

# **ACADEMY OF INNOVATION AND RESEARCH**

## **E-SERVICES ON DEMAND FOR A RESIDENTIAL CARE HOME**

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**EVALUATING A RANGE OF ASSISTIVE  
TECHNOLOGIES IN A RESIDENTIAL CARE HOME**

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## ESERVICES ON DEMAND FOR A RESIDENTIAL CARE HOME

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De Montfort University initially provided the technical support, which was later transferred to Smart Connected Living. Throughout the lifetime of this study, the open platform and devices were supported by Chi-Bui Wong and Dr Xi Chen.

This study was supported by Dr Justin Marshall and Erik Geelhoed, the researchers' PhD supervisory team.

## 1. Introduction

The Office of National Statistics in United Kingdom predicts that the number of people aged 85 years and over will increase from 1.5 million to 5 million people by 2050 (Davidson, Goodwin, & Rossall, 2013). With the rapidly growing ageing population, the demand for care homes will increase along with the demands on care home staff (Chan, Campo, Estève, & Fourniols, 2009). Assistive technologies are emerging as a possible solution to meet the needs of the ageing population and relieve some of the pressure on the care system (Martin, Kelly, Kernohan, McCreight, & Nugent, 2008; National Institute for Health Research, 2013; Niemeijer et al., 2010). According to the Royal Commission on Long Term Care, the definition of assistive technologies is “an umbrella term for any device or system that allows an individual to perform a task they would otherwise be unable to do or increase the ease and safety with which the task can be performed” (Sutherland, 1999), by definition these technologies could cover a variety of areas for example, physiological monitoring, functional monitoring, safety and security monitoring, social interaction or modification of the built environment.

Care homes are an asset to society and provide high level support and care for people with physical frailty, cognitive impairment and neurodegenerative disorders. Despite the value of care homes in society there is limited evidence with regards to using assistive technologies in this area, with the majority of research focusing on assisting older people to remain in their own homes for longer (Luff, Ferreira, & Meyer, 2011). Assisted technologies in private homes are generally used to assist and support individuals, while these technologies in residential care homes are used to monitor and safeguard individuals (Niemeijer et al., 2010).

Many studies evaluating the effectiveness of assistive technologies in individuals own homes have been undertaken in the United Kingdom, while few have been undertaken in a residential care homes due to complicating factors (Perry, Beyer, & Holm, 2009). Studies have shown varied results:

- Inconclusive results due to the lack of evidence (AKTIV Consortium, 2013; Barlow, Singh, Bayer, & Curry, 2007; Martin et al., 2008; Miskelly, 2001)
- Mixed results reported by the largest randomised control trial in telecare and telehealth in the world (Sanders et al., 2012; Steventon et al. 2013; Steventon et al. 2012)
- Positive results showing an improvement in the level of care and participants’ health and wellbeing (Alaszewski & Cappello, 2006; Jarrold & Yeandle, 2009; Schneider, Read, & Rhodes, 2010; Upton et al., 2011).

There has been a call for more research to be undertaken to build the evidence for policy and practice in using assisted technologies in residential care homes. This study chose to focus specifically on residential care homes, and evaluate the effectiveness of using a range of assistive technologies in a residential care home environment.

## **2. Aims, objectives and research question**

The aim of this study was to establish whether a bespoke system on an open platform, using a range of remote services, sensors and software, could deliver higher quality care to residents and improve their wellbeing.

The objectives:

- To establish whether a bespoke system could lead to the delivery of higher quality of care of residents looking at the areas of safety and monitoring.
- To establish whether a bespoke system could lead to an improved level of wellbeing in the residential care home, looking at the areas of entertainment and communication.
- To develop a better understanding of using an open platform for assistive technologies in a residential care home environment.

The research question:

Can assistive technologies through a range of remote services, sensors and software on an open platform aid the delivery of higher quality care in a residential care home?

## **3. Project Partners**

- Falmouth University part funded this study and was responsible for managing the research project.
- Superfast Cornwall part funded this study. It is a partnership project between BT and Cornwall Development Company; funded by the ERDF, Cornwall Council and BT.
- Anson Care owns and manages four care homes in Cornwall. They provided the location for the study and fully supported the study over its lifetime (30 months in total).
- Smart Connected Living provided the open platform. They gave ongoing support, commissioning and maintenance of the technology using the open platform.

## **4. Study Design**

This study incorporated recommendations from past research into the design, while focussing on the broader areas of wellbeing. It used a people-centred inclusive design where “designers ensure that their products and services address the needs of the widest possible audience” (DTI, 2000) and is based on the users’ real and actual requirements (Bharucha et al., 2009).

#### **4.1. Location**

Harbour House, the residential care home is situated in a coastal town in Cornwall, it consists of a 20 bedroom care home and four bedroom detached bungalow. It is owned and managed by the Anson Care Group.



**Image 1: The care home in Cornwall**

#### **4.2. Participants**

##### **Inclusion**

The study included a mixture of residents (with full mental capacity), staff and relatives. The study hoped to invite approximately 33 people to participate (12 residents, 15 staff and six relatives), with the residents being the main focus of the study. Twelve residents were identified as being suitable to participate, however once the research was underway the number of active participants changed. Further details about participants is available in Table 2.

##### **Exclusion**

Initially the study had hoped to include all residents, and therefore an ethics application was lodged with the Social Care Research Ethics Committee (SCREC) in September 2013 to include residents who fell under the protection of the Mental Capacity Act 2005. Following the feedback from SCREC, it was decided to change the participant group to include only residents who had full mental capacity and exclude all residents who lacked capacity. This study received approval from the Falmouth University Ethics Committee in April 2014, and therefore all residents who showed signs of memory loss were automatically excluded from the study.

### 4.3. Interventions

The interventions were two very distinct systems that were installed at the care home. The first system monitored and controlled the environment and monitored movement of occupants in the care home without being able to identify individuals, while the second system enhanced entertainment and communication.

Two systems chosen were:

- Monitoring and controlling the environment – This included passive infrared sensors, thermostatic radiator valves, temperature and humidity sensors, flood detectors, movement sensors and aperture opening/closing devices linked to a rain sensor. These devices all used an open platform, which allowed technologies from different providers or manufacturers to function as one integrated system.
- Entertainment and communication – This included a digital television in the shared living room, handheld tablets available to all residents and a wireless printer. These devices were supplemented with reminiscence applications and Google vouchers. Eight-inch size tablets were chosen following the recommendations from other research (Upton, Upton et al. 2011).

Initially it was hoped to install devices in shared spaces and private bedrooms. However as a result of poor connectivity due to the construction materials used in the main building and the layout of the care home, only shared areas were connected to the system. Superfast Broadband was installed and made available in as many areas as possible. Devices for monitoring and controlling the environment were installed in the shared living room and dining room (conservatory) in the main house, and in the shared living room, kitchen/dining room and conservatory in the bungalow. Table 1 shows a breakdown of the devices installed at the care home, and Appendix 1 details the makes and models of devices.

**Table 1: Number of devices**

<b>Monitor and Control</b>		<b>Entertainment/Communication</b>	
Thermostatic radiator valves	11	Handheld tablets	24
Temperature/humidity sensors	7	Digital television	1
Passive infrared detectors	9	Wireless printer	1
Motion sensors	2		
Aperture device	1		
Flood detectors – could not be connected to the system	2		
<b>Total</b>	<b>32</b>	<b>Total</b>	<b>26</b>

To create an inclusive environment, the handheld tablets, digital television and wireless printer were available to all residents at the care home. Only residents with full mental capacity were included in the study. Select staff were trained to use the handheld tablets, with the care home manager, activities coordinators and night staff all having access to them.



**Image 2: Resident typing an email**

The digital interventions were introduced slowly in the hope they would be better accepted and adopted. The researcher worked with the activities coordinator at the care home to better understand the residents and care staff. During the months of assisting the activities coordinator, the researcher became very much part of life at the care home and was involved in activities such as book club, crafts, journal club, outings, national care home afternoon tea, festive celebrations, tea dances and more. The handheld tablets were used during these sessions for looking up facts, searching for poetry, watching music videos, taking photographs and more. Residents and staff became familiar with the handheld tablets, which sparked an interest for some residents in potentially participating.



**Image 3: Residents involved in arts and craft activities**



Residents who showed an interest in using the handheld tablets met with the researcher to establish how the device could enhance their lives. The breakdown of residents who participated in the study is detailed in Table 2. The table shows that 4 residents were interested in additional entertainment and 3 were interested in accessing alternative communication.

**Table 2: Participants involved in study**

	Age	Interest	Involvement	Mobile	Landline	Computer	Level of skills
1	85	Communication	Interested but passed away before being given the handheld tablet	Yes	Yes	Desktop	Skilled – internet shopping and emails
2	70	Entertainment – YouTube, Tedtalks	Involved for 6 months before passing away	Yes	Yes	Laptop	Skilled – basic internet search and webmail
3	83	Communication - email	Involved for a few weeks but withdrew due to anxiety of learning a new skill	Yes	Yes	No	None
4	89	Entertainment - eBooks	Involved but withdrew due to anxiety of learning a new skill	Yes	Yes	No	None
5	86	Entertainment - eBooks	Involved but withdrew due to difficulty in remembering the sequences	No	No	No	None
6	84	Communication – email, internet, YouTube	Involved for 6 months but withdrew (reason unknown)	No	No	No	None - skilled at using a type writer
7	86	Entertainment – eBooks, games, internet, Facebook and more	Involved	Yes	Yes	Desktop	Skilled uses internet shopping and online banking

The researcher will continue to work with the activities coordinator through the summer 2015, at which point the field research will draw to a close.



**Image 4: Residents using handheld tablets in the dining room**

## **5. Methodology**

This was a mixed method study collecting both qualitative and quantitative data through semi structured interviews, questionnaires and observations. Where possible interviews were held with participants, with the aim of undertaking three interviews per participant. Residents were asked to complete two questionnaires at different stages of the research study, one was the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS) which measures mental wellbeing and the other was a questionnaire made by Falmouth University tailored to suit the care home environment. The researcher kept a detailed diary (totalling 38,000 words) on observations and reflections during the 350 hours spent at the care home. This questionnaires and diary will be analysed as part of the PhD study.

## **6. Key Findings**

This study was designed to investigate whether assistive technologies using an open platform could improve the quality of care and ultimately the wellbeing of residents looking at safety, monitoring, environmental conditions, entertainment and communication. This study is part of a four year PhD, due for completion in August 2017 therefore the findings presented in this report are interim findings.

The eight inch handheld tablets were light so residents were able to carry the tablets around and use them without getting too tired, however some did find the screen small for typing. All residents had to use a felt tipped stylus due to their long nails. Some staff and residents were adventurous in using their tablets, and tested the Google voice operated search function by themselves.

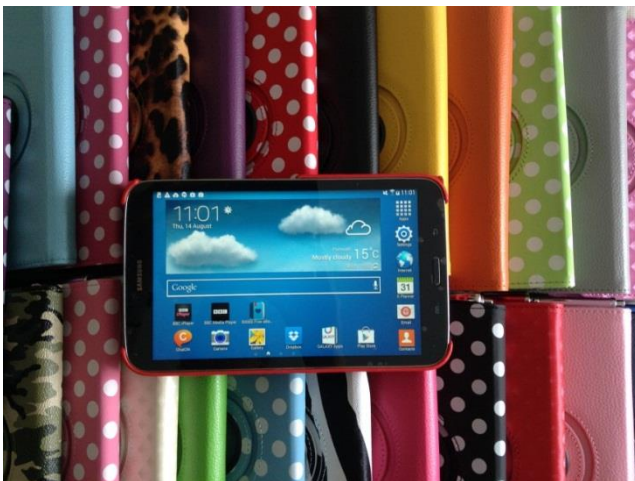


**Image 5: Researcher giving a resident a lesson**

*"...isn't this machine clever!"* [Participant referring to using the internet on the handheld tablet]

*"This amuses me because you just say 'Okay Google..' and up it comes!"*

Participants enjoyed choosing the colour of their tablet cases. Image 6 shows the selection of cases.



**Image 6: Coloured cases for hand held tablets**

There were a number of complications due to the construction of the building, which resulted in the radio waves and wireless signal being unable to penetrate the three foot thick granite walls, therefore some areas were impossible to access via connectivity, for example bathrooms and private bedrooms. This impacted on the scope of the project, which is reflected in the findings below.

## **6.1. Quality of care**

The two areas of focus under higher quality of care were safety and monitoring.

### **6.1.1. Safety**

The issue of safety ultimately was not addressed in the field study due to the bad connectivity in the building (as outlined above). Flood detectors and other monitoring devices could not be used in areas some distance from the central hub of the system.

### **6.1.2. Monitoring**

With 30 sensors installed in six areas of the main house and self-contained bungalow, monitoring statistics were collected over 12 months (with an additional four months still to be collected – at the time of writing this report). The monitoring system acted as assurance to residents and their families that the ambient environment was a suitable temperature (humidity was also monitored); it was especially useful for one particular resident who regularly raised questions about the heating.

## **6.2. Wellbeing**

The two areas of focus under wellbeing were entertainment and communication.

When residents volunteered to join the study, the researcher looked at ways the handheld tablet could be useful to them, some wanted the device as a tool to communicate and others wanted it to access additional entertainment. An unexpected finding was how the device brought people together from different groups: cross generational (resident and grandchildren), cross roles (resident and staff member) and across the residents themselves. Staff (carers, kitchen staff and activities coordinator) helped residents' access applications on the handheld tablets. The handheld tablet became a topic of conversation between the younger generation and the grandparent (resident) with photographs being taken on the device, and the youngsters giving the grandparent (resident) a whirlwind tour of the capabilities of the device. The handheld tablets were even a topic of conversation amongst residents at meal times.

For those less able bodied residents the digital television was available for all to use in the shared living room. Apart from the usual game shows and news, there were occasions when the researcher and activities coordinator used the screen to show photos of activities that residents had participated in (screen mirror function available on the handheld tablets). On one occasion, visiting relatives were seated in the living room during this session, where the photos sparked conversation about activities for example a visit from the donkey sanctuary, pumpkin carving and outings. It was very rewarding to see the younger generation get involved in these conversations and ask their grandparent (resident) about the activity.

### 6.2.1. Entertainment

A number of residents wanted to use the handheld tablets to access additional entertainment. Depending on the needs of individual residents the handheld tablets were used for different activities for example watching videos and finding poems, valuating stamps, looking up family history, searching for facts and news, and reading eBooks. Applications such as YouTube, Facebook, Borrow Box (Cornwall Library Books), Zino (Magazines) and Google Books were used, as well as other applications for Sudoku, Chess and Crosswords.

*"I've got pins and needles, numbness, in both my hands and yet if I hold a book after a very few minutes I have to put it down. But with that I can put my cushion on my lap and then the tablet rests of there and I don't have to hold it at all."*

*"I find the books, being able to borrow books, is the main advantage, I think."*

*"...In hospital but got tablet with me. Hooray!"* [Participant referring to using the handheld tablet for entertainment while in hospital]



**Image 7: Resident looking up the words of a poem**

### 6.2.2. Communication

For some residents, the key focus was on communication. One resident, who had never used a computer wanted to spend less money on postage stamps and was interested in sending free electronic messages (email). The resident was skilled in using a type writer so was confident in using the keyboard on the handheld tablet. The resident was involved for six months, and became confident in sending and receiving emails.

*"...it's lovely to keep in touch with your family like you go on Facebook and your grandchildren or great-grandchildren have put things on there and pictures and what you can see what they've been doing and they keep in touch."*

*"It's a complete mystery to me but I must say it's useful."* [Participant referring to using email on the handheld tablet]

### **6.3. Functionality of the open platform**

This study provided the perfect opportunity to test an open platform in a care home environment. Overall the devices functioned well, but there were some operational challenges due to the high volume of traffic in shared areas where some passive infrared detectors did not work as well as had been expected. Two devices were replaced and another two devices were hard wired into the power point due to the high volume of batteries consumed.

As the study progressed it became clear that adjustments needed to be made to the ambient environment on a day by day or hour by hour basis, especially in certain areas of the house. Most of the residents spent their day sitting still and therefore wanted the immediate environment extremely warm. In winter the background temperature was set at approximately 23-24 degrees (depending on the area), in spring and autumn it was set at approximately 21 degrees and summer at approximately 18 degrees.

At the time of writing this report, 12 months of data had been collected from the sensors with a further four months to go.

## **7. Key issues**

There were a number of issues in undertaking this project:

- Connectivity within the building due to its construction – It was assumed that there would be connectivity issues at the care home, however the scale of the problem was not anticipated. In order to overcome the poor wireless internet signal, exterior cabling was laid to link four routers at different locations in the house. This gave the communal areas access to high speed Superfast broadband. The radio wave signal was also an issue with the z-waves unable to penetrate the thick walls between the original building and extension. To overcome this additional plug points were installed to carry the z-wave signals down the passages. This allowed for the installation of the environmental sensors in select communal areas; unfortunately the signal did not extend to private bedrooms. The lack of signal (both wireless internet and radio signal) impacted on the areas that devices could be installed and/or used.
- Budget constraints – The care home had a 'wish list' with a need to improve and introduce some alerting devices for example the nurse call system, resident monitoring system, fall detectors and flood detectors. Unfortunately, some of these devices were outside the financial scope of the study. A number of manufactures were invited to participate and provide a resident monitoring system' however none accepted the invitation to participate.

- Ethical restrictions – It was unfortunate that the study excluded residents who lacked full capacity, as it was thought that these were the individuals who could have benefitted the most.
- Challenging environment – A care home environment is forever changing with residents' health fluctuating and changes in staff. Therefore a number of initial ideas for devices were not realised for example video conferencing with Skype, medication reminders and messaging services.

## **8. Next Steps**

This study continues as PhD until August 2017, with field work drawing to a close in September 2015. The researcher continues to train and assist staff in using the devices in the care home, in the hope that some devices will still be used once the study is complete. The environmental monitoring devices will be removed in August 2015, and the original devices will be replaced. The handheld tablets, digital television and wireless printer will remain at the care home and will be available for residents to use after the study has drawn to a close.

## **9. Engagement and Impact**

This study has taken a people-centred inclusive design approach using existing technology and applications. Based in Cornwall, the researcher has tried to stay connected to the national health and technology research fields. During this study, the researcher attended:

- Assisted living innovation platform (ALIP) – Technology Strategy Board
- Issues and perspectives on digital technologies and care – Manchester University
- Advancing knowledge of telecare for independence and vitality in later life (AKTIV) – Centre for International Research on Care, Labour and Equalities
- Independent living group – KX Bridge
- Superfast researchers event – BT Adastral Park
- Health, housing and ageing – Peninsula Public Health Network
- Designing new products, spaces and systems in health and social care – Plymouth University (The researcher was a member of the winning group with a design of a hands free blue tooth enabled communication device for nurses in hospital units)
- Innovation in community healthcare – Royal Society of Medicine
- Active ageing with technology – Royal Society of Medicine
- eHealth jam – University of Exeter Medical School and a Cornish design company
- Playing games, using apps, promoting wellbeing – Royal Society of Medicine
- Digital research in the humanities and arts – Greenwich University
- Integrated care using technology – Royal Society of Medicine
- Creating an impact: social care research in place – London School of Economics
- Annual conference of the school for social care research – National Institute for Health Research

- Digital healthcare – Worldwide Web Conference

The project connected with the following groups:

- The Centre for Usable Home Technology – Culture Labs, York and Newcastle Universities
- Sustainability, Society and Health Research Cluster – Plymouth University

It is difficult at this stage to assess whether or not this study will have a lasting impact on residents and staff. It is hoped that the legacy of the project will continue as some staff and residents are confident in using the devices (handheld tablets, digital television and wireless printer) that will remain at the care home.

## **10. Dissemination**

Harvie, T. (2013) 'eServices on demand for residential care homes' Presentation for Open Friday at Falmouth University, 19<sup>th</sup> July 2013

Harvie, T. (2013) 'eServices on demand for residential care homes', Presentation for Superfast Researchers Day, 10<sup>th</sup> September 2013

Harvie, T (2014) 'eServices on demand for residential care homes', Presentation for Sustainable Design Course at Falmouth University, 7<sup>th</sup> May 2014

Harvie, T. (2014) 'Researching digital technology in a residential care home', Presentation for PhD Summer Symposium at Falmouth University, 26<sup>th</sup> June 2014

Harvie, T. (2014) 'Would you like to dance?', Presentation for Writing Communities: People as Place at Falmouth University, 29<sup>th</sup> June 2014

Harvie, T (2014) 'Designing services for care home residents', Presentation for Sustainable Design Course at Falmouth University, 2<sup>nd</sup> October 2014

Harvie, T. (2015) 'Impacts of digital technology on the wellbeing of residents in a residential care home in Cornwall', Presentation for PhD Spring Symposium at Falmouth University, 13<sup>th</sup> February 2015

Future dissemination includes journals articles, conference papers and a published PhD in 2017/2018



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## Appendix 1

### Equipment List

- Thermostatic radiator valves – Danfoss z-wave radiator thermostat for RA valves M30 x 1.5
- Temperature/humidity sensors – Everspring ST814 z-wave temperature/humidity detector
- Passive infrared detectors - Everspring SP814 z-wave lens changeable PIR detector
- Motion sensors – Aeon labs z-wave door/window sensor
- Aperture device – Topp ACK42 230v window motor
- Flood detectors – Everspring ST812 z-wave flood detector
- Handheld tablets – Samsung Galaxy 3 8 inch Wi-Fi tablet
- Digital television – Sony Bravia KDL48W605 Smart 48 inch LED TV
- Wireless printer – Canon PIXMA MG4250 all-in-one printer