Institution: Glyndŵr University

Unit of Assessment: 11
Computer Science and Informatics

Title of case study:
EASYLINE+: Low Cost Advanced White Goods for a Longer Independent Life of Elderly People
[11/1]

1. Summary of the impact (indicative maximum 100 words)

Glyndŵr researchers designed and developed ambient user interface devices and middleware (known as the 'E-servant'), and evaluated the completed system, on an FP6 project developing near-to-market-ready prototypes of advanced kitchen appliances. Functionality included sensors in refrigerators that communicated if the door had been accidentally left open; in washing machines, RFID chips identified laundry and automatically selected correct programmes; other appliances, along with further sensors (e.g. smoke alarms) communicated their status via the E-servant to personalised user interfaces. Users could control the appliances, monitor them, and receive timely notifications. Impact relates to benefits to industrial partners and public engagement with research.

2. Underpinning research (indicative maximum 500 words)

Research enabling the impact described in this case study was based on the researchers' expertise in the fields of human computer interaction and networking. This expertise led to Glyndŵr University researchers being invited to join the FP6 funded EasyLine+ project (FP6 Contract Number 045515, 2007-2010), with BSH Electrodomesticos Espana S.A. (a subsidiary of Siemens) as the lead industrial partner. The overall aim of the EasyLine+ project was to develop a range of intelligent kitchen appliances, for use in particular by elderly or disabled people. Glyndŵr's specialist role was to develop the device interfaces, especially those allowing remote control.

Glyndŵr researchers working on Easyline+ conducted a number of laboratory and field-based usability studies between 2007-2010 which focused on a range of user interface designs as well as the hardware platforms (mobile interfaces, televisions, adapted digital photoframes etc.).The feasibility of RFID in enclosed environments, such as refrigerators, was evaluated **[refs. 1 and 3]**. Electrical safety, electromagnetic compatibility and EC certification tests have since been performed to validate sensors and actuator devices to be put into the production process. Glyndŵr researched the feasibility of utilizing powerline communications, RFID and Zigbee technologies in a smart home environment, all of which were subjected to benchmark tests during the project. Quality of Life measures relating to older and disabled people in the context of assisted living were investigated and published. A multi-agent architecture was applied incorporating all of these aspects **[ref. 4]**. During the research and development process, a new methodology for designing interfaces in an ethical and user centred manner was developed **[ref. 3]**. A set of new design principles for developing ambient user interfaces was also proposed **[ref. 2]**.

Names of the key researchers, dates employed and positions they held at Glyndŵr University at the time of the research are as follows:

Dr Richard Picking worked on the project throughout from 2007-10. He was the 'Technical Manager' responsible for overseeing the user experience research, directing research assistants (RAs) H. Grout, Crisp, and Robinet.
Professor Vic Grout worked on the project throughout. He was 'Project Manager' for

Glyndŵr University. He was also responsible for the project's network architectures, which utilized a range of technologies (e.g. Wifi, Zigbee, powerline communication, RFID, Ethernet). He directed RAs McGinn and Delgado.
Alexia Robinet (RA) worked on the project throughout. She developed user interfaces and conducted user studies in Glyndŵr University's usability laboratory.
Armando Roy Delgado (RA) worked on the project throughout. He specialised in networking and communications technologies and implemented the Easyline+ network architecture.
John McGinn (RA) worked on the project throughout. He designed and developed the Easyline+ 'E-servant'. This was the main control system which communicated with the interfaces and monitored/controlled the advanced kitchen appliances.
Helen Grout (RA) and **Jodi Crisp** (RA) worked on final evaluation of the project from August-December 2009.

3. References to the research (indicative maximum of six references)

These are available on request if required and not in the public domain.

1. Picking, R., Robinet, A., McGinn, J., Grout, V., Casas, R. & Blasco, R. (2011), "The Easyline+ Project: Evaluation of a User Interface Developed to Enhance Independent Living of Elderly and Disabled people", *International Journal of Universal Access in the Information Society* (Springer), doi: 10.1007/s10209-011-0246-8
2. Picking, R., Grout, V., McGinn, J., Crisp, J. & Grout, H. (2010), "Simplicity, consistency, universality, flexibility and familiarity: the SCUFF principles for developing user interfaces for ambient computer systems", *International Journal of Ambient Computing and Intelligence*, Vol. 2, No. 3, pp.40-49. doi: 10.4018/jaci.2010070103
3. Picking, R., Robinet, A., Grout, V., McGinn, J., Roy, A., Ellis, S. & Oram, D. (2010), "A case study using a methodological approach to developing user interfaces for elderly and disabled people", *The Computer Journal*, Vol. 53, No. 6, pp.842-859. doi: 10.1093/comjnl/bxp089
4. Roy Delgado, A., Blasco, R., Marco, A., Cirujano, D., Casas, R., Roy Yarza, A., Grout, V. & Picking, R., (2010), "Agent-based AmI System Case Study: The Easy Line + Project", *Proceedings of the 8th International Conference on Practical Applications of Agents and Multi-Agent Systems* (*PAAMS 10*), University of Salamanca, Spain, 26-28 April 2010, pp157-164

4. Details of the impact (indicative maximum 750 words)

Glyndŵr researchers were named as inventors in 2 of the patents of BSH Electrodomesticos Espana S.A from the project, in recognition of the contributions arising from their research. These patent applications are:

- Grout, V. & Picking, R., "Assembly and Method for Monitoring at Least One Household Appliance", (EP2302312 (A1) — 2011-03-30) *European Patent Office Patent No. 09382180.9 – 1266*, 11th November 2009 (with others from the EU FP6 'EASYLINE+' project – Proprietor BSH Electrodomesticos, Spain). **[source a]**
- Grout, V. & Picking, R., "Assembly and Method for Monitoring a Set of Household Appliances", (EP2302605 (A1) — 2011-03-30) (Grout, V. & Picking, R., with others from the EASYLINE+ project – Proprietor BSH Electrodomesticos, Spain). **[source b]**

Evaluation of the challenges of installing RFID in enclosed environments such as fridges and washing machines contributed to the "Design for all" programme at BSH's central technology unit in Germany. In the Design for all programme there is a vision that in a few years there will be appliances that can be integrated in an intelligent house, including those that users

will be able to control and monitor on a display. Siemens (BSH) was a partner in the Easyline+ consortium, and since then they have developed further concepts in smart home technologies, for example a range of Siemens smart homes appliance concepts which were exhibited at IFA 2012, the largest exhibition of consumer technology in Europe http://itersnews.com/?p=11708. Some of the functionalities on show were directly informed by Easyline+ (e.g. the Siemens 'homeConnect' system, which is very similar to the Easyline+ E-servant, and the controlling of appliances with mobile/tablet remote devices). **[source c]**

BSH Electrodomesticos has reported that the company learned valuable lessons from the research that have impacted their strategy not to implement the results of their project commercially until the technologies improve in reliability and affordability in kitchen environments (particularly RFID tagging and readers), and until these technologies become more mainstream in consumer retail. **[source d]**

A BBC television news story enabled widespread public awareness of the user interface concept developed by the Glyndŵr researchers and the achievements of the research. **[source e]**

The Glyndŵr researchers contributed to STEM education in the region by engaging with and visiting a number of high schools (6 in all – names/dates available on request) to explain the purpose, conduct and achievements of the EasyLine+ project in the context of future healthcare technologies. The largest of these events was held at Glyndŵr in March 2011, when over 100 schoolchildren and their teachers were shown the Easyline+ project as part of the BCS Computers at School conference series. **[source f]**

5. Sources to corroborate the impact (indicative maximum of 10 references)

a)
http://worldwide.espacenet.com/publicationDetails/biblio?DB=EPODOC&II=3&ND=3&adjacent=true&locale=en_EP&FT=D&date=20110330&CC=EP&NR=2302312A1&KC=A1
b)
http://worldwide.espacenet.com/publicationDetails/biblio?DB=worldwide.espacenet.com&II=0&ND=3&adjacent=true&locale=en_EP&FT=D&date=20110330&CC=EP&NR=2302605A1&KC=A1
c)
'Pictures of The Future' (Fall, 2010), an industry magazine published by Siemens, http://www.siemens.com/innovation/apps/pof_microsite/_pof-fall-2010/_html_en/cooking-up-a-better-life.html
d)
Fire and Radiation Protection Coordinator, BSH Electrodomesticos Espana, S.A.
e)
BBC news: http://news.bbc.co.uk/1/hi/wales/8093196.stm
f)
Computers at School (CAS) with powerpoint presentation: "Say 'Aah' for the Computer: A look into Healthcare technologies of the future" (presented to schools/colleges in 2011) http://www.eventbrite.co.uk/e/inventing-the-future-cas-north-wales-and-cheshire-event-tickets-818382805 / http://www.glyndwr.ac.uk/pickingr/CAS address 2011.pptx