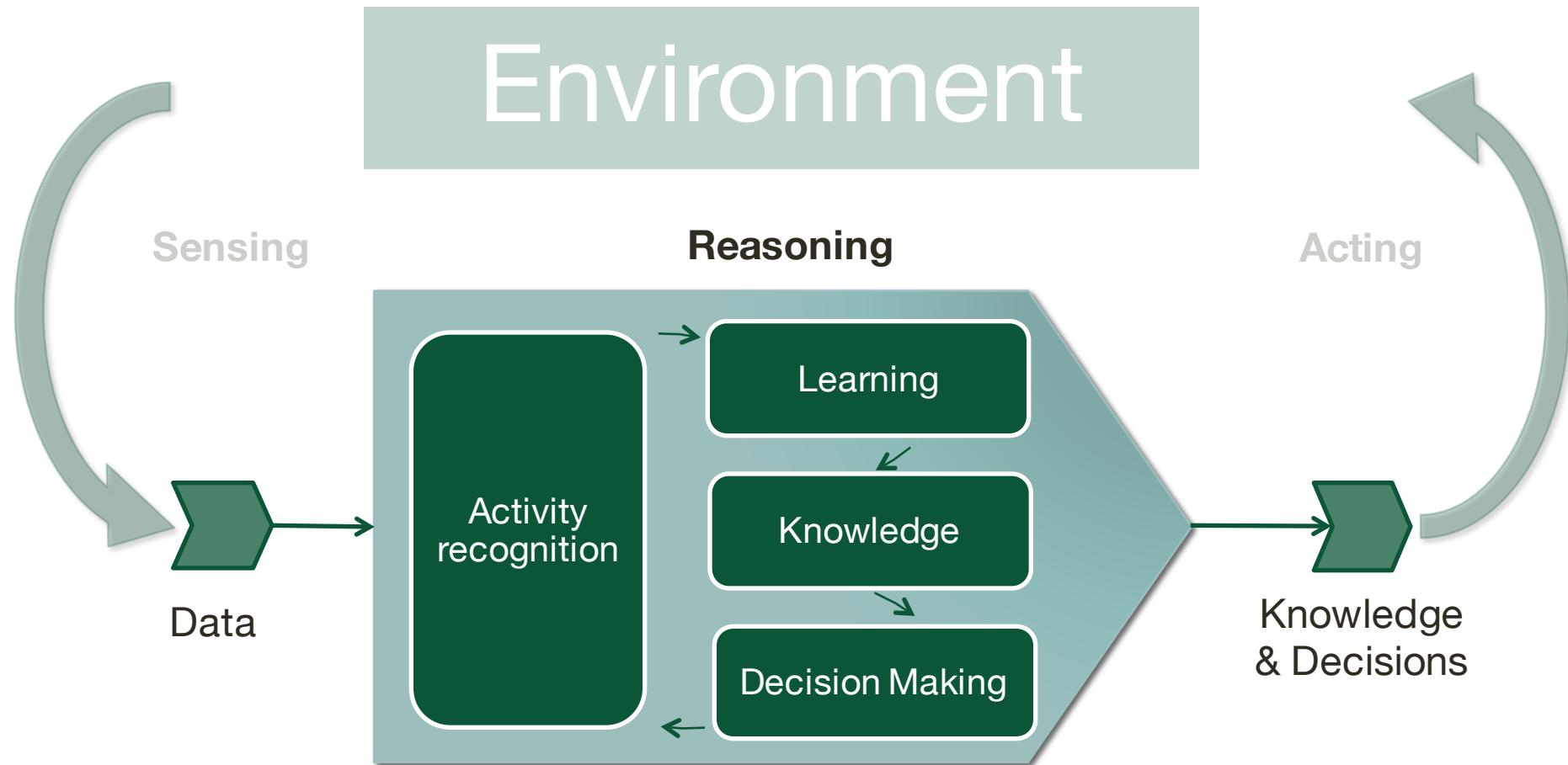




The Always Near Project

- **Phase 1:** Living Lab Validation
- **Phase 2:** Community Validation & Data Collection
 - Anticipated 60 older adults
 - 6 month participation period
- **Goal:** develop predictive and pattern mining models to detect changes in activity, sleep and medication compliance for early detection of adverse health conditions
- *Sensor-Based, Response-Oriented Technology for In-Home Monitoring of Senior Health & Well Being*

Future work: data-driven decision making



Aztiria, Izaguirre, Augusto (2010)

Thank you
Questions?

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Always Near
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