

Guide on Smart Homes

Smart Homes as a Challenge



According to the WHO guide on age friendly cities, it is important for the well-being of older people to be able to age at home and in the community to which they belong.¹ Although, some issues may arise when older people remain in their homes there are many possibilities to support them in doing so. One of the means of doing this is to set up digital technologies at home, notwithstanding the many non-digital support solutions the focus of this guide is on technology. Smart Home systems make it possible to live comfortably and safely at home and to maintain independence and quality of life, while still respecting one's privacy (please see our other guides on "Achieving privacy when using monitoring technologies" and "Medical Device Regulation and Certification of Apps".to ensure privacy is respected).

Several key challenges arise when older people remain in their homes and when it comes to Smart Homes, the following challenges are relevant or are addressed by Smart Home systems:

Essential services: it may seem obvious that services like electricity, gas and water should be accessible and affordable for a safe and comfortable home environment but in a highly digitalised world like ours it is also essential to have access to the Internet, especially in the case of Smart Homes Systems, which rely on the Internet of Things (IoT) to network sensors, software and devices.

Design and modifications: The housing design affects the means of living at home and it should be adapted to individuals' evolving needs. This is also necessary when it comes to Smart Homes. How many and which technical solutions need to be integrated into a house depends on the different progressive needs. Many things then happen automatically, which no longer need to be of concern and which provide more security and independence.

Maintenance: Since some older people may face difficulties in maintaining their own homes, qualified, affordable and reliable service providers are essential. The same applies to maintenance in the digital area. Besides, Smart Home systems automatically indicate when a repair is necessary.

Comfort: Smart home technologies should enhance home comfort for everyone through the automation of domestic tasks, easier communication, and higher security. Smart home functionalities are varied and extendable, the degree to which they can be personalised to meet the users' exact needs can affect the level of comfort they deliver - this is a factor that can be limited by cost and affordability.² Additionally in focusing on comfort when looking to support older people in functionalities for their everyday life there is a need to exercise caution: technology should be assistive and not replace human interaction or take over all aspects of simple everyday tasks, overreliance could cause loss of functional skills and inadvertently increase the need for care.

Assistance: Smart home technologies should provide assistance for older people to remain independent, live a healthy lifestyle, maintain social participation and improve quality of life. Careful consideration of where assistance is required, for which tasks and which needs it fulfils should be decided upon the needs' assessment of the end user. Therefore, the active involvement of older people is crucial when designing a smart home solution, as they will voice their real needs to innovators.³

Safety: Safety is a key concern when installing smart home devices to help older people to live independently. This means, of course, devices which detect falls or other accidents and trigger appropriate alerts or devices which prevent incidents such as sensors or automatic turn-off which recognise when water is rising too high in a sink or stove monitoring to avoid fire risk. It also means considering the safety or personal data and gaining appropriate consent, matters which can become more complicated with persons with certain conditions such as dementia if appropriate steps are not taken in time.

Access to services: When remaining at home, older people need to have access to services which help them to live comfortably and independently as long as possible (e.g. cleaning or gardening services and especially alarms in case of a fall or other accidents). Smart Homes complement or replace many of these services.

Community integration: Smart Homes support community integration of older people through technologies which facilitate information exchange and interaction between neighbours. They also aim to assist older people to remain socially active which is important for tackling the issue of loneliness.

Importance of Smart Homes for Transforming and Supporting Person-centred Care



We know that the quality of housing has major implications for people's health; nonetheless, Alice Pittini from Housing Europe reminds us that **"80% of our housing stock is not suitable for independent living"**.⁴ If not adapted, housing can exacerbate existing chronic health conditions, but it can also hinder the provision of health and social care services delivered at home. Below are three case examples of how smart homes could improve living conditions and quality of life for three different segments of the older population exemplified by three **Blueprint personas**.

Eleni: a smart home can support Eleni who has early stage dementia in keeping on living independently at home:⁵

- Learning sensors may predict and alert her before certain risk behaviours occur,
- Automated prompts e.g. a sensor or pressure mat can play a message when leaving the kitchen to remind Eleni to turn off the oven,
- Automatic lights with motion sensors, automated shut-off devices that turn off an oven or a running tap automatically can also help keep Eleni safe,

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- If an accident occurs nevertheless, an alert can be sent to a friend or emergency services following Eleni's preferences, to provide Eleni with a feeling of safety,
- As no dementia day care centre is available nearby, services typically offered there such as memory exercises or patient empowerment programmes could be integrated into Eleni's smart home,
- Technical solutions can also be used to remind her to take her medication (e.g. through an automatic pill dispenser setting off an alarm until the pills are removed) and to attend her doctors' appointments.

Jacqueline: Jacqueline has complex needs, amongst them her dementia which causes her episodes of waking up and wandering around the house at night. A smart home⁶ with sensors that predict risky behaviour could support better management of these episodes, so that her husband is aware when she is active or when she does things which may have safety implications (e.g., trying to open the front door, turning on appliances). Automatic lights with motion sensors, automated shut-off devices that turn off an oven or a running tap automatically, and front door sensors can also help to keep Jacqueline safe.

Randolph: a smart home⁷ can support Randolph in the care of his wife whose dementia is worsening e.g. by using sensors that can predict high risk behaviour that may need the attention of the informal caregiver. Automated shut-off devices that turn off an oven or a running tap automatically, and front door sensors can also provide Randolph with more peace of mind.

Key Issues Regarding Smart Homes



Needs assessment: is the technology responding to a real need (co-designed based on feedbacks from end users? Or was the technology developed by a restricted circle of inventors?)

Privacy: A balance has to be struck regarding the need for care, where some intrusion will unfortunately be necessary, and maintaining dignity and respecting the private sphere. In general, taking into consideration the wishes and concerns of the intended older person is essential when designing smart home solutions: the 'small' things matter.⁸ Cultural and religious considerations also need to be considered.

The above concerns apply to care approaches in general, but when focusing on the digital and the innovative nature of smart homes we should be made aware of a point raised in an editorial in the Information Systems Journal which stated that "recent technological changes [in Smart Homes] are generating additional privacy challenges beyond the existing landscape".⁹ Smart Homes utilise sensors which collect large amounts of data". This collection of personal data in combination with the increasing deployment of internet-connected devices in the home exposes residents to new privacy and security risk".¹⁰ Issues around the lack of standard and interoperability don't make the situation easier. Please see the Blueprint Guide on Privacy for more information.

Affordability: Naturally, new innovative technology is not always cheap which can create barriers to its widespread adoption and make it a marker of inequality. Models for funding smart care solutions to support health and care of older persons vary between countries with some countries offering financial support for smart housing whereas in others it remains a largely privately funded enterprise. A case has to be made for the benefits that smart housing can provide and the savings that can be made in other areas of care provision by avoiding exacerbation of acute episodes and hospitalisation for those suffering from chronic conditions and alleviation of associated aggravating factors for example by relieving loneliness which could trigger a bout of depression.

Interoperability / Technology fragmentation

A vast ecosystem and multitude of technologies in the business lead to communication fragmentation with adverse effects on the market. In other words, large number of different industry stakeholders and equipment lead to silo dominations, meaning that the inclusive technology stands alone and does not work in combination with other technologies. Furthermore, the issue of standard's fragmentation needs to be solved to make interoperability more tangible; this issue currently has a very slow progress as the fast development of mostly non-interoperable technologies mean the reinforcement of the silos.

Maintenance

There might be network issues that affect the smart home's system speed and reduce its connectivity to other devices; to tackle this issue a proper network infrastructure is needed to be built with the help of professional internet providers, whose service might not be accessible to some clients. Furthermore, smart home technology will need regular updates (for ease of use as well as security reasons). Although a need for updating smart home controllers is lifted via smart home mobile apps which are downloadable on mobile phones, tablets or computers, it could still be a painstaking effort for younger or older citizens if they have low digital skills, but also to citizens with no access to smart devices or internet connection.

Safety

All the above smart upgrading, however, will be a huge magnet to the cyber criminals who, if left unhindered, could be enticed to steal valuable personal information such as password and credit card numbers which could be used to commit identity theft or illegal purchases. The location tracking of a smart home, if hacked, could conveniently show the intruders that homeowners are away, and their home is unattended. Through these breaches the intruders can also take control of the critical functions (heating, oven etc.) of homes which can lead to disasters. Rogue recordings through home's smart speakers and cameras can also violate the users' privacy and be used for bribery, theft and manipulation of the recorded data.

Another issue to consider regarding safety is the storage, processing and movement of an

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individual's data. It is necessary that all devices and associated apps and other software comply with the European Union General Data Protection Regulation which came into force in 2018. Data processors need to provide appropriate technical and organisational measures to ensure data transfer and storage are secure. Data encryption or cloud services are two possibilities.¹¹ Please see two other Blueprint guides on “Achieving privacy when using monitoring technologies” and “Medical Device Regulation and Certification of Apps”.

Supporting Mechanisms and Tools that Help Address the Topic



Digital tools

- Personal alarms such as pendants and other wearables to trigger an alert with a response centre; the alarm could also be situated within the home with a cord, button, or sensory device;
- Medical monitoring, such as pulse, blood pressure and soiling that can be assessed automatically within set parameters and forwarded to triage systems when appropriate;
- Reminders for cognitive and sensory assistance, such as to take medication or eat meals
- Entry systems that allow the person to see who is visiting and to then open the door remotely;
- Sensors:
 - to monitor general activity that provides early warning if the person does not return to a bed or chair within a pre-set time frame, or can alert trip and fall detection,
 - hazards such as oven left on or tap left running,
 - Lighting that can be automatically activated;
- Increased use of robotics to assist with tasks around the home;
- Video conferencing for medical appointments but also virtual social participation;
- Lost item locators such as keys and medication dispensers.

Non- Digital tools (e.g. policies)

- Co-creation/co-design methods; such as the living lab approach would be well suited to smart homes
- Policies – affordability, procurement, funding (support for housing renovation); Age-friendly housing policies;
- Training / education.

Main Stakeholders Concerned



Older adults – co-design, needs and demands, financial contributions, end users

Local and regional authorities – housing policies + public procurement + investments

Construction stakeholders (builders, architects): being educated about the benefits of smart housing will improve the products and information provided to consumers. Additionally, a more wide-spread implementation of age-friendly housing will ensure everyone has access to smart homes and this will also make it affordable in accordance with the law of offer and demand: the rarer a good is, the more expensive it is.

Technology developers – if well informed about the benefits, they should adopt a co-design approach if they want an uptake.

Civil society (social housing organisations, end-users, home owners) – collaborate with developers **Investors** in social innovation.

Examples, Good Practices and Evidence of Impact Relevant to the Topic



Thinking Ahead: The Financial Benefits of Investing in Housing for Older People
<http://www.housingagency.ie/ageing-population-research>.

Potential Funding Sources



National Level

- NL: Health insurance provisions, such as eHealth at home, digital consultations, district nursing
- DE: Deutsches Seniorenportal. 2020. Sicherheit und Komfort durch das Smart Home. <https://www.seniorenportal.de/dienstleistungen/umbau-im-alter/smart-home#5>

Local Level

- NL: Municipal community support to individual needs, such as alarm, participation, mobility.

Cross EU

- This article highlights the cost barriers and how they may be avoided: European smart home market development : Public views on technical and economic aspects across the United Kingdom, Germany and Italy <https://www.ecologic.eu/sites/files/publication/2014/public-views-on-smart-homes-2014.pdf>

References and Guidance Documents



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- Global Age-friendly Cities: A Guide (WHO, 2007): https://www.who.int/ageing/publications/Global_age_friendly_cities_Guide_English.pdf
- Multi-sensors acquisition, data fusion, knowledge mining and alarm triggering in health smart homes for elderly people: <https://reader.elsevier.com/reader/sd/pii/S1631069102014804?token=18FCDA0BB38E5BA496C803D9C226831A259414A7D03E7D0D739F2BEB689E19F86DB164F785DB7407BAC870045FA9AA5C>
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- Hope Project (smart homes for the elderly with Alzheimers): <http://www.hope-project.eu/>
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- Verbraucherzentrale. Smart Home - Das "intelligente Zuhause", (2020): <https://www.verbraucherzentrale.de/wissen/umwelt-haushalt/wohnen/smart-home-das-intelligente-zuhause-6882>

Endnotes



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