My Place

my life, my choice

THE HOME AUTOMATION PROJECT

ENABLING PEOPLE WITH DISABILITY TO LIVE MORE SAFELY, INDEPENDENTLY, COMFORTABLY AND ECONOMICALLY.

GREG LEWIS
TONY RYAN
PHIL DESCHAMP
PETER DUNN

MY PLACE FOUNDATION INC.
17 YORK STREET, SUBIACO, WESTERN AUSTRALIA
E: GREG.LEWIS@MYPLACE.ORG.AU W: WWW.MYPLACE.ORG.AU

AUGUST, 2015

JOINTLY FUNDED THROUGH A
WESTERN AUSTRALIAN GOVERNMENT SOCIAL INNOVATION GRANT
AND
MY PLACE PHILANTHROPIC FUND

EXECUTIVE SUMMARY

While it has long been acknowledged that the use of assistive technology can play a vital role in enabling people with disability to live more independently and participate more in community life, there is little sign of any systematic efforts to make this a reality for the growing number of people with disability who are living in their own homes.

This project set out to demonstrate that sophisticated and reliable home automation systems that are commercially available to the wider community could be customised and adapted for people with a range of disabilities by competent installers at an economical price.

The project found that the purposes to which home automation is put is limited more by the person's imagination than the technical capabilities of home automation systems or the availability of suitable switching mechanisms. In this project alone, home automation was put to more than 30 different uses in and around the homes of 21 people with disability (see Appendix A).

This project established that the design and installation of efficacious home automation systems did not prove to be an arcane science requiring the involvement of doctors, therapists and clinical engineers. Rather it required the person with a disability, and anybody they chose to be involved in the discussions, to be presented with practical information by people who had expertise in the installation of home automation systems and had the time to sit down and explore all possibilities. On the basis that people don't know what they don't know, these discussions were enhanced by presenting each person with a customised suite of assistive devices that might be useful and practicable to them.

The cost of the home automation systems in this project averaged $12,463 and ranged from $3,610 to $20,760, with two-thirds of the installations within $2,000 of the average. Disability funding bodies will be more attracted to one-off home automation funding if they can see an economic, as well as a social, dividend. If a home automation system saved a user just five hours per week in support hours, this would translate to a saving of $12,500 per annum at an hourly funded support rate of $50. Thus, the average home automation system, as described in this project, would pay itself off in just one year. This project did not have the capacity to undertake a more detailed cost-efficiency analysis. The authors recommend that this research be undertaken in the future, perhaps in collaboration with a major accounting firm, to provide better financial metrics for people with disability, funders and providers.

An unanticipated finding of the project was that several people with significant physical disability declined an invitation to join the project on the grounds that there were other people with disability who were more needy than them. Had My Place been able to provide them with better cost-efficiency data (as recommended above), they would have understood that the taxpayer was financially ahead after just one or two years. This would then enable other

people to have their homes similarly automated – and their decision to decline the invitation to participate in the project may have been different.

Another unexpected finding of the Home Automation Project was that four of the original participants chose not to proceed to installation. The major reason behind their respective decisions to withdraw from the project appeared to be their trepidation about the impact of the installation of so much new and unknown technology on their home, themselves and their support staff.

It is probable that many other people with disability have equally mixed views about technology (which they no doubt share with the wider, typically older community). Having an opportunity to visit the home of a person with a similar disability and have a frank and open conversation about the pros and cons of home automation may be a crucial factor in them deciding to have their own home automated. This project set out to establish a network of automated homes around Perth that were open to interested people, especially people with disability. The fact that more than 60 people have already visited one or other of these homes is early testament to the success of that initiative.

Previous research has found that assistive technology, if it was installed, was often abandoned due to poor device performance, dissatisfaction with equipment and/or changes in user needs or priorities. This project required home automation participants to commit to pay $500 for a six-monthly maintenance visit by the installers to reduce the likelihood of disengagement. As almost all of the project participants are already receiving individualised living support from My Place, the ongoing usage of the home automation technology will be able to be monitored and reported over time.

The independent post-installation survey undertaken during the course of this project revealed a number of common themes. Pre-eminent amongst these was the increased sense of security and safety that the home automation brought to people with disability and everybody else who lived in, worked in or visited their home. Respondents also expected to exert less physical effort and suffer less physical injuries from no longer having to struggle with doors and switches.

Another dominant theme was being able to have ‘me time’. Many treasured the opportunity that home automation afforded them in being able to spend several hours at home (or even overnight) without having any family or carers in the house - in other words, to be more independent and to have more freedom. Coupled with this was the ease and efficiency with which they could now enter and leave their homes, which made it easier for them to come and go as they pleased. Several family members and carers also felt more free to be able to leave the house knowing that the technology would look after the person and that they could easily be alerted if something had gone wrong.

Many respondents appreciated the reduced reliance they now had on family members and carers to undertake simple tasks such as getting into or out of the house, turning lights and air conditioners on and off, or watching TV. They

were similarly comforted in the knowledge that there was less pressure on the family to always be available to help out.

Some respondents offered the observation that it had become easier to recruit and retain support people as their newly automated home worked better for everybody in it – and that they were able to use their disability support funding more flexibly by freeing up funds previously spent on tasks that they were now able to do themselves through their home automation system.

Other respondents reported they were living a more comfortable life, a more dignified life, a more enjoyable life. As one respondent, who had recently moved into his own home after 30 years living in a group home, exclaimed at the post-installation survey, ‘I love my life!’

'It took ages to get in the front door using the key, which meant if I was desperate to go to the toilet I often didn't make it. Now the remote lets me get in straightaway. If I accidentally drop my remote, I can call Mum and she can open my front door from 20 kilometres away!'

Home Automation Project Participant

THE HOME AUTOMATION LANDSCAPE IN WA

In 2008, the WA Disability Services Commission (DSC) established a reference group, which included My Place, to assist people with disability, policy makers and stakeholders to work together to create a new direction for people with disability living in the community. The resultant publication was titled *Count Me In – Disability Future Directions* (Disability Services Commission, 2010).

Count Me In identified 13 key areas requiring attention by DSC. One of the priority areas identified was Enabling Information and Technologies, noting that 'Rapidly developing information, communication and assistive technologies have the potential to open up a range of opportunities to people with disabilities.'

Count Me In identified six pathways that would assist in achieving this priority area. Of relevance to the current project are:

- Pathway 1: Ensure that people with disabilities can easily access and afford new developments in assistive technologies and the technical support needed to maintain their effective use.
- Pathway 4: Improve the benefits of assistive technology through better matches between individual needs and equipment and by training people in their effective use.

Assistive Technology in this context can be taken to refer to 'Any device, system or design…that allows an individual to perform a task that they would otherwise be unable to do, or increase the ease and safety with which a task can be performed.' (Independent Living Centre Australia, 2009).

Soon after the publication of *Count Me In*, the Independent Living Centre of WA (ILC) published findings of an audit of assistive technology, in which My Place was a co-investigator, titled '*Access and Use of Assistive Technology for Adults Living in Supported Accommodation.*' (Independent Living Centre, 2011). In the report's words, the audit was intended to assist DSC, stakeholders, service providers and people with disability to:

- Identify unmet needs in the areas of assistive technology in accommodation services.
- Provide resources and strategies to manage assistive technology in accommodation services.

The audit reviewed the access to and use of specific forms of equipment, information communication technologies (ICT); telecommunications, augmentative and alternative communication (AAC); environmental control units (ECU); and night-time positioning equipment.

The ILC report found that the literature supported the qualitative belief that the use of assistive technology played a vital role in enabling people to complete daily activities and participate in community life (Scherer and Glueckauf, 2005).

A Victorian study, also referred to in the ILC report, found that assistive technology had a positive impact on a person's life and facilitates their daily participation across a broad spectrum of life areas. (Layton, Wilson, Colgan et al, 2010). The same study found that people who have limited or poor access to assistive technology were negatively impacted in terms of their ability to participate in the community and complete of daily living activities.

The ILC report also explored the reasons why people with disability gave up using various assistive technologies that had been previously provided to them. Hongxin and Philips (1993) identified four primary reasons: lack of consideration for the user's opinion, easy device procurement, poor device performance and change in user needs or priorities. They concluded that this highlighted the need for assistive technology assessors and providers to take a more person-centred approach to equipment selection, purchase and use of assistive technologies. Other researchers have found that when the user does not feel the outcome has met their personal goal of achieving the set task this leads to dissatisfaction with the equipment and loss of value (Scherer, Sax, Vandbierdvliet et al, 2005). Assistive technology users reported the need to have their equipment needs reviewed as their lifestyle and activities changed (Louise-Bender Pape, Kim and Weiner, 2002).

In relation to Environmental Control Units (ECUs), which is most relevant to My Place's Home Automation Project, the ILC found that access to other environmental controls (e.g. doors, windows, lights, air conditioners, TVs, security systems) was rarely addressed for people with disability - even those who were living in their own homes in the community (which is the case with all of the people that My Place supports, unless they are living with their family).

The ILC report found that door openers were the most common form of ECU. In one case a person living in their own home had been provided with an electric door opener on her main door, but she was unable to open her security screen door and therefore had to leave this unlocked. Consequently, there was no way for her to speak to someone through her door safely. Another person living in their own home had no way to access his provided personal alarm system at times his support people were not present as he could not independently manoeuvre his wheelchair to the computer to contact someone. Two people living in their own homes had created homemade door opening systems, which allowed them to turn the handle then hold a rope and drive their wheelchairs back to open their front doors. However, as the ILC

report observed, there was no way for them to exit the property quickly in an emergency situation.

The ILC report found that ECUs are not funded under the DSC Community Aids and Equipment Program (CAEP): 'essential equipment' being limited to the 'most basic model/type that meets the clinical need' (Disability Services Commission, 2014). The majority of people with any ECUs in their own home were funded through individual grant applications.

THE ORIGINAL VISION

At the time the current project was conceptualised, it appeared that no-one had yet put together a comprehensive home automation system, for many of the reasons outlined above. Efforts to create an assisted living house had been generally *ad hoc* by individuals working largely in isolation. An early, and successful, example of such an effort was a young man with a significant physical disability by the name of Ben Brown. Ben designed and planned his own home in Shenton Park in the early 2000s. The home was comprehensively automated and could be controlled by voice commands, allowing him to live alone and fairly independently. This gave more control over his life and his need for support people was less, meaning that his support costs were correspondingly reduced.

Subsequent to his untimely death, Ben's family and friends decided that his legacy should live on and benefit other people with disability – and, from this, Bentech Assistive Technologies was formed. The first project undertaken by Bentech was to research, develop, prove and implement a range of home automation devices supported by an integrated control system to enable the devices to be independently operated by people with disability.

As an unincorporated organisation, Bentech needed to partner with a recognised not-for-profit organisation that was qualified to make application for funding under the Social Innovation Grants program administered by the Department of Local Government and Communities. After two earlier partnering efforts had failed to germinate, Bentech approached My Place Foundation Inc. to develop and submit a grant application under the name *Ben's House Project*. My Place supports more than 300 people with disability in their own homes or their family home. As such it opened the doors to the homes of many people with disability who would potentially benefit from the installation of home automation devices.

The grant application contended that little had yet been done in Australia, or even overseas, to make the technologies available to people with disability in an integrated manner. This was attributed to: components that are not readily available from known suppliers; the lack of a single integrated operating system for all components; and the high cost for individual components; and the difficulties involved in procuring and installing these components.

This project aimed to address the above deficiencies by designing and developing integrated systems that have the ability to control a range of

assistive technologies aimed directly at people with disability. This would enable them to enjoy a more independent, comfortable and secure life in their own homes.

A Project Steering Group was formed comprising four representatives each from My Place and Bentech to steer the project. Each partner had a distinct role in the project. My Place's role was to be the project manager (as the recipient of the grant funds), manage the grant funds, undertake the financial management and administration, take responsibility for engaging any staff, and acquit the grant funds. Bentech was responsible for the day-to-day project operations and for delivering the outcomes of the project.

The project commenced with an assistive technology needs survey involving 27 people with disability currently living in their own homes with the support of My Place and understood to be interested in home automation. The face-to-face surveys were developed by My Place and jointly administered by My Place and Bentech representatives. Four individuals surveyed lived in the Kimberley, 2500 kilometres north of Perth, and one lived in Busselton, 250 kilometres south of Perth. The primary purpose of the survey was to establish a baseline of how people were living before the introduction of any assistive technology and to establish what types of assistive technology each person thought might be of greatest value and utility to them. If respondents were unsure of what might be available or possible, they were provided with examples of possible home automation devices. A secondary purpose was to give the Bentech representatives a broader understanding to the way that people with a range of disabilities and support arrangements were living their lives.

The survey revealed that respondents identified the following home automation features as being vital, useful or a bonus to have installed in their own home (see Table 1).

As Table 1 shows, 14 out of 27 (52%) respondents did not identify a single home automation device that they felt they needed, would find useful or would even be nice to have. Given that all of the people who were invited to participate in the home automation survey had been nominated by their respective My Place service co-ordinator as likely to benefit from some form of automation, and given that all agreed to participate in the project and the survey, these results are somewhat surprising.

Table 1. Rank order of initial survey respondents by automated devices that were identified as A ('really need'), B ('very useful') or C ('nice to have').

ORIGINAL INTERVIEWEE	Front door controller (10)	Rear door controller (10)	Internal door controller (9)	Front door communications (8)	Emergency call system (8)	Lift + transfer assistance (6)	Computer controller (6)	Lighting controller (5)	Gate controller (4)	Television controller (4)	Phone/mobile controller (4)	External monitoring system (4)	Radio/music controller (3)	Bed controller (3)	Bathing assistance (3)	House communications system (2)	Shower controller (2)	Food preparation aids (2)	Window controller (1)	Internal Blind controller (1)	Power point controller (1)	Equipment charging system (1)	TOTAL DEVICVES
1	A	A	C	A		C	B	A	A	A	A	C	B			A							13
2	A	A	B	C	A		A	B	A		A	A											10
3	B	A		C	A		A		B	A	A	C	A										10
4	A	A	A		A	B			A	B							B	B					9
5	A	A	B	A	B		B	A			C				A								9
6	A	A	A		A	A		A							B						B		8
7	A		B		B	C		A						A				B				C	8
8	B	B	B	A		B								A			B						7
9					A		A			A			A	A	A								6
10		C		A		B										A			C	B			6
11	A	A	A	B			A																5
12	A	A	A																				3
13				B	A							A											3
T	10	10	9	8	8	6	6	5	4	4	4	4	3	3	3	2	2	2	1	1	1	1	

Several possible reasons may be advanced as to why more than half of the participants saw no need for any of the above assistive devices – or any other assistive devices. They may have found it difficult to conceptualise just how such devices could be operated safely, reliably, simply and effectively. They may have felt there were others with disability who more 'needy' than them (this sentiment became more evident later in the project). They may have preferred to wait until others had installed and tested the devices before they were willing to become involved.

The other 13 respondents (48%) identified, with or without some prompting or suggestions, 22 different home automation devices that they thought they really needed, would find very useful or would just be nice to have. Across the 97 discrete device nominations (respondents identified between three and 13 devices), 61% were rated as 'really needed', 28% were categorised as 'very useful' and only 11% were considered 'nice to have'. This suggests that respondents were limiting their requests to devices they felt would have a material impact on their independence and safety around the home.

The most commonly identified devices were those that controlled entry into and egress from their home, movement within their home, audio-visual communication facilities to establish who was seeking to enter their home, and an emergency communication system should they need help or feel endangered. In fact, half of all assistive technology identified by respondents

fell into one of these five categories – and two-thirds of those were rated as ‘really needed’.

The theme that connects all of the most commonly identified, and most needed, home automation devices is safety (underlined by the fact that many of the respondents, especially those who lived alone, simply left their doors unlocked to enable support people to come and go as required). This finding accords with Maslow’s Needs Hierarchy (Maslow, 1954): that the most basic, or physiological, level of needs (e.g. shelter, sustenance, safety and security) must be met before the individual will focus upon higher, or psychological, levels of need (e.g. friendship, intimacy, self-esteem, self-actualisation). From a human development standpoint, these basic needs simply have to be met if the individual is to grow and reach their full potential. Thus, home automation should not be viewed as a luxury, but as a necessary pre-cursor to a person with disability living the life to which they aspire.

Based on the above survey findings, the Bentech project members set about working on the most commonly identified assistive technologies with the intention of first installing them in a one-tenth-scale model ‘house’ in the first instance. The model, in effect, was a one-room house that could be operated by a smart phone over the Internet. The scale model house, being portable, could then be used for educative and demonstration purposes.

From the outset, the project attracted significant interest and a growing band of volunteers. Within 12 months of launching the project, Bentech had some 20 volunteers working on the project and contributing more than half of the total hours being invested in research and development. The volunteers brought expertise in legal matters, strategic planning, research methods, business, manufacturing, computer and network configuration, software engineering, digital electronics, electrical wiring, mechanical engineering, mechatronics and assistive technology.

The project was also invited to enter the 2013/14 Western Australian Information Technology and Telecommunications Association Awards and was subsequently selected as a finalist in the Community Division, which resulted in an automatic direct entry into the national competition. This opportunity was not taken up as it was considered too early in the development of the project.

By early 2014, the Bentech project members had developed and built their own automated door that could be controlled from a smart phone through a Raspberry Pi (a $30 credit card-sized single-board computer developed in the UK by the Raspberry Pi Foundation). A camera was mounted on top of the door and fed a video image back to the smart phone. When a visitor rang the front door the image came up on the smart phone, enabling the user to see who was at the door and communicate verbally through the phone and camera. An icon on the phone could then be pressed to automatically open the door.

The Bentech project members next developed their own ‘control hub’ that was capable of taking inputs from a range of different sources, processing those signals and then sending out signals to a range of actuators. This meant that, if the person had their own computer, that could serve as the hub. A software solution was subsequently developed that enabled the program to be loaded onto a computer and be activated remotely. It could then read what actuators it was required to drive, configure itself and generate the required menu structure for the user. The main input for the system was a browser based menu that could be operated on any device that could access the web. This meant that the person could operate it from any brand or model of smart phone, tablet or computer.

The other input developed by the project team was voice recognition, which allowed the use of simple voice commands to operate the system. Work had also commenced on muscle-sensing switches to further extend the range of user-device interfaces. This system only required the user to have control of one muscle. When activated, the muscle sent a small electrical signal to sensors attached to the skin. This signal then activated an array of devices via a rolling menu. When the desired device was highlighted, the user simply flexed the muscle and the device was activated (e.g. a light was turned on).

A Change of Direction

In the two years that had elapsed between the original project submission in October 2012 and the progress that is described above, significant and rapid advances began to be reported in home automation technology for the general population.

Because of these advances, the original project premise that ‘no-one had yet put together a comprehensive home automation system’ no longer held true. Ongoing research undertaken by the broader project team revealed that proven, certified, integrated systems that can be operated by one core unit in a flexible manner were now becoming available in the marketplace at very reasonable cost.

As a case in point, the Fibaro home automation system (www.fibaro.com), first developed in Poland several years ago, had already been installed in more than 40,000 homes and offices around the world, including Perth. Fibaro, which is designed for the generic home and office market, can operate both swing and sliding doors, windows, blinds, air-conditioning, lights, intercom with camera, and music/TV/Foxtel systems - all with voice recognition capability. The Fibaro system operates through a base station, the current model being the Fibaro Home Center 2, and communicates with all devices that incorporate the Z-wave wireless standard. This means that it is able to control the majority of electrical devices and appliances in a typical home. Many other devices (e.g. light switches, power points) can be enhanced with Fibaro compatible wireless receivers so that they can be operated remotely in addition to the normal way.

The Fibaro automated home can be controlled from anywhere in the world via devices such as laptops, smartphones and tablets via a free downloadable and customisable App (see itunes.apple.com or play.google.com). The Fibaro system operates autonomously, based on information received from sensors and via GPS. The Fibaro system is installed on existing electrical systems without the need to modify the building structure, meaning that it can be packed up and reinstalled in another home.

Fibaro is fully authorised and proven - and constantly being enhanced by a large team of electronic and software engineers around the world. Other organisations, including some in Perth, are now developing switching arrangements so that people with disability for whom voice control is not viable, can also operate the system through interfaces such as neuro-muscular switches, eye-pointers and the like.

My Place organised to have a Fibaro home automation system installed in the home of a person with disability and customised to their needs and preferences to test the practicality, efficacy and cost of such a system. The design and installation was undertaken by a local Fibaro agent operating as aLED (aled.com.au). The trial installation was judged by the person and key stakeholders to be a success.

Armed with the knowledge that the project's principal objectives could be successfully achieved immediately and at a realistic cost through a WA-based installer, My Place's representatives considered that it was no longer justifiable for the project to continue spending public money on developing, proving and commercialising a competing system when a suitable and locally available alternative had presented itself. The Bentech members on the Project Steering Group did not share this view - and the two parties determined to go their separate ways. My Place advised the Social Innovation Grants program administrators of this outcome in June 2014 and resolved, as it was the sole signatory on the Grant Agreement, to proceed with the project on its own.

THE SECOND SURVEY

Having assumed responsibility for all aspects of the project, My Place approached 23 of original 27 people with disability who had been surveyed by Bentech representatives during the original needs survey – and who had not had any communication since the survey was undertaken 18 months previously. The other four original interviewees, who lived in Broome and Fitzroy Crossing in the Kimberley region of northern WA, were felt to be outside the financial resources of the project to install and maintain potentially complex home automation systems.

The purpose of the contact with the remaining 23 interviewees was to offer each of them a comprehensive home automation system built around their specific needs and preferences – regardless of whether they had identified the need of, or interest in, home automation in the first survey. Only 14 of the original 23 respondents were in a position to, or willing to take up, the offer.

Two had died in the interim, two had moved into private rental accommodation and six declined to participate for various reasons (including feeling that others were more deserving and becoming too ill to effectively operate a home automation system). An additional seven people with disability were identified by My Place to replace the people who were no longer participating in the project: bringing the total number of participants to 21 people living in 20 different homes (two brothers were living at home with their parents).

All but one of the 21 participants lives in the Perth metropolitan area (the other person lives in Busselton, 230 kilometres south of Perth). Nine people live in their own homes, eight live in houses supplied through the Department of Housing, three live at home with their parents and one lives in a separate dwelling at the rear of his parents' property.

Five of the participants are female and 16 are male. The average age of participants is 45, with a range from 11 to 72. The disabilities of the participants are:

- Quadriplegia (5)
- Muscular dystrophy (4)
- Spinal muscular atrophy
- Hemiplegia
- Tetraplegia
- Cerebral palsy
- Cerebral palsy and vision/hearing impairments
- Cerebral palsy and intellectual disability
- Intellectual disability
- Intellectual disability and neurological disability
- Rhett syndrome
- Cerebellar ataxia type 6
- Cerebrovascular accident (stroke)
- Multiple sclerosis

An interesting finding from the Home Automation Project is that the participants' original ideas about what assistive devices that they needed or wanted altered significantly across the two surveys. This was evident in the array of assistive devices newly selected and de-selected across the two surveys and also the increased number of assistive devices selected in the second survey.

A key difference between the first round of surveys and the return surveys 18 months later, was that an experienced designer and installer of home automation systems (namely, the principal of aLED) was present at each interview. The installer's broad knowledge of the range of what could be practically and economically automated within each person's home enabled the person and their families and/or key support people (including the My Place service co-ordinator who was present at all interviews) to consider a far broader menu of home automation possibilities than had either been contemplated, or thought possible, at the original interview.

Perhaps largely as a result of this more informed discussion, the automation features from the original survey were expanded in the second interview round to include, in rank order of frequency:

- Movement sensors for ceiling and side lights
- Movement sensors for air conditioners and fans
- Off-site monitoring and control of automated devices
- Garage door controllers with position feedback
- Automated security screens integrated into automated front doors
- Automated security roller shutters
- Wheelchair proximity activation systems when approaching a door

Also of interest is that four home automation possibilities that were identified in the first interview by participants (albeit at low frequency) did not feature when they were interviewed on the second occasion. These were:

- Computer controller (3)
- Bathing assistance (2)
- Lift and transfer assistance (1)
- Food preparation aids (1)
- Window openers (1)

The average number of automation types nominated by interviewees almost doubled from an average of 3.6 per home in the first survey round to 6.2 in the second survey round. The aspects of their homes that participants in the second round of surveys wanted automated were:

- Front door controllers (18/20)
- Internal light controllers – with or without motion sensors (18/20)
- Rear and/or side door controllers (11/20)
- Front door video/audio communications (11/20)
- External surveillance systems (9/20)
- Television controllers (7/20)
- Bathroom and bedroom door controllers (5/20)
- Radio/music controllers (5/20)
- Off-site monitoring/control of automated devices (5/20)
- Internal blind controllers (5/20)
- Front and side gate controller/s (4/20)
- Garage door controllers – with or without position feedback (3/20)
- Emergency call systems (3/20)
- Automated front doors with inset automated security screens (3/20)
- Security roller shutter controllers (3/20)
- Wheelchair proximity activation when approaching a door (1/20)
- Power point controller (1/20)
- Phone controller (1/20)
- Shower controller (1/20)
- Bed controller (1/20)

Researchers in home automation and assistive technology have contended that lack of consideration for the user's opinion significantly reduces for assistive technology uptake (Hongxin and Philips, 1993; Scherer, Sax, Vandbierdvliet et al, 2005). The survey findings from this project suggest that participant's opinions not only need to be central in the design of the system, but also need to be well informed.

To operate the various assistive devices, participants of selected from an array of control devices. These included iPhones, iPads, an Android phone, Mac and PC desktop computers, Mac and PC laptops, one to four button keyfob remotes, four to eight button hand held remotes, large format customised remotes, jelly button hand and head controls, oversized wall switch plates and buttons, environmental controllers, motion detectors, infra-red beams, wheelchair proximity activators, and voice control (LiLi comes pre-installed on the Fibaro App).

THE INSTALLATIONS

Following the first trial installation of the Fibaro home automation system in April 2014, My Place invited the only local Fibaro system supplier/installer (aLED) to customise various aspects of the Fibaro system to the needs of the person. This included allocation of specific person from aLED to assist the principal to undertake the installations. Although not the most qualified amongst his electricians, the selected person was older, and was thought would demonstrate a patient and thoughtful approach to modifying people's homes and equipment. As the project unfolded, a younger electrician from aLED also became involved in installations – and proved equally proficient. Later in the project, aLED collaborated with a similar business in Busselton to undertake the installation for the one participant who lived in that regional area.

The first author attended five of the early pre-installation surveys to provide feedback to the principal of aLED (who attended all of the pre-installation surveys) on how to ask questions of people with disability, how to provide information and how to develop a valid and reliable list of home automation needs and wants. Although his own qualifications were as an electrician (as were the other involved aLED staff), he and they learned very quickly how to communicate effectively with people who had a broad array of physical, cognitive, sensory and communication disabilities. The findings of the post-installation surveys that are reported later underline their proficiency in this regard.

With the exception of the original beta test site, all of the 19 home automation systems were designed and installed in the last nine months of the project (October 2014 to June 2015): a design/installation rate of one home automation system every two weeks. This compares more than favourably with the experience of several participants who reported having had to wait more than year to just have an automated front door installed in their homes, which usually proved unfit for purpose.

The cost of the home automation systems averaged $12,463 and ranged from $3,610 to $20,760. Three systems cost less than $10,000 and four cost more than $15,000 – suggesting a fairly tight clustering around the mean. Given the wide range of disabilities of the participants and the even wider array of automation devices that they elected to have installed, it is comforting from a budget planning standpoint that $12,500 is fairly reliable number to use across multiple sites and applications.

Two pre-conditions needed to be agreed prior to any installation proceeding. The first was that the person was willing and available to demonstrate their home automation to other interested people, which was a key project outcome. This may be people with a similar disability who wanted to see a home automation system in action before committing (an important strategy given that several original participants withdrew from the project just prior to installation due to uncertainty about the impact of having their home automated), researchers who are investigating the utility of home automation, professionals and technicians who are interested in the design and installation elements, and funding bodies who may be willing to provide future grants for home automation. By the end of the project, more than 60 such people have visited one or other of the home installation sites (primarily prospective users, disability professionals and researchers).

The second installation pre-condition was initiated due to previous research findings that assistive technology was often abandoned due to poor device performance, dissatisfaction with equipment and changes in user needs or priorities (Louise-Bender Pape, Kim and Weiner, 2002; Scherer, Sax, Vandbierdvliet et al, 2005). Home automation recipients agreed to a six-monthly maintenance visit by the installers. At each visit, all devices would be checked and re-calibrated where required, the person's current use of the installed technology would be reviewed, and emerging issues and automation solutions would be discussed. The person would make a financial contribution of $500 for each six-monthly maintenance visit out of their disability support funding.

During the course of each installation, the principal of aLED was asked to keep a record of the needs and preferences of each participant, the challenges addressed in customising operating systems and the customised user interfaces that needed to developed for each person. Appendix A includes a home installation report on the 19 home installations completed between October 2014 and June 2015.

While the home installation reports are self-explanatory from the perspective of the assistive technology implemented and the installation challenges that were overcome, several adjunctive themes emerged that need to be taken into account when installing home automation systems.

An important safety feature of the home automation systems installed through this project was that all of the doors, lights, appliances and other devices could still be operated as they had been prior to automation. That is, door handles still functioned, light switches still operated, proprietary remote

controls for TVs and air conditioners still operated. However, this would provide little comfort to the home occupier if they were suddenly plunged into darkness due to a mains power failure and were not able to manually operate these devices in any event. As a result, almost all of the homes that were automated were also fitted with uninterruptible power supplies (UPS) at the suggestion of aLED. This provided the person with at least 2-3 hours of continuous power – and, therefore sufficient time to take whatever action they needed should the mains power supply not be reinstated within that time.

Another vulnerability identified in the homes of approximately half of the people who participated in the project, was that their current Wi-Fi arrangements were not powerful enough to afford reliable connectivity. This led to a number of modems/routers being replaced during the course of the automation to enterprise grade. Other modems/routers were boosted by the addition of extra access points to ensure that the remotes, smartphones or tablets remained in communication with all assistive devices wherever the person was inside or around their home.

The other area that required considerable work on the part of the installers was the supply of standard or custom-built devices to operate the various home automation systems. A number of people did not have an adequate smartphone or tablet to download the Fibaro App or communicate with the automated devices. Sometimes it was the live-in support person or a family member who lived elsewhere who did not have the required technology. These problems were easily resolved by the supply of a suitable device. All of the smartphones/tablets already in place or supplied as part of the installation were then capable of controlling all of the automated devices by on-site or off-site physical manipulation and/or the voice control capability built into the installed Fibaro App.

Almost three-quarters of the homes that were automated utilised some form of remote control, as opposed to a smartphone or tablet (although most used some combination of the three). Two forms of remote control were most commonly supplied. The first was a compact keyfob remote with up to four buttons that could be programmed to operate any device connected to the Fibaro control hub. The second was a larger format hand-held remote with up to four buttons that could be configured to send eight different commands simply by pressing any of the buttons for a shorter or longer period.

A number of participants were not physically able to manipulate the above remotes. On these occasions, the installers worked with each person to build a remote control system that would work for them. On some occasions this involved building a large format wheelchair-mounted or hand-held remote with buttons that could be more easily and reliably struck with an unsteady hand. On other occasions large ‘jelly buttons’ were affixed to the sides of the wheelchair, or to the person’s head supports, to give them the opportunity to operate four automated devices in any particular zone of the house. On one occasion the system was further configured in conjunction with a wheelchair proximity sensor to operate different devices as the person moved through different zones in the house (e.g. TV and audio controls in the lounge room or

lighting/heating/door controls in the bathroom). A vast and growing array of mechanical press, lever, membrane, sip/puff, chin, eye-pointer, neuro-muscular switches is now widely available for purchase over the Internet (see spectronics.com.au), but were not needed in the course of this project.

THE POST-INSTALLATION SURVEYS

Once the 20 homes had been automated to the person's specifications, a post-installation survey was developed (see Appendix B) to ascertain:

- How they felt about the installers and installation;
- How the home automation systems had affected their lives;
- What home automation features they used the most;
- What home automation features didn't work so well;
- What parts of the home automation could be made to work better for them;
- What other home automation they think might be useful to them;
- Whether the home automation system had saved them any money in term of support or other disability related costs.

Ten of the 20 homes that were automated were selected for survey using an orthogonal approach. That is, once the first survey home was selected (which was arbitrarily chosen to be the first home that was automated), the second survey home was selected on the basis of being most different in most key aspects (disability, age, living situation, date of installation) from the first home selected. The third survey home was selected on the basis of being most different to the first two survey homes – and so on until the 10 most different survey homes were selected. Once the survey homes were known, a Project Information Sheet (describing the survey aims and administration) and a Consent Form was personally handed to each person by their My Place service co-ordinator, who was available to answer any questions.

The authors approached an independent interviewer who was a qualified psychologist with 30 years experience interviewing people with disabilities. Once the interviews were completed, the interviewer met with the first author to undertake a theme analysis of the survey findings. These findings are reported below.

The installers and the installation

The survey respondents were universally positive about the three aLED installers who were variously involved in the design and installation of their home automation systems. They were described as likeable people and competent installers with a friendly and helpful demeanour. They were seen to have good product knowledge, a broad skill base and able to open the person's eyes as to what other automated devices may be of benefit.

> *'I wasn't initially convinced about home automation, but Rob [from aLED] convinced me to the possibilities in a non-pressure way.'*

Beyond their product knowledge, they demonstrated insight into the individual needs of each person (e.g. locating the front door keypad so that their friends in wheelchairs could enter with the codes they had each been given). This extended to a willingness to alter or repair existing infrastructure to better accommodate the automation devices. They were also able to explain and demonstrate the technology in an unhurried, user-friendly, non-technical way.

> *'I used to be able to open the door with a hooked stick, but I took too long and damaged the switches. It also took me ten minutes to turn on my bedroom light (with a stick), which was tiring and exhausting. And sometimes I would fall out of my wheelchair. I was very conscious of the cost and I resisted because I thought it was extravagant, but Rob said I would cause further damage to the switches if I continued to hit them with the stick.'*

The installation itself generally met or exceeded expectations. The installers were noted for the speed with which they did the whole installation: typically between two and four days. They were variously described as professional, respectful, non-intrusive, discrete and clean. Post-installation, they responded quickly to any problems encountered - on either the equipment or the operator side.

> *'The [accessible] phone installation from [my former disability services provider] took one year - this took two-and-a-half days.'*

Effect of the home automation system on their lives

The dominant, almost universal, theme that emerged from the post-installation surveys was the increased sense of security and safety that the home automation brought. Coupled with this was the control they had over who entered their house. From a security and safety standpoint, respondents saw this as extending to everybody in their home: family, friends and support people. They also expected to suffer less physical injuries from no longer having to struggle with doors and switches.

> *'I'm a soft target and I dread school holidays. I can now shut my security blinds myself and my paranoia is down to a tolerable level.'*

Another dominant theme, mentioned by most of the respondents, was being able to have 'me time'. Many treasured the opportunity that home automation afforded them in being able to spend several hours at home (or even overnight) without having any family or carers in the house. Several family members and carers who participated in some of the interviews echoed this sentiment, saying they were no longer afraid to go out to the shops or lunch ('them time?') knowing that the technology would look after the person and that they could easily be alerted if something had gone wrong. In many cases the family member or carer could control the automated off-site with their smartphone or tablet. This brought peace of mind to everybody involved.

Others appreciated the reduced reliance they now had on family members and carers to undertake simple tasks such as getting into or out of the house, turning lights and air conditioners on and off, or watching TV.

> *'It's doing that extra bit by themselves. I can now leave the house before my sons and they don't have to wait outside [for their lift]'*

Several others mentioned the ease and efficiency with which they could now enter and leave their homes (reporting time savings of up to 30 minutes just getting through the front door). This meant that they could come and go as they pleased – not as family members and carers dictated or could accommodate.

> *'Opening my study and laundry doors was quite difficult, because you needed to open the door towards the wheelchair, which is not easy. I had devised a way of doing this with a loop of string, which worked. It was not very elegant and sometimes nearly cost me a tooth. The biggest help has been the ability to open and close the three doors I use most without any effort.'*

At a practical level, some respondents felt that it had become easier to recruit support people because the house was now safer, easier to work in and easier to sleep in.

At a more personal level, respondents talked about increased independence and control, savings in time to do things and a reduction in stress levels

> *'I don't have to call the carers or family members to come and turn off the lights or close the doors. Everything is at my fingertips.'*

The home automation features they used the most

Given that these automation features were the most commonly installed, it is not surprising that the most commonly used features were the automated doors, automated lights and camera/intercom systems at the entry to the house.

> *'The door openers are by far the technology I use most. I did not think this would be the case before we started. In fact, I did not think I needed them. I completely failed to appreciate the impact it would have.'*

Other home automation features that were installed in fewer homes were routinely or continuously used. This included the security roller shutters installed in several homes, the internal blinds and the motion-activated air conditioners and fans.

Naturally, the various devices that remotely drove the systems (such as remote controls, keyfobs, control panels, jelly buttons, smartphones and tablets – even the behind-the-scenes Fibaro control centre) were in regular or constant use. As one interviewee exclaimed, *'I live off my remote!'*

The home automation features that don't work so well or aren't useful

This survey question was of particular interest given the findings of previous researchers regarding the high rate of assistive technology abandonment by people with disability. No single theme emerged from the survey responses – rather individual issues that are best portrayed as a verbatim list:

- A particular brand of air conditioner in bedroom could not be manipulated through Fibaro
- The government installed automatic front door does not work reliably, or at all, but government won't fix it or let tenant get it fixed.
- Older TV is less amenable to full operation under Fibaro system
- Garage fluorescent light should have been hooked up to automatic garage door opener
- Older, occasional carers are reluctant to embrace the technology
- Have given all the carers/cleaners the same code – now need to give them a discrete codes

With exception of older non-compatible appliances and governmental constraints placed on fixing an automated front door, all of the issues raised can be easily resolved in a post-installation visit (some of these installations had only been completed a week or two prior to the survey) or the six-monthly maintenance visit.

Any part of home automation system that could have worked better

Respondents could offer few suggestions as to improvements in their systems. One respondent ventured that the hallway light motion sensors could be adjusted to avoid reacting to the cat's movements (this has been rectified). Another asked that the external surveillance camera be reoriented to take in the front door so that her mother could monitor it remotely from her own home (again now resolved). The same respondent reported that her keyfob remote and external door keypad were a little too compact for her to manipulate due to hand tremors. A third respondent felt that the external surveillance camera image was only just acceptable.

Other home automation technology that you think might be helpful.

Respondents were more forthcoming in regard to their home automation enhancement, with most offering at least one suggestion. These included: adding front door communications and remote opening; installing wheelchair proximity activation; automating internal lights to respond to movement; adding external cameras; and automating the TV. The most person-specific

suggestion was automating a sewing machine for a keen dressmaker with muscular dystrophy (which has since been done).

> *'It saved my sanity! My sister-in-law doesn't have to come over to turn on the sewing room lights for me.'*

Has your new technology saved you money on anything that you previously had to pay for?

An important line of enquiry in the home automation project was whether the installation of a comprehensive home automation system saved the person money in terms of reduced disability related costs.

Half of the respondents volunteered that they were, or were anticipating, savings in support costs. It was beyond the scope of this project to quantity those savings, but it is recommended that such research be undertaken to provide a stronger case to funding bodies about the economics of funding home automation.

Other respondents said that support costs could be redirected, rather than simply saved. One suggested, for example, that they could use the savings to enjoy more nights out with friends – a fillip to their quality of life.

Beyond direct support costs, it was suggested that there would be material savings in power costs as lights were replaced with low energy alternatives that turned themselves off when there was nobody in the area.

Parents, too, have seen benefits in the resultant reduction their own care obligations. One parent commented that she no longer needed to stay at home, or have someone else at home, to let her sons into the house.

> *'It allows [the boys] to be at home alone for several hours – and they like being alone.'*

The final word is left to the person who subjected himself to being the beta test site for the first home automation system undertaken through this project – and one of the project authors.

> *'It is also made it easier for my wife to go to sporting events, concerts and even interstate or overseas without requiring such an increase in support staff time. My being able to turn on heater lights, open doors, leave the house by myself, control audio-visual equipment and turn lights on and off in other rooms means I am far more independent.'*

CONCLUSION

This project set out to demonstrate that sophisticated and reliable home automation systems that are commercially available to the wider community could be customised and adapted for people with a range of disabilities by competent installers at an economical price. In this project alone, home automation was put to more than 30 different uses in and around people's homes (see Appendix A).

This project established that the design and installation of home automation systems did not need to be the exclusive domain of medical and allied health professionals. Rather it required the person with a disability, and anybody they chose to be involved in the discussions, to be presented with practical information by people who had expertise in the installation of home automation systems and had the time to sit down and explore all possibilities. On the basis that people don't know what they don't know, these discussions were enhanced by presenting each person with a customised suite of assistive devices that might be useful and practicable to them. This was not done in the first round of surveys in this project, as no designer/installer was involved at that stage, and probably explains average number of automation types nominated by interviewees almost doubled from an average of 3.6 per home in the first survey round to 6.2 in the second survey round.

The cost of the home automation systems averaged $12,463 and ranged from $3,610 to $20,760, with two-thirds of the installations within $2,000 of the average. My Place asserts that potential funding bodies (increasingly the National Disability Insurance Agency with the progressive roll-out of the National Disability Insurance Scheme) will be more attracted to one-off home automation funding if they can see a 'Return on Investment' in business parlance. If a home automation system saved a user just five hours per week in support hours, this would translate to a saving of $12,500 per annum at an hourly funded support rate of $50. Thus, the average home automation system, as described in this project, would pay itself off in just one year. Further research is required in this area.

Previous research has found that assistive technology, if it was installed, was often abandoned due to poor device performance, dissatisfaction with equipment and changes in user needs or priorities. This project required that home automation recipients pay for six-monthly maintenance visits, at which all devices would be checked and re-calibrated, current use of the installed technology would be reviewed, and emerging issues and automation solutions would be discussed.

The independent post-installation survey of half of the automated homes revealed a number of common themes. Pre-eminent amongst these was the increased sense of security and safety that the home automation brought to people with disability and everybody else who lived in, worked in or visited their home. Respondents also expected to exert less physical effort and suffer less physical injuries from no longer having to struggle with doors and switches.

Another dominant theme was being able to have ‘me time’. Many treasured the opportunity that home automation afforded them in being able to spend several hours at home (or even overnight) without having any family or carers in the house - in other words, to be more independent and to have more freedom. Coupled with this was the ease and efficiency with which they could now enter and leave their homes, which made it easier for them to come and go as they pleased. Several family members and carers also felt more free to be able to leave the house knowing that the technology would look after the person and that they could easily be alerted if something had gone wrong.

Many respondents appreciated the reduced reliance they now had on family members and carers to undertake simple tasks such as getting into or out of the house, turning lights and air conditioners on and off, or watching TV. They were similarly comforted in the knowledge that there was less pressure on the family to always be available to help out.

Some respondents offered the observation that it had become easier to recruit and retain support people as their newly automated home worked better for everybody in it – and that they were able to use their disability support funding more flexibly by freeing up funds previously spent on tasks that they were now able to do themselves through their home automation system. Other respondents reported they were living a more comfortable life, a more dignified life, a more enjoyable life.

REFERENCES

Disability Services Commission (2010). Count Me In - Disability Future Directions. Perth, Western Australia: Disability Services Commission.

Disability Services Commission (2014). Community Aids and Equipment Program: Referrer's Information Kit. Count Me In - Disability Future Directions. Perth, Western Australia: Disability Services Commission.

Fibaro Home Centre 2. www.fibaro.com

Hongxin, Z. and Phillips, B. Predictors of Assistive Technology Abandonment. Assistive Technology, 1993: 36-46.

Independent Living Centre (2011). Access and Use of Assistive Technology for Adults Living in Supported Accommodation. Perth, Western Australia: Independent Living Centre (WA).

Layton, N., Wilson, E., Colgan, S., Moodie, M. and Carter, R. (2010). Equipping Inclusion Studies: Assistive Technology Use and Outcomes in Victoria. Melbourne, Victoria: Deakin University.

Louise-Bender Pape, T., Kim, J. and Weiner, B. The shaping of individual meanings assigned to assistive technology: a review of personal factors. Disability and Rehabilitation, 2002: 5-20.

Maslow, A. (1954). *Motivation and personality.* New York, NY: Harper

Scherer, M. J. and Glueckauf, R. Assessing the Benefits of Assistive Technologies for Activities and Participation. Rehabilitation Psychology, 2005: 132- 141.

Scherer, M.J., Sax, C., Vandbierdvliet, A., Cushman ,L. A. and Scherer,J.V. Predictors of assistive technology use: The importance of personal and psychosocial factors. Disability and Rehabilitation. 2005; 27(21): 1321-1331.

APPENDIX A

HOME INSTALLATION REPORTS

SITE REPORT - Participant B (54, Quadriplegia, lives in own home) (INSTALLATION DATE OCT 14; INSTALLATION COST - $11,602)

Agreed Home Automation Needs:

- Control of lighting zones throughout the home.
- Automation of existing door opener.
- Automation of air conditioner.
- Door intercom system connected from own home at rear of property to main (parents') dwelling at front of property.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Lighting Zones - Control modules installed for Study, Kitchen, Living Area and Main Bedroom.
- Additional automation of Front Doors - there were already two auto-slide door openers installed, which have now been automated so they can be operated by smartphone or by supplied and configured Keyfob.
- Intercom - Helios Door Station installed at the front door to the main house. Door station has an inbuilt camera, which has a wide-angle lens enabling him to view the front of the property. The Helios Door Station will ring his phone and PC.
- Air conditioner in the bedroom automated to be controlled by iPhone.
- Wi-Fi Access Points - two access points were installed to extend the Wi-Fi coverage to the entire property (both the parents' front house and his rear house).
- 4 Button Remote to control lighting and front door. The remote can be further configured to control any Fibaro enabled device in the home.
- Front Security Light automated with a Motion Sensor.

Installation Issues and Solutions:

- Person's house is located behind his parent's home. To establish a connection to the Wi-Fi Access Point near the Door Station, several long runs of CAT6 cable had to be installed.

Further Potential Automation Solutions and Estimated Costs:

- None identified.

SITE REPORT - Participant C (41, Hemiplegia, own home)
(INSTALLATION DATE DEC 14; INSTALLATION COST - $8,281)

Agreed Home Automation Needs:

- Control front door control.
- Security shutters control.
- Garage door control.
- Kitchen lights control.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Electric Swing Door Opener and Door Strike for Front Door, controllable by smart phone app and/or remote controls
- Roller Shutter Control Module, controllable by smart phone app, remote controls and/or existing wall switch
- Fibaro Control Module for Kitchen Lights, controllable by smart phone app, remote controls and/or existing wall switch
- Fibaro Control Module for Garage Door, controllable by smart phone app, remote controls and/or existing garage remote
- 4 Button Hand-Held Remote for common controls.
- Keyfob Mini-Remote for common controls.

Installation Issues and Solutions:

- Front door in poor condition and quite warped meaning it will not reliably close (sometimes not closing fully and sometimes not latching when closed)and a lot of work to get it to close without catching. Overcome by new door being installed at owner's cost and re-automated.
- Interface and explanation of controls to person. Overcome with simple button layout diagrams and intuitive interface layout.

Further Potential Automation Solutions and Estimated Costs:

- None identified.

SITE REPORT - Participant D (62, Cerebellar Ataxia, own home)
(INSTALLATION DATE JAN 15; INSTALLATION COST - $11,400)

Agreed Home Automation Needs:
- Front door Control.
- Lighting and Fan Controls.
- TV Controls.
- Custom Hand Controls.

Automated Devices Installed:
- Fibaro HomeCenter 2 Control Station.
- Front Door Opener and Door Strike, controllable by smart phone app, wall switch and/or custom remote control.
- Study Lights and Fan, controllable by existing wall switch, smartphone app or automatically via motion and temperature sensors installed in study. Lights turn on if motion is detected, the light level is low enough and the time is outside Ian's rest period, and then off after motion has ceased. Fan turns on at speed set by wall control if motion is detected, and the room temperature is high enough, and then turns off again after a pre-set period of no movement.
- TV and Foxtel, controllable by smart phone app, remote controls and/or existing remote controls.
- Custom Oversized Button Control - designed and built a large 8-button controller so person can operate controls with some accuracy. Controller has integrated handles on the sides to assist in handling the device.

Installation Issues and Solutions:
- Size and weight of custom controls difficult to ascertain. Several trial and error attempts were required to get the combination correct.

Further Potential Automation Solutions and Estimated Costs:
- Existing front door is a Hollow-Core door and lock is a standard entry set, which isn't particularly secure. Solved by replacing front door and existing lockset with mortise lock to increase security and improve operation.
- If person's physical capabilities continue to deteriorate further, it is possible to further simplify his controls to 1 or 2 'jelly buttons' using proximity/location data to change the functionality of his buttons depending on his location. Pricing is dependent on the number of locations. A switch would be required to extend the wired network capabilities at an estimated one-off price of $700 plus $600 per location. Therefore 3 locations would cost $2,500 including the 2 Jelly Button switches.
- Supply, install and configure an 2kVA UPS (Uninterruptible Power Supply) to provide power to the door opener, modem router and Fibaro Homecenter 2 for approximately 2-3 hours after a power outage at a cost of $1,350.

SITE REPORT - Participant E (28, Cerebral Palsy, social housing) (INSTALLATION DATE FEB 15; INSTALLATION COST - $20,760)

Agreed Home Automation Needs:

- Ability to open/close front/rear doors and bedroom door.
- Means to prevent unwanted persons entering the gate at the front of the property.
- Enhanced TV controls.
- Control over automated devices based on person's location in the house.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Video Door Intercom for Entry Door - front door station set up to call Grandstream IP Phone located in lounge room.
- Front Gate Opener - Lockwood deadbolt lock located at the front gate has a keypad, which accepts a pre-programmed code (for each carer) to open gate.
- Front Door Opener - front two sliding doors can be opened via the keypad mounted on the adjacent wall, which accepts a pre-programmed code.
- Rear Door Opener - existing glass sliding door already fitted with Dorma door opener has been automated with Fibaro. Rear security door has been automated. Both doors open/close with Proximity Activator and/or Jelly Button Remote.
- Air Conditioning Control - when the person is in the lounge room, a press of either Jelly Button remote will activate a scenario that will either turn on the heating or cooling to the home depending on the ambient temperature.
- TV Control - When the person is located in the TV area and presses either Jelly Button remote, the TV turns on or off.
- Proximity Activator - operates throughout the home to provide access to all the devices listed above. The system relies on the person being stationary for 30 seconds in set locations and then pressing one of two Jelly Button remotes located to either side of his head on the wheelchair.
- Modem/Router upgraded to provide increased Wi-Fi range and ensure trouble-free connection of smartphones and tablets, the existing modem/router (which also had limited configurability) was replaced.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.
-

Installation Issues and Solutions:

- The Proximity Activator required a fair bit of programming and configuration to get working effectively. It would be ideal to invest in a smart phone app to be developed in order to reduce the 30-second time delays before activation.

Further Potential Automation Solutions and Estimated Costs:

- Although the modem router has been upgraded, it has still not provided the coverage required – leading to occasional drop-outs. Installation of an enterprise-grade Wi-Fi Access Point will provide increased Wi-Fi range and ensure trouble-free connection of smartphones and tablets.

SITE REPORT - Participant F (57, Muscular Dystrophy, social housing) (INSTALLATION DATE FEB 15; INSTALLATION COST - $8,636)

Agreed Home Automation Needs:

- Ability to view people outside the front door without having the kitchen blinds open.
- Ability to alert carer by way of a push button whilst he is sleeping, and ensure call device operates in the event of power failure.
- A secure and reliable means for person and carers to enter home.

Automated Devices Installed:

- Fibaro HomeCenter 2 Automation Control Station.
- Front Door Video Intercom - Grandstream IP phone installed inside front door. Front door station set up to call Grandstream IP Phones located in carer's room and also inside front door. The door station also calls person's laptop and can also be viewed via live feed of the camera through his laptop.
- Front Door Keypad and Door Reed - Helios door station has a keypad, which accepts a pre-programmed code to open the front door. Alternatively, the door can be opened with the existing RF remotes or the added Z-wave remotes. Door reed provides continuous feedback on door position (open or closed).
- Modem/Router upgraded to provide increased Wi-Fi range and ensure trouble-free connection of smartphones and tablets, the existing modem/router (which also had limited configurability) was replaced.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.
- Automation of Front Security Light - a motion detector was installed at the front of the house to trigger the security light when movement is detected.

Installation Issues and Solutions:

- A newer alert system was trialled to enable Peter to contact the carers during the night, but was not implemented however due to range issues.

Further Potential Automation Solutions and Estimated Costs:

- Installation of an enterprise-grade Wi-Fi Access Point will provide increased Wi-Fi range and ensure trouble-free connection of smartphones and tablets.
- Sliding doors to the rear garden that could be automated with door openers and magnetic locks for security.
- Whilst the Helios camera provides a good view of the front yard, it would be better if he was able to view more of the yard and down the drive. A dome camera with a wide-angle lens feeding into laptop could be installed.
- A Proximity Activator could be installed to allow easy access through the front door as well as access to the rear garden if rear doors are automated.
- A remote control with easy to press buttons would be beneficial.
- Motion-sensitive lighting zones throughout home would be beneficial.

SITE REPORT - Participant G (39, CP/ID, social housing)
(INSTALLATION DATE MAR 15; INSTALLATION COST - $3,610)

Agreed Home Automation Needs:

- Audio system that person (with significant intellectual and physical disabilities) can control and interact with independently.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- 2 new Mini Hi-Fi systems with Ethernet to Infrared Adaptors controlled via 2 Jelly Button remotes mounted on each side of wheelchair and connected to a wireless sender unit.

Installation Issues and Solutions:

- Supply 2 mini Hi-Fi systems into which carers can pre-load CDs (one with favourite music and the other with stories read by his mother). Person is then able to play/pause the two choices of media by using the wireless buttons attached to either side of his wheelchair – a new skill that he developed in just a week!

Further Potential Automation Solutions and Estimated Costs:

- Person also enjoys basic numeracy and other cognitive development games, which could also be loaded onto one or other Hi-Fi system for him to select and play at his own will.

SITE REPORT - Participant H (15, CP/vision/hearing loss, parental home) (INSTALLATION DATE MAR 15; INSTALLATION COST - $12,010)

Agreed Home Automation Needs:

- Provide Front Door Opener with Automatic Lock.
- Provide Lighting Control for person to be able to control lighting zones within the home.
- Provide Intercom/Door Station for person to be able to see who is at the front door.
- Power continuity through Uninterruptible Power Supply (UPS).
- Modem/Router for new ADSL connection and Wi-Fi access point.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Automatic Swing Door Opener and Z-Wave Digital Deadbolt to allow person to easily operate the front door without assistance.
- Lighting Zones - control modules installed on main bedroom lights and study lights, allowing person to independently switch lights on and off as required.
- Modem Router for new ADSL connection.
- Enterprise Grade Wi-Fi Access Point - to provide increased Wi-Fi range and ensure trouble free connection of smartphones and tablets.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:

- Complications arose during installation with Fibaro and Z-wave deadbolt integration. Fibaro updated the software to make it compatible with the deadbolt at the installer's request.

Further Potential Automation Solutions and Estimated Costs:

- Replacement of entry door with a solid type door, complete with a mortise lock, would provide better security and remove the need for battery replacements. A door strike rather than the battery deadbolt could then be used for automated locking and unlocking of the front door. A keypad module would need to be added to the Helios door station to control the front door. Price not yet determined.
- Additional automated lighting controls could be added at $350 per zone.

SITE REPORT - Participant I (37, Quadriplegia, social housing) (INSTALLATION DATE MAR 15; INSTALLATION COST - $12,935)

Agreed Home Automation Needs:

- Access through existing door opener by way of keyfob and iPhone.
- Ability to see who is at the front door prior to opening.
- Remote control of lighting zones.
- Better access rear of property.
- Automated side gate entry.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Video Door Intercom for Entry Door - front door station set up to call person's iPhone.
- Front Door - had an existing door opener installed. A Fibaro module was installed to allow automation by way of the keypad outside, the keyfob or the iPhone.
- Rear Sliding Door – a sliding door operator has been installed on the rear door. The door can be opened by iPhone, keyfob or keypad located on the outside wall.
- Side Gate Opener - a new electric gate opener and gate has been installed to the side of the house. The gate has been automated to allow control by iPhone, keyfob or keypad located on the carport side of the gate.
- Lighting Zones - control module installed in Master Bedroom.
- Keyfob Mini-Remote configured to control the opening of Front Door, Rear Door and Gate. The keyfob also controls the light in Master Bedroom.
- Modem/Router upgraded to provide increased Wi-Fi range and ensure trouble-free connection of smartphones and tablets, the existing modem/router (which also had limited configurability) was replaced.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:

- Nil

Further Potential Automation Solutions and Estimated Costs:

- Person has expressed interest in a security camera being fitted to allow him to view the front yard and driveway at a cost of $700 including network cable.

SITE REPORT - Participant J (66, Stroke, social housing)
(INSTALLATION DATE MAR 15; INSTALLATION COST - $13,350)

Agreed Home Automation Needs:
- Control of lighting zones throughout the home.
- Automation of Front Door.
- Automation of the Side Gate off the carport.

Automated Devices Installed:
- Fibaro HomeCenter 2 Control Station.
- Front Door - a door opener was installed, which can be controlled by an internal button, keyfob remote and/or smart device. The door has a Z-wave deadbolt installed for extra security, which has an integrated keypad that can be used to open the door with a PIN given to each carer.
- Side Gate Opener - a new, more robust gate and gate opener was organised through a third party and then automated by aLed. The gate can be opened by the wall-mounted keypad or controlled from the remote.
- 4 Button Hand-Held Remote configured to control the Font Door and Side Gate.
- External Surveillance Camera - a camera was installed near the front door so that the person can view who is at the door before opening the front door. The video feed can be accessed through the Fibaro App on the person's iPad.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:
- The Internet was not connected at the premises during time of install, which made it difficult to configure the devices and perform updates.
- It proved difficult for the person to understand and remember control instructions for the devices. A laminated card was created to help her identify the buttons and functions of controls.

Further Potential Automation Solutions and Estimated Costs:
- Person would like to obtain a mounting system for the iPad to be attached to her bed, where she spends much of her time.

SITE REPORT - Participant K (50, Quadriplegia, social housing)* (INSTALLATION DATE JUN 15; INSTALLATION COST - $19,610)

Agreed Home Automation Needs:

- Increased security for entry by way of an automatic door opener and lock (person leaves door unlocked and open for convenience)
- Ability to see who is at the front door prior to opening if timber door closed.
- Ability to easily turn lights on and off throughout the home.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Video Door Intercom for Entry Door - iPad mini with wall charging station for camera viewing. Front door station set up to call iPad and person's laptop through an App.
- Front Door - install Safe Breeze solid wooden door with integrated security screen and mortise style lock to increase door security but still allow airflow through the door in summer.
- Automatic Swing Door Opener and Door Strike - to open and close the Entry Door independently.
- Lighting Zones - control modules installed on Living Area light and Master Bedroom light.
- Air Conditioning Control Coupled with Temperature Sensor - when the dedicated button on the 4-Button remote control is pressed, the system checks the room temperature and starts the air conditioner in the correct heating or cooling mode (original air conditioning remote also still functions).
- 4 Button Hand-Held Remote to control air conditioning, lights and front door.
- Modem/Router provided to enable the Fibaro system to communicate with the iPad.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:

- Existing front door frame that had to accommodate the new wooden door with integrated security screen had been previously modified, which made the door and new lock installation difficult.
- Person had never used a tablet or smartphone before, and was quite apprehensive about the technology, which increased the length of the handover. The system was also designed so that no existing controls or services were affected – rather another layer of control was added to existing switches and remotes to ease the transition for the person to use the new automated systems.

Further Potential Automation Solutions and Estimated Costs:

- Nil.

** This system was installed in a regional area by an independent electrician who was a former associate of the principal of aLED (the primary installer).*

SITE REPORT - Participant L (56, Muscular Dystrophy, own home) (INSTALLATION DATE APR 15; INSTALLATION COST - $14,110)

Agreed Home Automation Needs:

- Lighting control throughout the home.
- Automation of Sliding Door.
- Automation of Air Conditioner.
- Door Intercom System.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Front Door Intercom – Helios Door Station installed at the front door of the house. Door station has an inbuilt camera, which has a wide-angle lens providing a view across the front of the property. The Door Station ring person's iPhone.
- Internal Hallway Door - autoslide door opener installed, which can be controlled by either the keyfob or iPhone.
- Side Glass Door - autoslide door opener was installed, which can be controlled by either the internal button, keyfob remote or iPhone. There is also an external keypad, which can be used to open the door with a PIN. The door is secured with a magnetic lock that engages when the door is closed to provide security.
- Lighting Zones - control modules installed for Main Bedroom, Kitchen and Hallway. The Hallway and Kitchen lights were also automated with Fibaro Motion Sensors.
- Rear Roller Shutters – automated to 2 security roller shutters, which can be operated by the wall mounted buttons or from her iPhone.
- 4 Button Hand-Held Remote configured to control lighting and sliding doors. The remote can control any Fibaro enabled device in the home.
- Wi-Fi Access Points - two access points were installed to extend the Wi-Fi coverage to the entire property (both the parents' front house and his rear house)
- Modem/Router upgraded to provide increased Wi-Fi range and ensure trouble-free connection of smartphones and tablets, the existing modem/router (which also had limited configurability) was replaced.

Installation Issues and Solutions:

- The internal door presented a few difficulties during install due to its age and condition, but is now working fine.

Further Potential Automation Solutions and Estimated Costs:

- Nil.

SITE REPORT - Participant M (63, Tetraplegia, own home)
(INSTALLATION DATE MAY 15; INSTALLATION COST - $12,660)

Agreed Home Automation Needs:

- Communication between person's bedroom and upstairs bedroom where carers sleep.
- Control over key lighting zones within the home
- Ability to ascertain to ascertain who is at the door prior to opening the door.
- Automation of garage door and rear door.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Video Door Intercom for Entry Door, Video Intercom for Main Bedroom (with Jelly Button remote) and Grandstream Multimedia Phone in upstairs carers' bedroom - each device has in individual address within the system. Door intercom configured to call smartphone, tablet, bedside intercom and multimedia phone upstairs. Door Station in main bedroom has been modified to allow a Jelly Button switch to be connected via a phone jack to initiate a call to the upstairs phone.
- Garage and Rear Door Controls and virtual device to enable person to open/close rear and garage doors to allow 3rd party access to the property, and also be able to see the position of the doors without seeing them physically.
- Lighting Zones - control modules installed on Main Bedroom lights, person's Painting Zone light, Dining Room, Kitchen, Entry, and Living Room all controllable by smart phone app, existing wall switches or one of the two 4 button hand-held remote controls.
- Smartphone provided for the purposes of installing applications to allow person to control all of the services installed.
- 2 x 4 Button Hand-Held Remotes provided to simplify control of the most common services.
- Modem/Router provided to enable the Fibaro system to communicate with the iPad.
- Enterprise Grade Wi-Fi Access Point - to provide increased Wi-Fi range and ensure trouble free connection of smartphones and tablets.

Installation Issues and Solutions:

- Construction of a second floor to accommodate carers had made several lighting junctions inaccessible without removing a substantial amount of ceiling. The solution was to re-design the initial plans and substitute alternative lighting zones.

Further Potential Automation Solutions and Estimated Costs:

- Nil.

SITE REPORT - Participant N (42, Quadriplegia, own home)
(INSTALLATION DATE APR 15; INSTALLATION COST - $12,760)

Agreed Home Automation Needs:

- Front Door Opener with Automatic Lock.
- Sliding Door Opener for home extension.
- Control of key lighting zones within the home.
- Security Cameras at property entry points.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Automatic Front Door Opener and Z-Wave Digital Deadbolt to allow person to easily operate the front door without assistance.
- Automatic Rear Door Opener and magnetic lock on glass sliding door in kitchen leading to courtyard
- 2 x IP Based Cameras covering the entrance outside the front door and down the driveway.
- Lighting Zones, controlled by modules installed on Main Bedroom lights and Kitchen lights, allowing person to independently switch lights on and off as required.
- Single Button Keyfob Mini-Remote to enable remote front door opening/closing.
- Enterprise Grade Wi-Fi Access Point to provide increased Wi-Fi range and ensure trouble free connection of smartphones and tablets.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:

- Nil.

Further Potential Automation Solutions and Estimated Costs:

- Additional Lighting controls could be installed at a cost of $350 per zone.
- Camera recording functionality could be installed at a cost of $850.

SITE REPORT - Participant O (42, ID/neurological, own home)
(INSTALLATION DATE FEB 15; INSTALLATION COST - $10,730)

Agreed Home Automation Needs:
- Provide Front Door Opener with Automatic Lock.
- Lighting Control to control key lighting zones within the home.
- Front door camera to view who may be at the front door via iPhone/iPad.
- Remote On/Off control for air conditioner through Fibaro module.

Automated Devices Installed:
- Fibaro HomeCenter 2 Control Station.
- Automatic Front Door Opener and Z-Wave Digital Deadbolt - to allow operation of the front door without assistance.
- Surveillance Camera - to view courtyard and front door.
- Lighting Zones - Control modules installed on Main Bedroom, Dining Room, Lounge Area and Bathroom lights enabling person to independently switch lights on and off as required.
- 4 Button Hand-Held Remote - for ease in controlling the four most common devices.
- 1 Button Keyfob Mini-Remote - for person to take out with her to allow easy opening of front door when returning home.
- Modem/Router provided to enable the Fibaro system to communicate with the iPad.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:
- Complications arose during installation with Fibaro and Z-wave deadbolt integration. Fibaro updated the software to make it compatible with the deadbolt at the installer's request.

Further Potential Automation Solutions and Estimated Costs:
- Replacement of entry door with a solid type door, complete with a mortise lock, would provide better security and remove the need for battery replacements. A door strike rather than the battery deadbolt could then be used for automated locking and unlocking of the front door. A keypad module would need to be added to the Helios door station to control the front door. Price not yet determined.
- Additional automated lighting controls could be added at $350 per zone.

SITE REPORT - Participants P (34/36, Spinal Muscular Atrophy, Parents' home)
(INSTALLATION DATE JUN 15; INSTALLATION COST - $13,580)

Agreed Home Automation Needs:
- Independent entry and exit system in the parental home.
- Ceiling Fans control.
- Lighting Control.
- Incorporation of external security cameras into system.

Automated Devices Installed:
- Fibaro HomeCenter 2 Control Station.
- Electric Front Door Opener, Door Strike and Recessed Drop Bolt, controllable by smart phone app, wall switch or external keypad. Door modified to include a security screen insert within the main door-frame to allow the removal of existing flyscreen door. Secondary bolt lock installed to further increase security rating of the door given the loss of the deadbolt function of the previous door lock.
- Garage Door Control Module and Position Feedback to enable person to open/close garage door and also be able to see the position of the doors without seeing them physically.
- Ceiling Fans and Lighting Zones - Control modules installed on Living, Dining, Kitchen, Entry, Bathroom and two Bedrooms lights. Bedroom fans also installed with a control module. All controllable by smart phone app, or existing wall switches with the addition of a motion sensor on the hallway lights that switches them on automatically after sunset and before sunrise.
- Enterprise Grade Wi-Fi Access Point - to provide increased Wi-Fi range and ensure trouble free connection of smartphones and tablets.
- Uninterruptible Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:
- Front door was difficult to modify due the side-light being on the same side as the keeper/door strike. Additional carpentry was required to increase the thickness of the side-light timber to accommodate the electric door strike and the drop bolt.

Further Potential Automation Solutions and Estimated Costs:
- Interest expressed in having the fluorescent garage light automated, which would need to be replaced at a total cost $450 including control module.
- The second of the two existing security cameras was not functioning correctly at the time of the installation, so was not able to be connected the Fibaro system. It would be better to have hard-wired cameras as opposed to the Wi-Fi versions currently installed at a cost of $660/camera including cable and setup.

SITE REPORT - Participant Q (38, Muscular Dystrophy, social housing)
(INSTALLATION DATE JUN 15; INSTALLATION COST - $18,715)

Agreed Home Automation Needs:

- Control of lighting zones throughout the home.
- Independent access to rear garden area.
- Automation of existing door opener.
- Installation and automation of Venetians Blinds.
- Automation of security shutters.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Front Door Opener - there was already an existing Dorma door opener installed, which has now been automated so that it can now be operated by the person's iPhone Fibaro App.
- Front Door Intercom – a Mobotix Door station was installed at the front door. The door station has an inbuilt camera, which has a wide-angle lens, enabling person to view the front of the property. The door station will also ring the person's iPhone, from which can then choose to open the front door.
- Rear Door Opener - installed on the two sliding doors at the rear of the house enabling the person to operate the doors via the internal wall buttons, iPhone Fibaro App or the keypad located on the outside wall.
- Lighting Zones - Control modules installed for Façade, Kitchen, Hallway and Living Room lights. Automation to the Façade, Hallway and Kitchen lights with Fibaro Motion Sensors.
- Venetian Blinds – arranged for internal blinds to be installed through a third party supplier/installer with aLed installing wall switches. Blinds installed in the Main Bedroom and two windows in the Living area.
- Security Shutters - 3 existing external security shutters automated to operate through iPhone or existing wall mounted buttons.
- Audio Visual Systems - The Sony TV and Blu-ray players have been automated with IR control and can be operated through the person's iPhone or PC.
- Uninterruptible Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:

- The air conditioner was not able to be further automated as the only port (connection) available is currently being used in conjunction with the smoke alarm. However, the person already the proprietary air conditioning App on his iPhone, so he is not greatly disadvantaged.

Further Potential Automation Solutions and Estimated Costs:

- Nil.

SITE REPORT - Participant R (11, Rhett Syndrome, parent's home) (INSTALLATION DATE JUN 15; INSTALLATION COST - $13,360)

Agreed Home Automation Needs:

- Provide ease of access for carers to gain access in and out of property by way of automating 2 Gates, Garage Door and Sliding Door.
- Provide Infra-Red control of the family TV by way of a large Jelly Button switch for Juliet to interface with the TV and engage with controls

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Garage Door Opener with positional feedback.
- Electric Operator for two Timber Gates at rear of home with positional feedback.
- Electric Operator for Rear Glass Sliding Door with positional feedback.
- Bedroom Lamp Control by installing Z-Wave power point.
- 2 x 4 Button Mini-Remote Keyfobs to Garage Door, two Gates and Glass Sliding Door.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:

- Glass sliding door was extremely difficult to provide automated locking due to the flexibility of the frames. Special model autoslide door opener was used with integral brake as well as a magnetic lock to overcome the issue
- Home made timber gates were challenging to attach automated door openers, but was successfully achieved.

Further Potential Automation Solutions and Estimated Costs:

- Nil.

SITE REPORT - Participant S (47, Cerebral Palsy, social housing) (INSTALLATION DATE JUN 15; INSTALLATION COST - $12,165)

Agreed Home Automation Needs:

- Control of lighting zones throughout the home.
- Automation of Side Door and Front Door
- iPad for System Control.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Lighting Zones - Installation of lighting control modules to Kitchen and Hallway. Lighting Zones are also controlled with Motion Sensors.
- Side Glass Door - Autoslide door opener installed. The internal button, keyfob remote and iPhone and iPad can control the door. There is also an external keypad, which can be used to open the door with a PIN. The door is secured with a magnetic lock, which engages when the door is closed to provide security.
- Front Door - There was already an existing Dorma door opener installed. We have automated it so that it can now be operated by the iPad located in the Kitchen.
- Front Camera - camera mounted above the front door allows vision to a large portion of the front yard. The Fibaro App on either the Kitchen iPad or the carers Phones can access it.
- 4 Button Hand-Held Remote to control television in person's room.
- 1 Button Hand-Held Remote - acts as a panic button and will send a notification to live-in carers via Fibaro app on each their iPhones to let them know assistance is required.
- iPhones **-** iPhones supplied to carers to allow them to access the Fibaro App and utilise the functionality of the system.
- iPad and Dock **-** an iPad mini and charging dock supplied to allow control of all Fibaro enabled devices. The iPad can be removed from the dock and used around the house and then replaced in the dock to be charged without the need to plug in cables.

Installation Issues and Solutions:

- Nil.

Further Potential Automation Solutions and Estimated Costs:

- TV being controlled in the person's room may need to be swapped with a model that accepts "discrete" IR codes if he becomes too confused with the operation of the proprietary TV remote control.

SITE REPORT - Participant T (63, Multiple Sclerosis, own home) (INSTALLATION DATE JUN 15; INSTALLATION COST - $16,960)

Agreed Home Automation Needs:

- Independent access to the rear of the premises.
- Independent access to Master En-suite.
- Control of Lighting Zones.
- Installation and automation of Venetian Blinds to front windows.

Automated Devices Installed:

- Fibaro HomeCenter 2 Control Station.
- Lighting Zones - control modules installed in Hallway and Living Room. Automation to the Hallway light by Fibaro Motion Sensor
- En-suite Door- Door Opener installed in en-suite to allow automatic opening/closing by way of the Keyfob or a smart device.
- Rear Security Door – install a door operator on the rear security door that can be opened/closed by smart phone, keyfob, internal wall button or keypad located on the outside wall.
- Venetian Blinds – arranged for internal blinds to be installed through a third party supplier/installer with aLed automating to operate from keyfob.
- Keyfob Mini-Remote to control the opening of Bedroom Door, Rear Security Door, Living Room Light and Electric Blinds.
- Uninterruptable Power Supply (UPS Battery Backup) installed to provide 2-3 hours power if there is a mains power outage.

Installation Issues and Solutions:

- Nil.

Further Potential Automation Solutions and Estimated Costs:

- An automated front door opener would allow person to independently access the front of the property.
- A video door station would allow person to communicate and identify visitors at the front door and then allow entry through front door.

APPENDIX B

POST-INSTALLATION SURVEY QUESTIONS

QUESTION 1. Were you happy with the people who installed your home automation system?
- What was it that you liked (or disliked) about them?
- Can you give me an example?

QUESTION 2. Were you happy with the way the home automation installation was carried out?
- What was it that you liked (or disliked) about the way it was done?
- Can you give me an example?

QUESTION 3. What has been the biggest change in your life since the home automation system was installed?
- Could you tell me how this has helped you?

QUESTION 4. Has the new technology improved your life in any other ways?
- Can you give me an example?

QUESTION 5. Which part (or feature) of the new technology do you now <u>use</u> the most?
- Is that what you thought would be the case?

QUESTION 6. Is there anything that you have found doesn't work well (or usefully) for you?
- Can you tell me what it is that hasn't worked well for you?
- Is there anything you have had installed that you are not using?

QUESTION 7. Now that you have been using the new technology for a while, do you think that any part of it could have been made to work better for you?
- Can you give me an example?
- Can you think of any other examples?

QUESTION 8. Have you heard about or seen any other home automation technology that you think would be helpful to you?
- In what way you think it would help?
- Do you think it might be able to help in any other ways?

QUESTION 9. Has your new technology saved you money on anything that you previously had to pay for?
- Can you estimate how much this is now saving you each week (or month)?

QUESTION 10. Is there anything else about your experience with home automation that you would like to tell us about?