



Activity Recognition Enhancement based on Groundtruth

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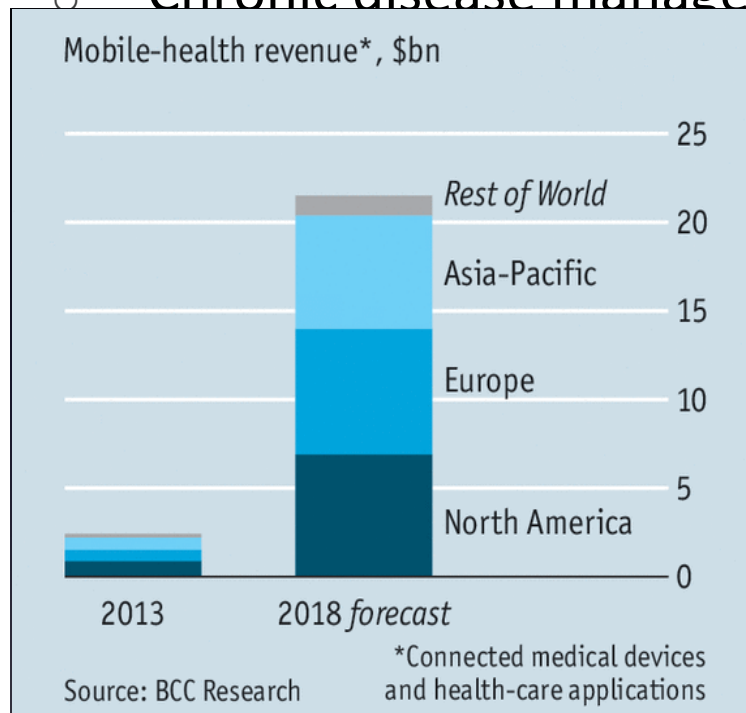
17-18 October, 2016



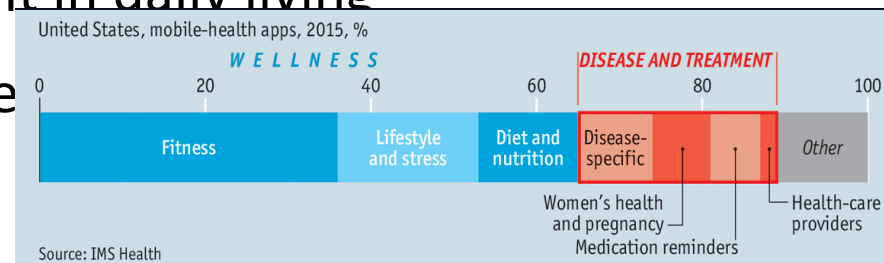
PROBLEMATIC

Imminent crisis in healthcare

Chronic disease management in daily living



give





RESEARCH STRATEGY

❑ Research strategy

- Leveraging on ICT and development of IoT to propose innovative services
- Consider the city as an extension of living space for smart mobility and social inclusion
- Focus on 2 different major health issues related to wellbeing: Diabetes (T2D) and Respiratory chronic diseases

❑ Pilot site oriented research

- Khoo Tech Puat Hospital
- ³ ○ Touch (Senior Activity Centre)



HORIZON 2020

WORLDWIDE DEPLOYMENT

City4age approach will be deployed and validated in 6 different pilot sites:

Athens (GR)

Social interactions through community centers

Birmingham (UK)

Public E-services and digital technologies

Lecce (IT)

Daily activities in Public social areas

Madrid (ES)

Mobility in the city and public transport

Montpellier (FR)

Indoor/outdoor assistive services for ageing well

Singapore (SG)

Social activity and engaged community within the HDB

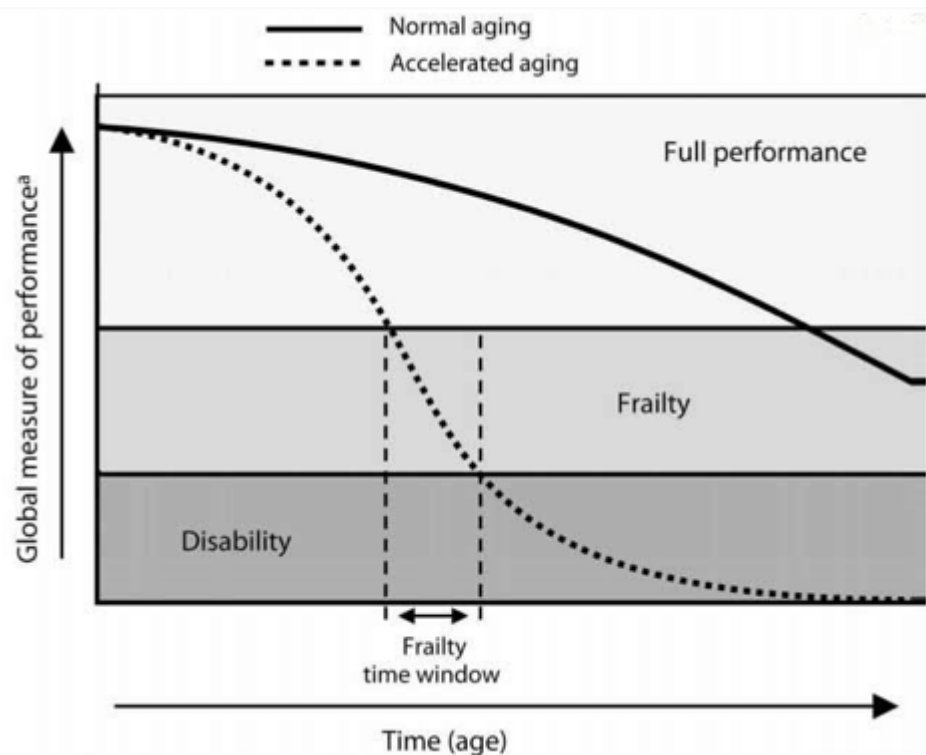




OUR APPROACH

Detect early signs of frailty

THROUGH SOCIALIZATION – MOBILITY - ADL



- **Socialization:** places of interest visits, senior activity center visits frequency, activities attended, shopping patterns
- **Mobility:** going-out frequency and going-out length, speed rate, walking steps, walking patterns, falls
- **Activity of Daily Living :** active/inactive periods/day

Local Partner



LOCAL CONTEXT

HDB neighbourhood and local facilities



Local Partner



EVALUATION SURVEY

Senior Activity Center

28 elders (22 active, 6 homebound)

11 young volunteers for 2 interview sessions

~74 years old



Local Partner



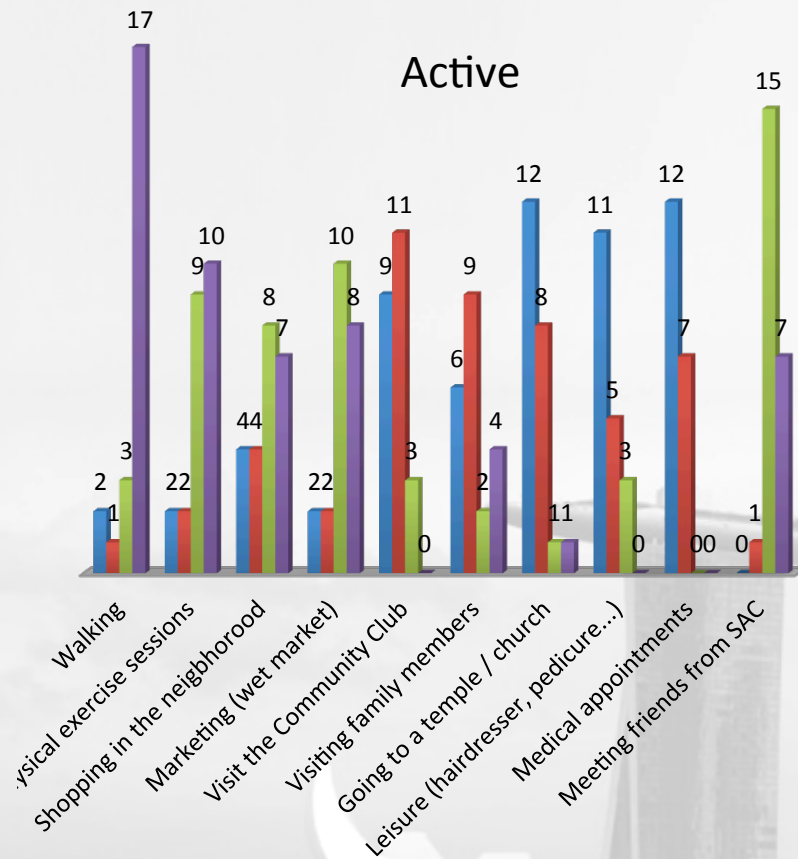
EVALUATION SURVEY

Outdoor activities

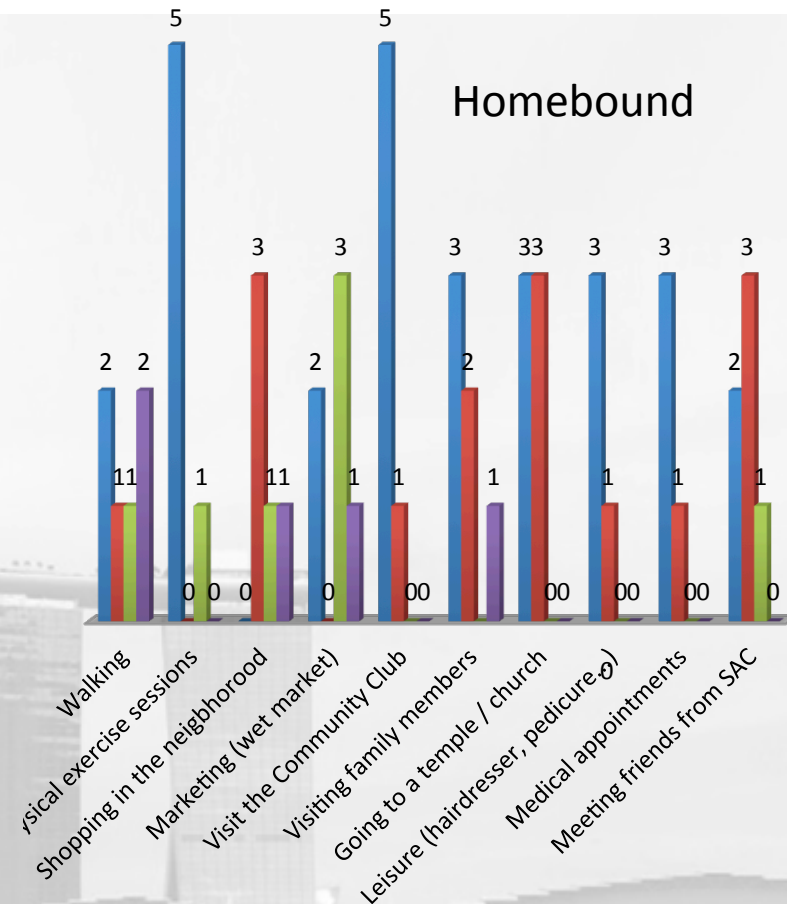
■ Never (0) ■ Rarely (1-2) ■ Frequently (3-4-5) ■ Every day (6-7)

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Active



Homebound





UBISMART - Challenges

- A framework for Ambient Assisted Living
 - Simplify the deployment process
 - Seamlessly extend for multiple deployments
 - Design for the end-users

Qualify and improve Activity Recognition



Activity Recognition

- Purpose: Accurately recognize ADL
- Inputs: A sequence of sensor events
- Method: 2 Approaches:



Powerfull computation, based on machine learning methods



Ontological representation of knowledge

Choosing knowledge-driven methods:

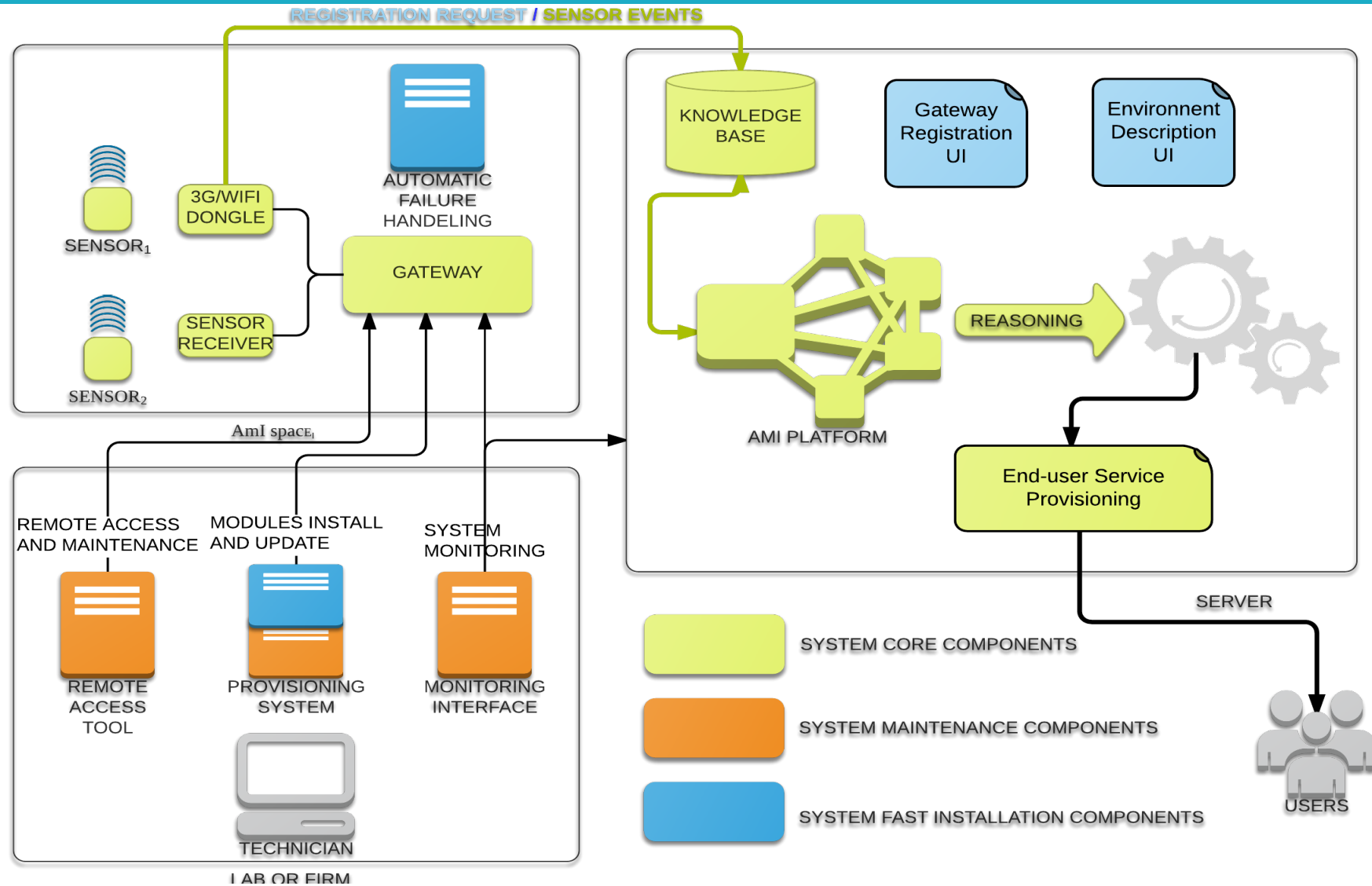
- Does not require datasets;
- Specific to each user;
- Adapted for complex-systems.

1 Romain Endelin, Stéphane Renouard, Thibaut Tiberghien, Hamdi Aloulou, and Mounir Mokhtari. "Behavior recognition for elderly people in large-scale deployment". In: Eleventh International Conference on Smart Homes and Health Telematics (ICOST 2013). Springer, 2013, pp. 61–68.

2 Romain Endelin, Hamdi Aloulou, Jos De Roo, Stéphane Renouard, Thibaut Tiberghien, and Mounir Mokhtari. "Implementation of Allen's interval logic with the semantic web". In: Proceedings of the Fifth International Conference on Management of Emergent Digital EcoSystems (MEDES 2013). 2013, pp. 252–253.



UBISMART - Framework





Semantic Model (T-Box) for a Stripped-Down Activity Inference

Using ontological models:

- Semantic web technologies;
- OWL-DL / N3 formalism;
- Euler Rule Engine.
- Includes both model and reasoning:

Model

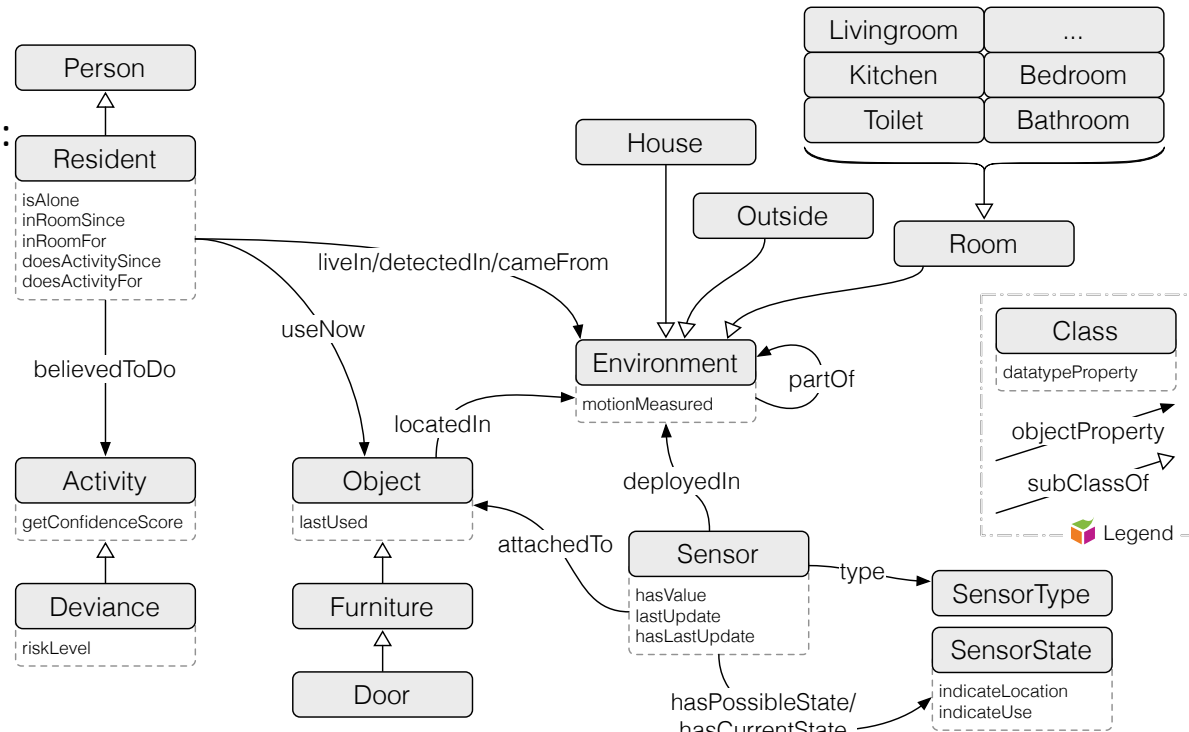
```

hom:resident_a a :Resident ;
:detectedIn hom:outside ;
:name "A" ;
:residentIn hom:house_a .
hom:sensor_bedroomMotion a :MotionSensor ;
:deployedIn hom:room_bedroom ;
:id "Bedroom Motion"@en .
hom:sensor_mainDoorSensor a :ContactSensor ;
:attachedTo hom:door_bedroom-outside ;
:id "Main Door Sensor"@en .
  
```

Reasoning

```

{
?u qol:detectedIn ?r.
?r a qol:Livingroom.
?r qol:motionMeasured ?m.
?m math:notLessThan 2
} => {
hom:watchtv :getScore 7.
}.
  
```





Perspectives

- Change of behavior and risk qualification (MCI/Frailty)
- Ethics approval – ongoing
- After a pre-deployment, deployment in 3 homes
- Uncertainty management: from physical characteristics of the sensors to logical uncertainty