Accompany: Acceptable robotiCs COMPanions for AgeiNg Years

Clustering Event
Ambient Intelligence Advanced Technologies in Support of Healthcare and Assisted Living

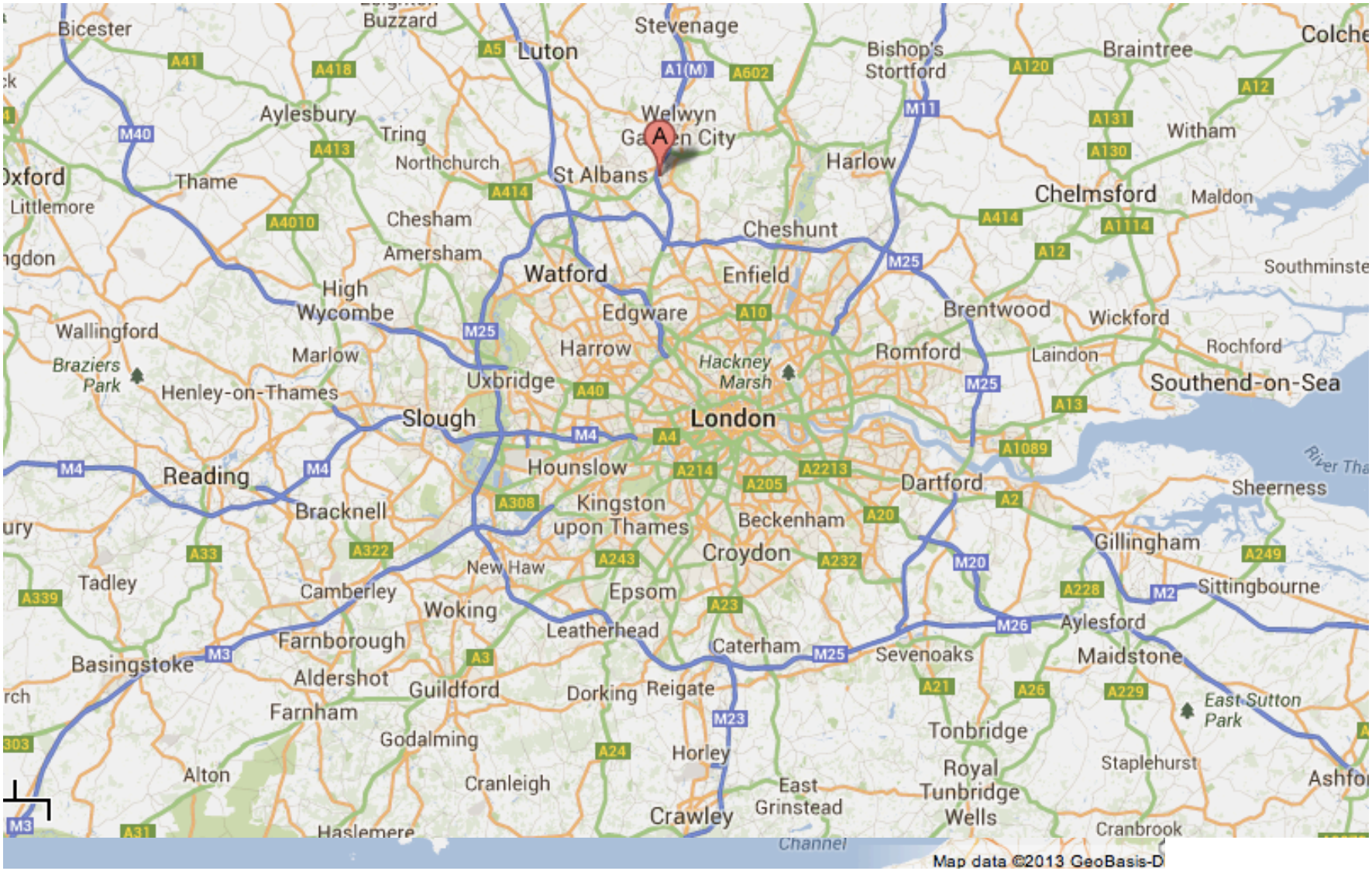
Dr Farshid Amirabdollahian

About me

- Senior lecturer in adaptive systems
- Background in rehabilitation robotics (since 1999)
- PhD in Cybernetics
- Prior to that, software engineering/system analysis (since 1989)

- Currently supervise 5 PhD students (two new positions opening) – one PhD student is a Doctor now.
- Coordinate two EC-funded projects (€9M) and contribute to a 3rd project.
- Part of a 4th project starting this Year on robot safety
- Member of AMT/-/2 team on robotics standardisation (BSI/ ISO)

Where is Hertfordshire University?



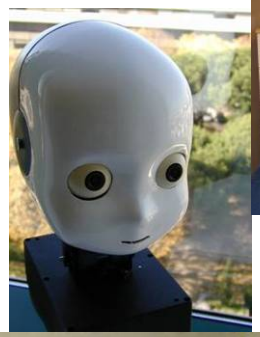
Human-Robot Interaction Research @ UH:

- Academics:
  - Prof Kerstin Dautenhahn
  - Prof Chrystopher L. Nehaniv
  - Dr Daniel Polani
  - Dr Farshid Amirabdollahian

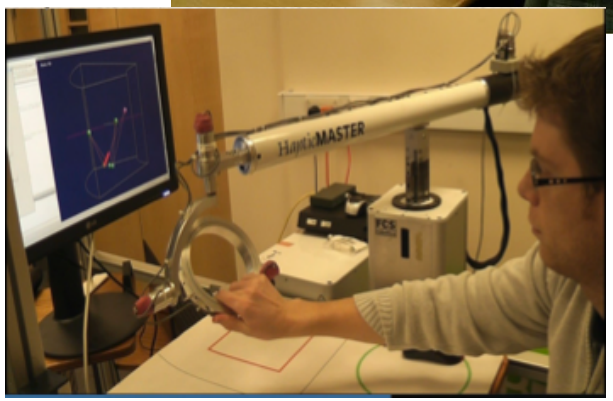
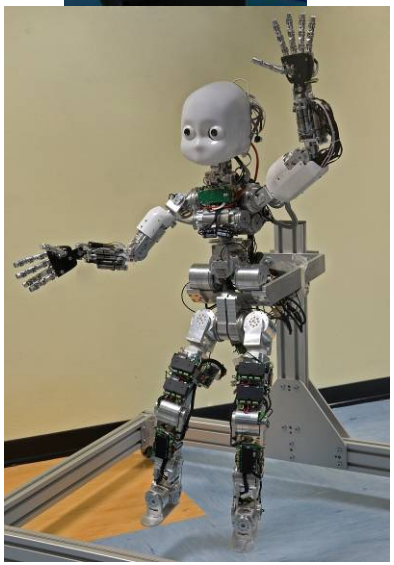
- Research Staff
  - Dr. Ben Robins
  - Dr. Joe Saunders
  - Dr. Khenglee Koay
  - Dr. Michael L. Walters
  - Dr. Hagen Lehmann
  - Dr. Cornelius Glackin
  - Dr. Christoph Salge
  - Dr. Caroline Lyon
  - Dr. Aryel Beck
  - Dr. Paolo Dini
  - Dr Joan Saez-Pons
  - Dr Maha Salem
  - Mr Dag Syrdal
  - Dr. Angelo Basteris
  - Dr. Naila Rahman
  - Dr Yun Qin
  - Dr Beatriz Leon

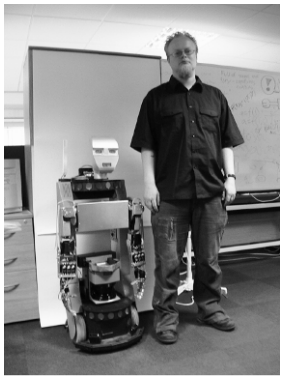
- PhD students
  - Qiming Shen
  - Dag Syrdal
  - Josh Wainer
  - Frank Forster
  - Kyron Du Casse
  - Megan Davis
  - Amiy Chatley
  - Fotis Papadopoulos
  - Michael Bowler
  - Radhika Chemuturi
  - Lisa Bowers
  - Luke Wood
  - Nauman Shah

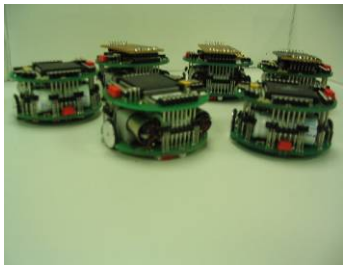
Robots in UH **Robot House** and Adaptive Systems lab





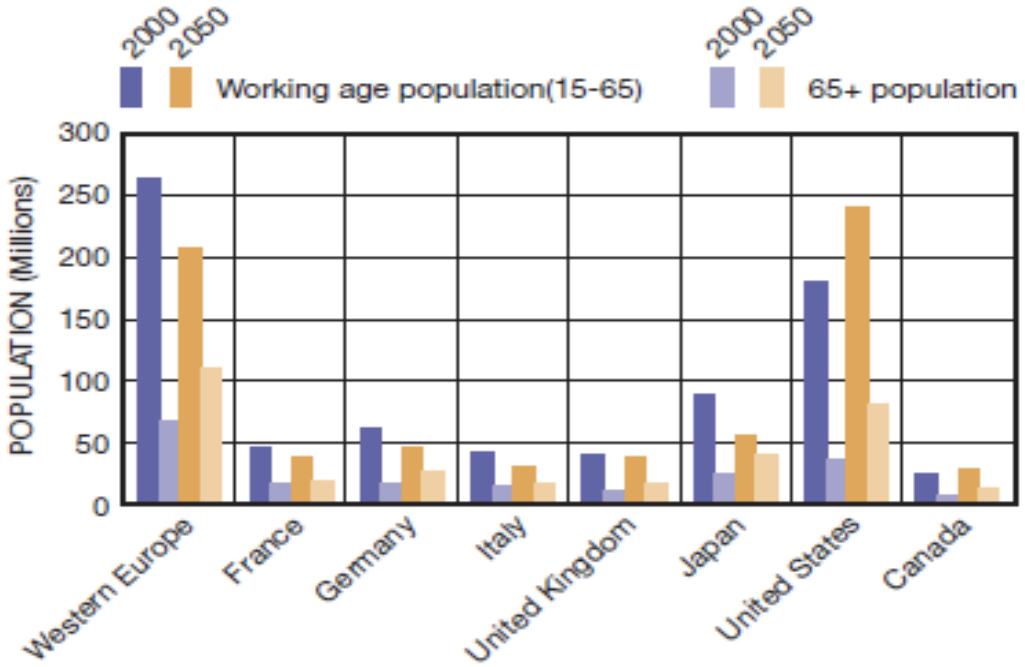





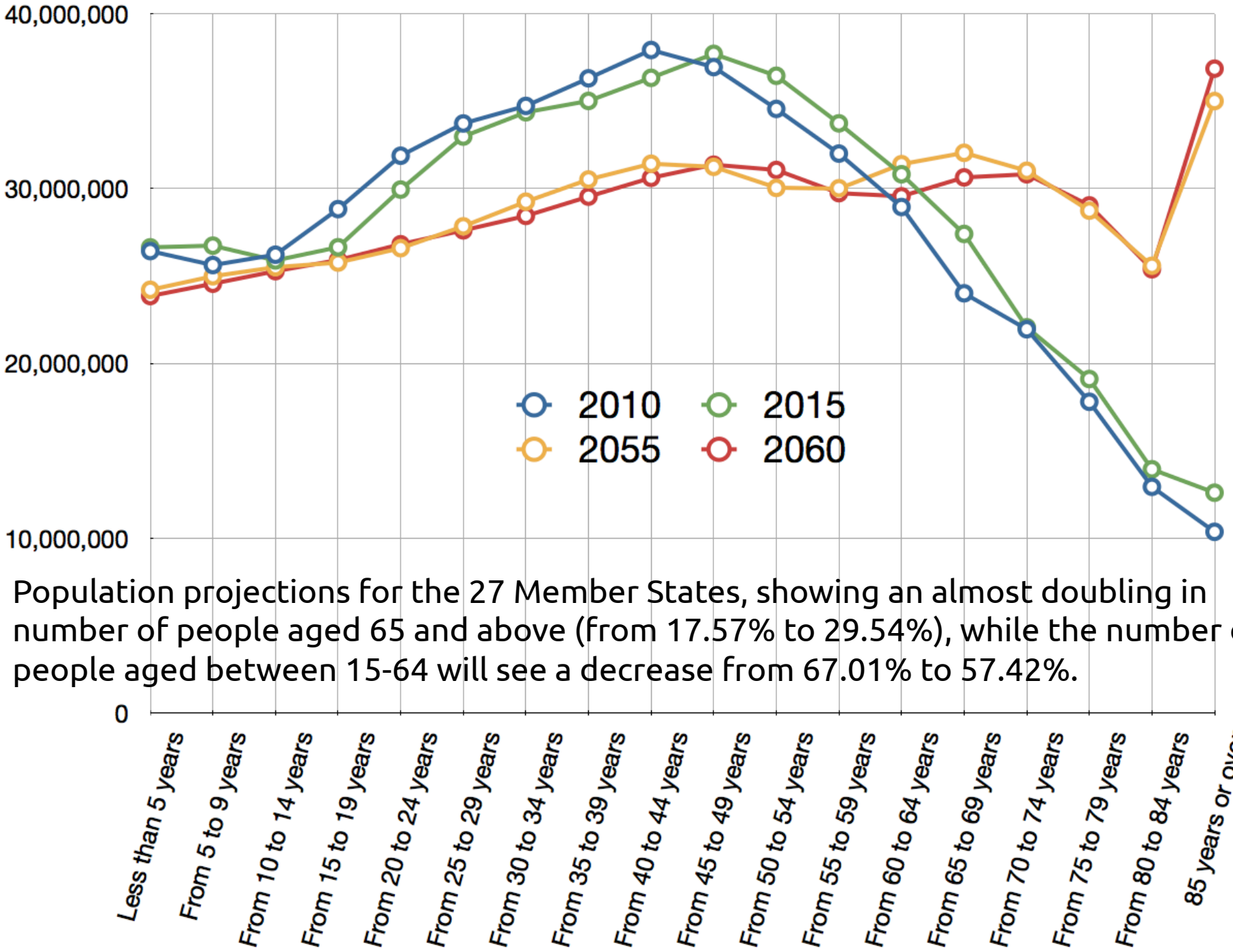

Crete, Sep 2013

Aging population

- According to Eurostat, the percentage of the European population aged 65 years and over will grow from 16% in 2010 up to 29,3% in 2060 (EUROSTAT, 2011).



Demographic changes in Europe (source: Birks, 2007)



Population projections for the 27 Member States, showing an almost doubling in number of people aged 65 and above (from 17.57% to 29.54%), while the number of people aged between 15-64 will see a decrease from 67.01% to 57.42%.

Areas where robots/advanced ICT can help?

- Physical support
- Cognitive support
- Social activity
- Re-ablement => a new way to do the same task
- Co-learner => robot and person learn together

- Rehabilitation
- Assessment & Telecare

Our vision at first

Project & Partners

- 1. The University of Hertfordshire (UH), United Kingdom
- 2. Hogeschool Zuyd (HZ), The Netherlands
- 3. Fraunhofer (Fraunhofer), Germany
- 4. University of Amsterdam (UVA),The Netherlands
- 5. University of Siena (UNISI), Italy
- 6. Maintien en Autonomie à Domicile des Personnes Agées (MADOPA), France
- 7. University of Birmingham (UB), United Kingdom
- 8. University of Twente (UT), the Netherlands
- 9. University of Warwick (UW), United Kingdom

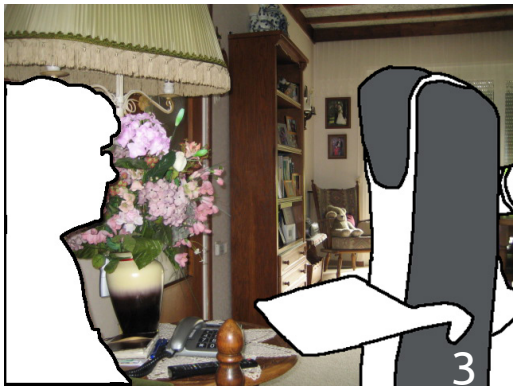
- Budget: €4,825,535
- EC funding: €3,653,929

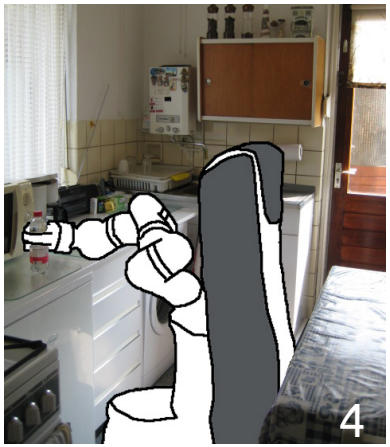
Areas where robots can help

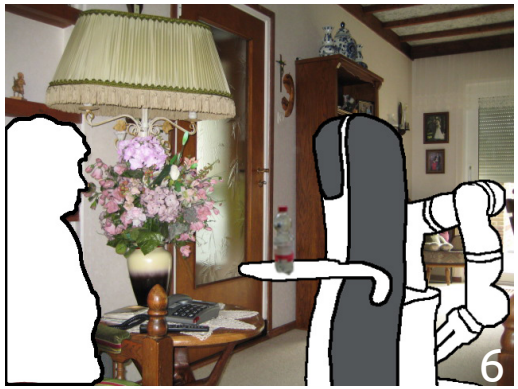
- Physical support
- Cognitive support
- Social activity
- Re-ablement => a new way to do the same task
  - Support people to do rather than doing to / for people
- Co-learner => robot and person learn together
  - Services for people with poor physical or mental health to help them accommodate their illness by learning or re-learning the skills necessary for daily living UK Department of Healths Care Services Efficiency Delivery [4].

SOA1

User requirement elicitation - focus group method & Cognitive walkthroughs







User requirements analysis; 68 requirements

1. Execution task
   - 27 user requirements (no. 1 – 27)
2. Visitors
   - 5 user requirements (no. 28 – 32)
3. Information
   - 7 user requirements (no. 33 – 39)
4. Robot behaviour
   - 2 user requirements (no. 40 & 41)
5. Camera usage
   - 3 user requirements (no. 42 – 44)
6. Robot appearance
   - 6 user requirements (no. 45 – 50)
7. Environment
   - 1 user requirement (no. 51)

- Additional robot functionalities
  - 17 user requirements (no. 52 – 68)

Bedaf, S., Gelderblom, G.J., Guichet, F., Iacono, I., Syrdal, D., Dautenhahn, K., Michel, H., Marti, P., Amirabdolahian, F., de Witte, L. (2012) Functionality of service robotics for Aging-in-Place: What to build? Gerontechnology; 11(2):361 doi: http://dx.doi.org/10.4017/gt.2012.11.02.555.00

Bedaf, S., Gelderblom, G.J., de Witte, L., Hewson, D., Syrdal, D., Lehmann, H, Amirabdollahian, F., Dautenhahn, K., (Accepted). What should a care robot be able to do? Evaluating problematic activities threatening the independence of elderly persons, International Conference on Rehabilitation Robotics (ICORR2013), June 2013.

Lehmann H., Syrdal D., Dautenhahn K., Gelderblom G.J., Bedaf S. and Amirabdollahian F. (2013) What can a robot do for you? - Evaluating the needs of the elderly in the UK, ACHI 2013, The Sixth International Conference on Advances in Computer-Human Interactions, pp. 83-88

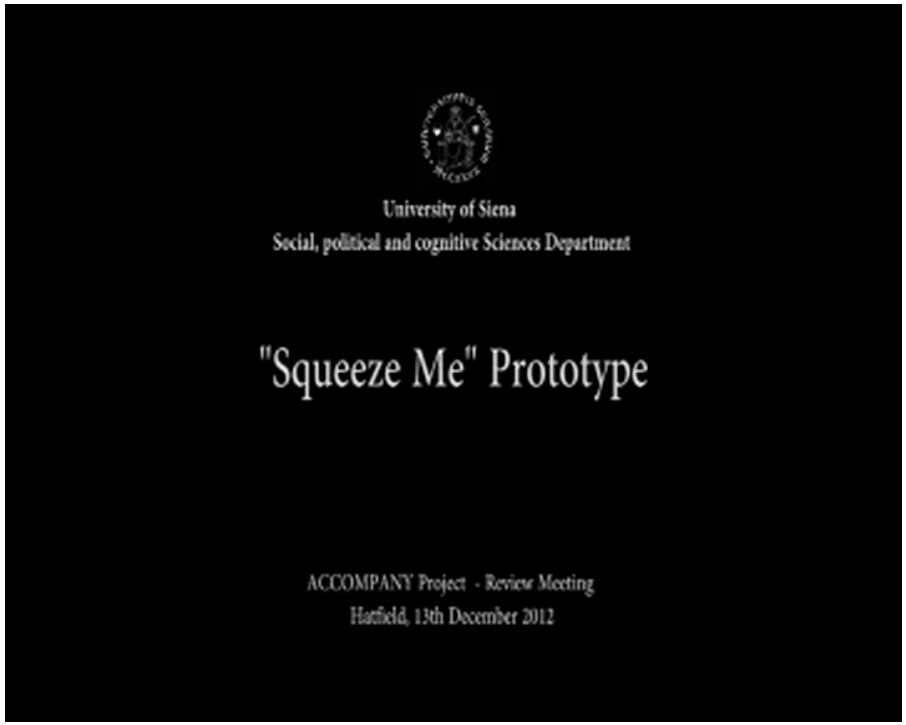
Social & Empathic interaction

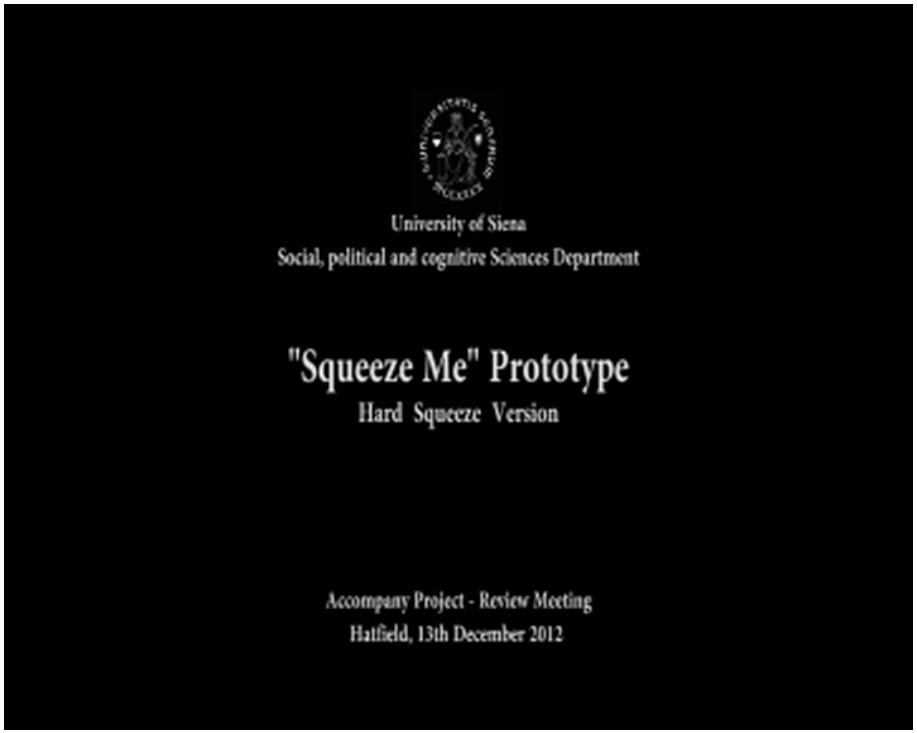
- Would the robot provide social interaction?
- Would the robot provide empathic interaction?

- Its interaction will be designed towards these. It will have aesthetic, perceptual and emotional interaction added to its functional and physical behaviours.

SOA2

Social and empathic interaction





Marti, P. and Stienstra, J.T.; Exploring Empathy in Interaction. Scenarios of Respectful Robotics. GeroPsych The Journal of Geron-topsychology and Geriatric Psychiatry. In press

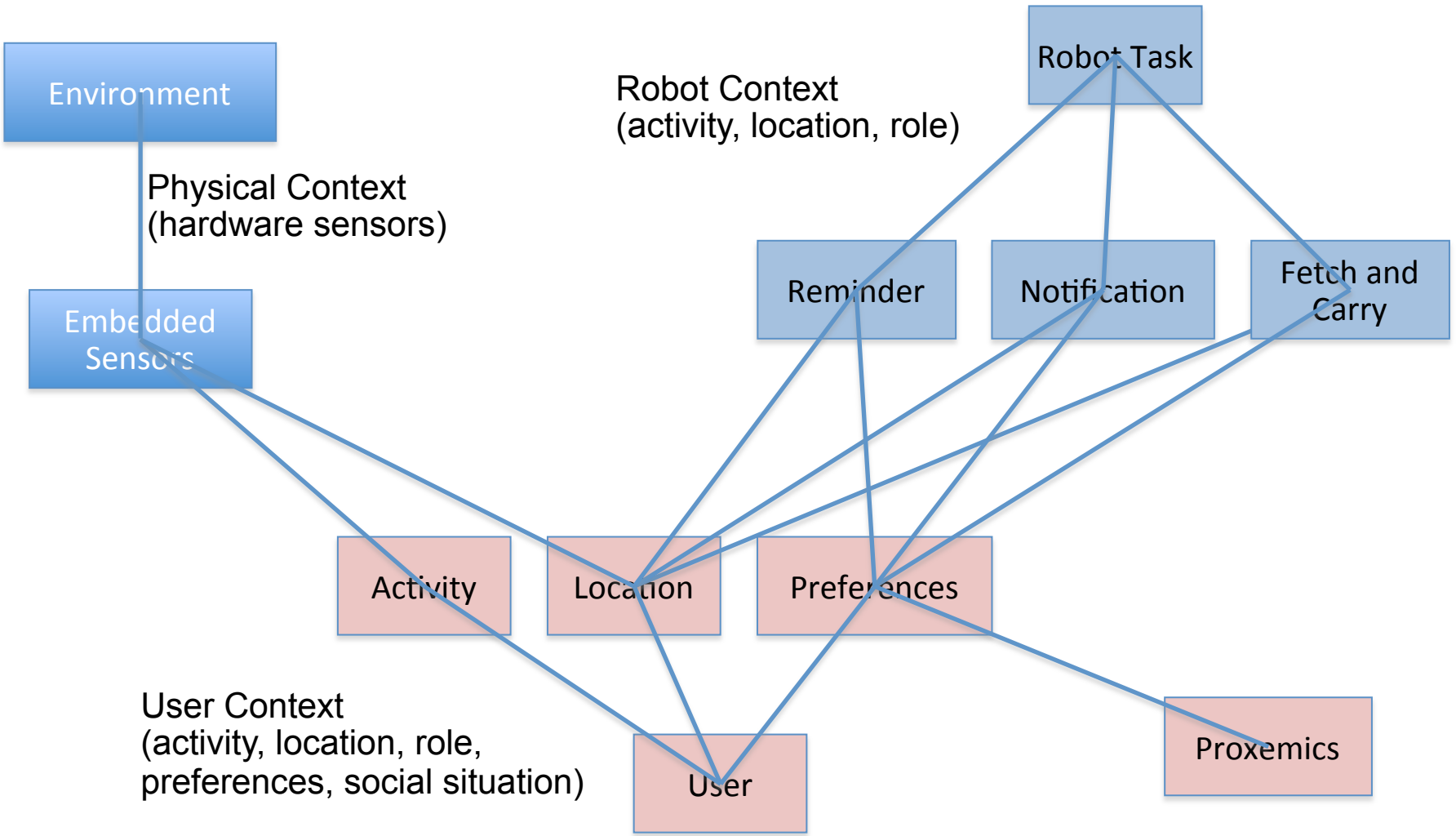
Stienstra, J.T. and Marti, P. (2012). Squeeze Me: Gently Please. In Proc. of NordiCHI 2012, (pp.746-750). New York: ACM Press

Stienstra, J.T., Marti, P. and Tittarelli, M. (2013). Dreamy Eyes: Ex- ploring Dynamic Expression in Human-System Interaction. CHI2013

Social and empathic interaction

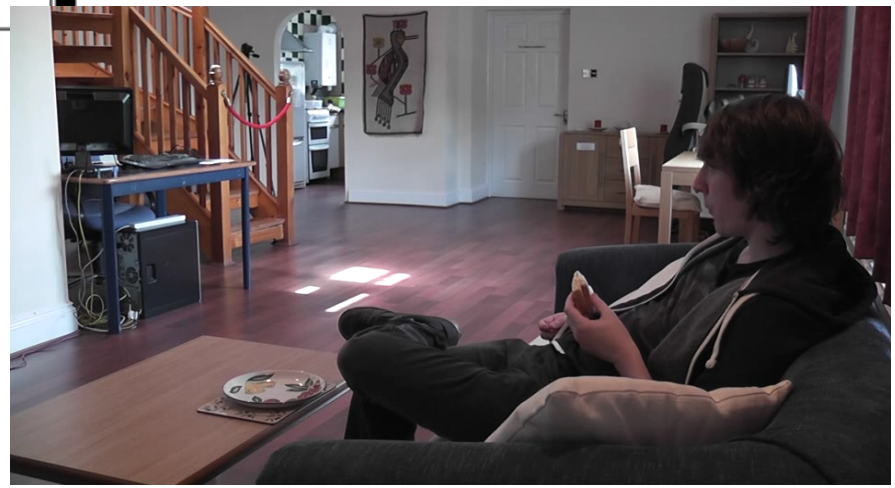
SOA3

Context awareness



SOA4

Robot House



I. Duque, K. Dautenhahn, K.L. Koay, I. Willcock and B. Christianson (2013). Knowledge-driven User Activity Recognition for a Smart House. Development and Validation of a Generic and Low-Cost, Resource-Efficient System. Accepted for publication (ACHI 2013).

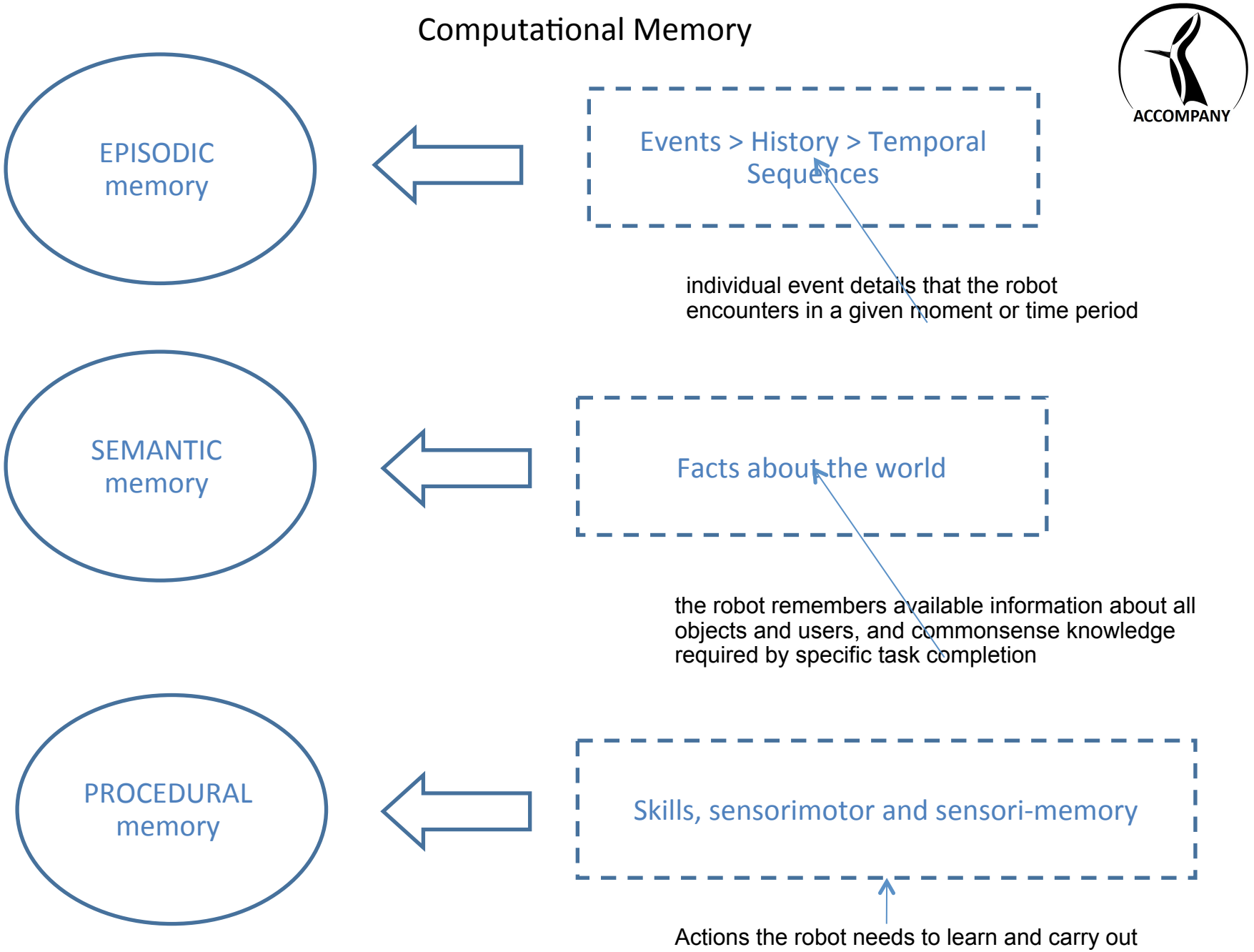
Context awareness/Preferences Proxemics

Robot learning and adaptability

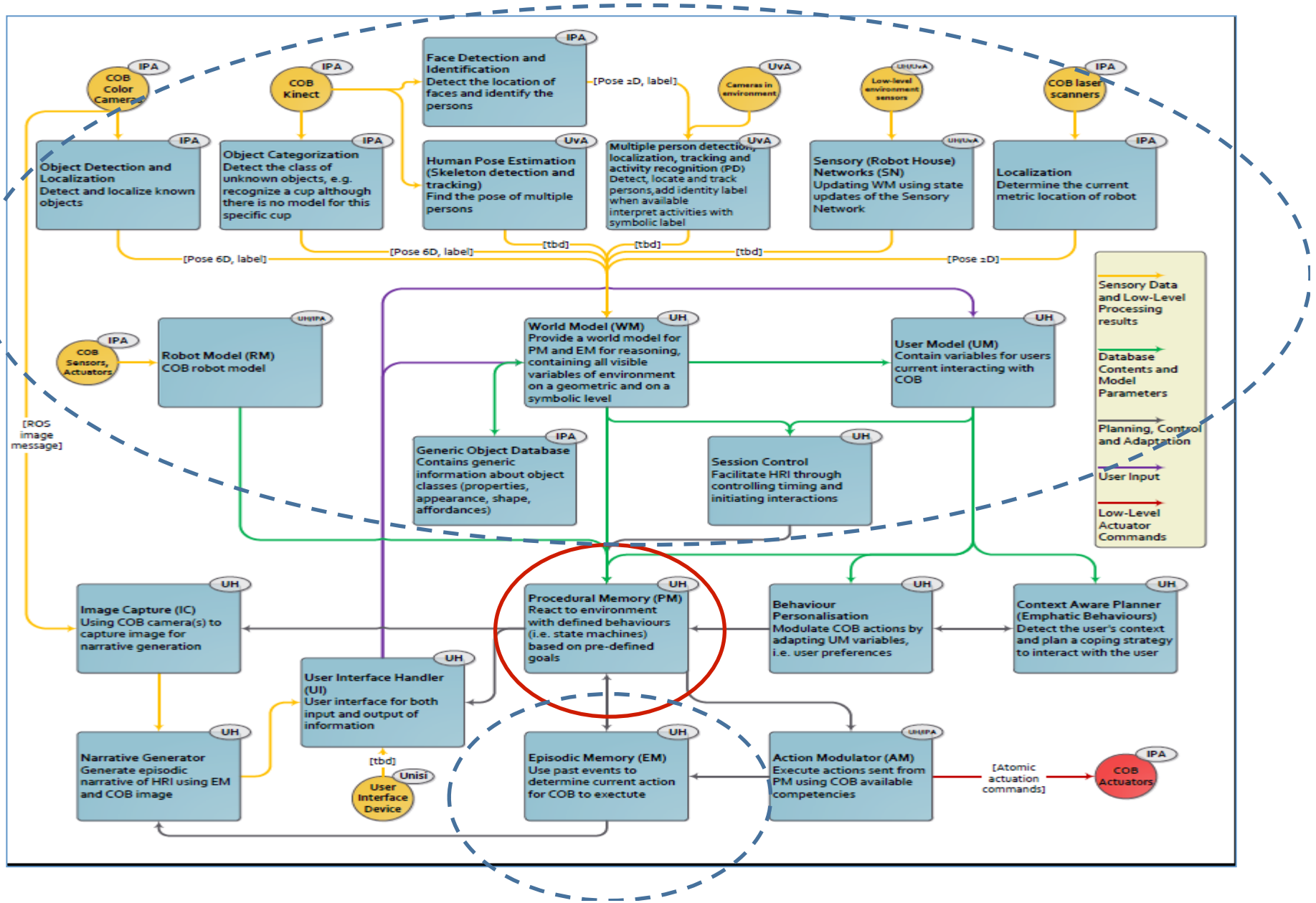
- What if the robot can remember its interaction history?
  - It needs to have ability to learn and recall
  - It needs to have a cognitive architecture for this

- Our research here focuses on dynamic computational long-term memory for the robot
  - Initially, domain knowledge is limited to scenario at real home environment – Robot House
  - How can robot visualise its memory and share with user?

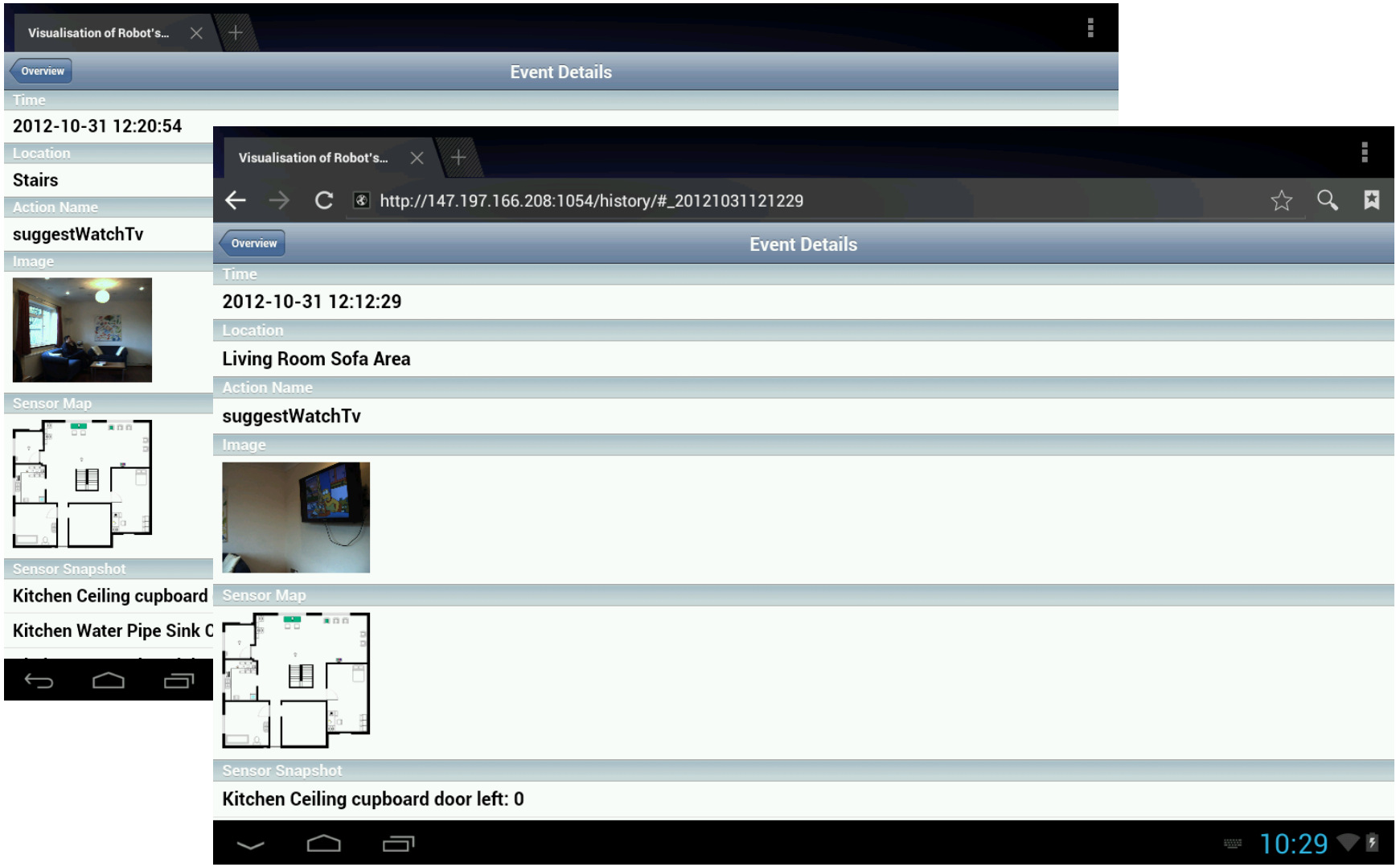
Computational Memory



Complex tasks - Architecture



Robot learning & adaptive interaction



SOA6

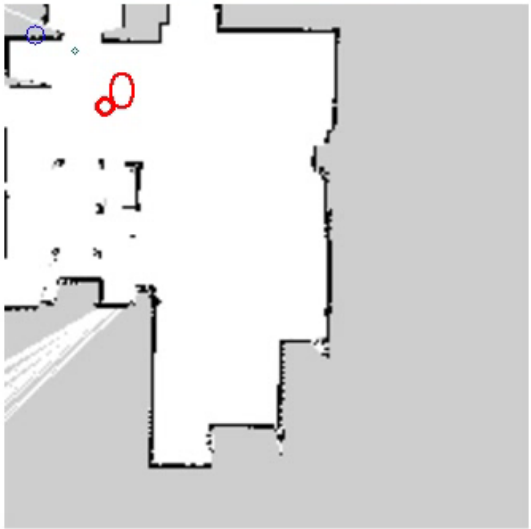
Environment and activity monitoring

- Detects people and objects using robot and environmental sensors
- Activity recognition of household chores

- It needs ability to fuse data from the house sensors with those of the robot, i.e. ceiling camera and robot's camera
  - Advantages are that this would allow robot to know where user is, so it can help being near or away from the users

Englebienne, G. and Kro¨se, B.J.A (2010).Fast Bayesian people detection. Proceedings of the 22nd benelux AI conference (BNAIC 2010).
Hu, N., Englebienne, G. and Kro¨se, B.J.A. (2012). Bayesian Fusion of Ceiling Mounted Camera and Laser Range Finder on a Mobile Robot for People Detection and Localization. In Proceedings of IROS workshop: Human Behavior Understanding Vol. 7559. Lecture Notes in Computer Science (pp. 41-51).

Human tracking

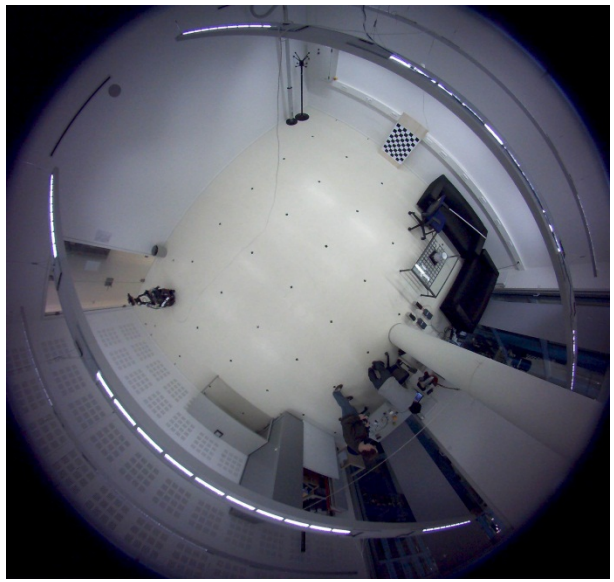


Environment & activity monitoring

Platform

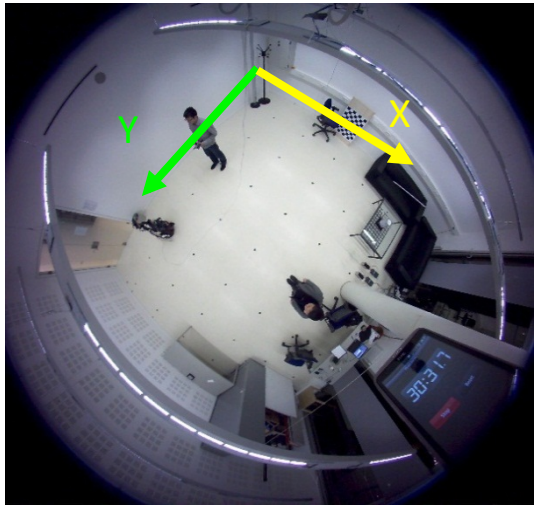
•Can be used at UvA, UH and Hertfordshire

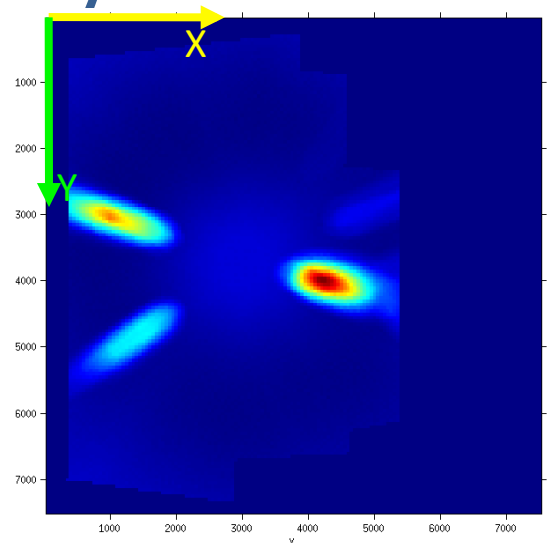
GV-FE110 / 111 1.3MP H.264 Fisheye IP Camera



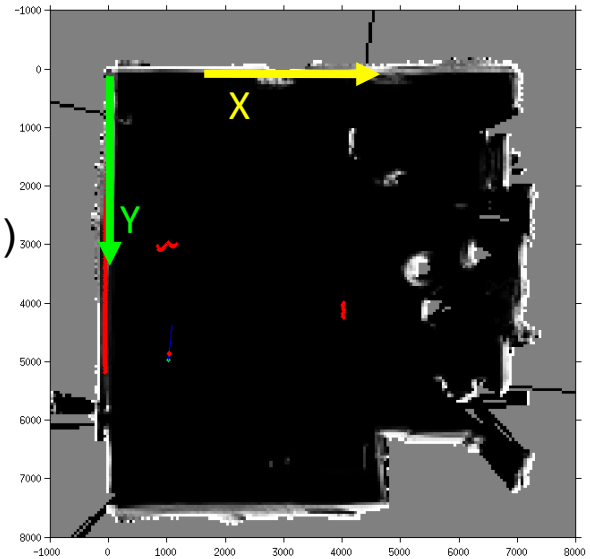
Human Detection and Localization
Data Fusion of Fish-eye and Laser

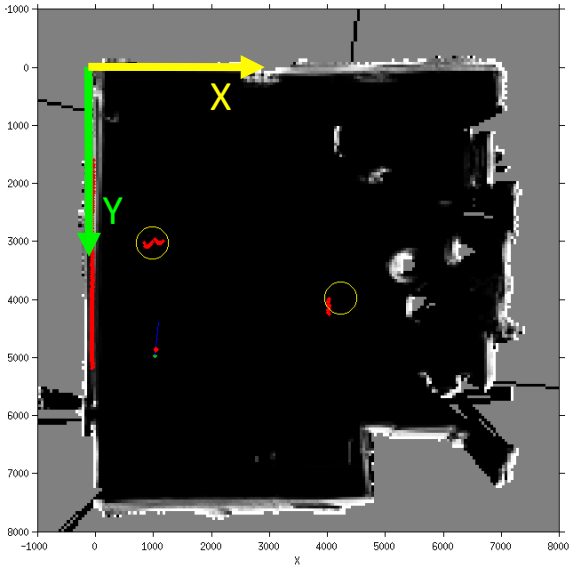
Fish-eye Camera





Robot sensor (LRF)





Model-based approach

Challenge of integration

- Many modules need to come in from many partners
- they all need to work together, in a timely and reliable manner
- Good architecture and good procedure for integration

Acceptability

- What are the factors that influence robot's acceptability?
  - Trustworthiness
  - Loyalty
  - Un-intrusiveness
  - Helpfulness
  - What else?

} Human Butler

Heerink,M.andKro¨se,B.J.A.andWielinga,B.J.andEvers,V.(2010), Measuring acceptance of assistive social agent technology by older adults: the Almere model. International Journal of Social Robotics, Vol. 2. Issue. 3.

SOA9

New ethical norms

- Identifying new norms related to using robots as companions
  - Issues such as privacy
    - Who gets to decide what the robot would pass on?
    - How much does the robot need to know?
    - How much does the environment need to know?
  - What other norms are important here?
    - Autonomy, independence, enablement, safety and privacy, social connectedness
  - An example: Can the robot say I won't do it?

What next in the project?

- Passed our first year review with Excellent mark

- Future work in next years
  - Progress towards individual SOA objectives
  - Progress in robot role identification and acceptable roles and behaviours
  - Progress in summative evaluation, comparing requirements to achievements => SOA10

Acknowledgments

- The work described in this project was partially funded by the European project 'ACCOMPANY' Grant agreement no: 287624.
- Thanks to Accompany Consortium
- And thanks to our research team in Adaptive Systems group

http://scriptproject.eu &
http://accompanyproject.eu &
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THANK YOU FOR YOUR ATTENTION!

SCRIPT

ACCOMPANY

SEVENTH FRAMEWORK PROGRAMME