Positive and Negative Beliefs of Older Adults Regarding Unobtrusive eHealth Monitoring Using Artificial Intelligence

Stijn J.M. Temmink

Faculty of Behavioural, Management and Social Sciences, University of Twente

BSc Thesis PSY (202000375)

1st Supervisor: Dr. L.M.A. Braakman-Jansen

2nd Supervisor: Dr. J.E. Spook

03-06-2023

APA 7th edition

Abstract

Nowadays, an increasing average life expectancy has led to a larger older population, often facing chronic illness and requiring care. However, there is a shortage of caregivers, resulting in the implementation of ageing in place policies. To support older adults with ageing in place, innovative eHealth technologies, such as unobtrusive monitoring systems using artificial intelligence (AI), are being developed. The AI in the system compares measures to patterns and if abnormalities occur, a warning is sent to the caregivers. This study aimed to explore the positive and negative beliefs of older adults regarding unobtrusive monitoring systems using AI.

Semi-structured interviews were conducted with eight participants ranging from age 70 to 89. Inclusion criteria were Dutch-speaking older adults, who are ageing in place and are aged sixty or older, while cognitive impaired older adults who lived in retirement homes were excluded. To analyse the interviews, a thematic analysis was used. Within the created themes, several codes were discovered based on sentences that conveyed the same meaning.

The findings revealed that safety, prevention, and care replacement were the most prominent benefits. Meanwhile, fear of human substitution and invasion of privacy were often mentioned as disadvantages. The participants further named familial support and their need for safety as facilitators, meaning beliefs that promote use of the system. On the contrary, identified barriers for use of the system were unfamiliarity with the system and a reduction in contact.

The results contribute to the understanding of beliefs of older adults regarding unobtrusive monitoring system. The findings show that enthusiasm, especially regarding safety and prevention, was expressed as well as concerns, like invasion of privacy and fear of human substitution. In the future, the system can be adapted using these beliefs and tested by the older adult to ensure that the preferences of the end-users are taking into account for a successful user-centred design.

Contents

Introduction

Worldwide the life expectancy has increased, resulting in a large ageing population posing a problem for the current healthcare system. Older adults, who are defined as being sixty years or older, consist of 12% of the total world population in 2020 (World Health Organization [WHO], 2022). Whereas the global average life expectancy was 66.8 years in 2000, it increased to 73.4 years in 2019 (WHO, 2020). This increased life expectancy is often accompanied by chronic physical diseases, such as diabetes mellitus type 2, that impair the functioning of these older adults (Khan et al., 2019; Maresova et al., 2019). In addition to chronic physical diseases, psychological illnesses also pose a threat to older adults. One example of such a debilitating psychological disorder that increases in prevalence with age is dementia (Cao et al., 2020). These chronic illnesses in the ageing population are also a cause for the increasing expenditure resulting in a higher societal cost (De Meijer et al., 2013).

As a result of a larger prevalence of chronic illnesses, the older adults are in need of care and attention from professional healthcare workers. Yet, the healthcare workforce is revealing a severe shortage, which is an issue partly caused by the ageing workforce (Darzi & Evans, 2016; Harrington & Heidkamp, 2013). Considering this shortage, politicians decided to implement policies that support ageing in place, which means living independently as long as possible with as little help as possible (Alders & Schut, 2019; Pani-Harreman et al., 2021). According to Griffin (2022), these policies required the number of assisted living facilities to be reduced, which resulted in an increased cost of such living places. However, older adults also value ageing in place more compared to a retirement home, most importantly due to the appeal of autonomy and need to control their personal space (Ahn et al., 2020; Mulliner et al. 2020).

As increasingly more older adults age in place, informal caregivers are often tasked with providing care. However, research by Limpawattana et al. (2013) has shown that 48% of the informal caregivers for chronically ill patients experience caregiver burden. This burden can lead to financial difficulties, such as absenteeism from work to care for the older adult, as well as physical health problems like an increased risk of cardiovascular disease and mental health problems such as depression (Ahn et al., 2021; Del-Pino-Casado et al., 2019; Fakeye et al., 2022). Additionally, the age of informal caregivers has increased and will continue to grow, which is associated with the same aforementioned diseases accompanied by an increased life expectancy (Health Policy Institute, 2005). Thus, a double ageing problem is discovered in which the population gets older who rely on the care of formal and informal caregivers, however, due to the greying population the caregiving workforce also ages. As a result, innovative solutions that improve health, safety and communication are needed to ensure that older adults, especially the ones with chronic illnesses, are more supported in ageing in place, while still being able to receive the necessary human care from formal and informal caregivers.

eHealth and Monitoring Technologies

The innovative solutions that assist the older adults with ageing in place are eHealth technologies. A study by Shaw et al. (2017) stated that eHealth can be divided into three domains. Firstly, eHealth technologies can be used to track and monitor the health status of older adults in terms of physical activities or vital signs. Secondly, the collection and storage of health data is enabled through eHealth, such as in electronic medical records. Lastly, eHealth technologies facilitate the communication between the older adults and the healthcare professionals through for example video calls.

Among these technologies, eHealth monitoring technologies are particularly important for supporting self-management among older adults (Ware et al., 2017). These technologies use sensors or health applications to track the current health status of older adults and predict potential future issues (Fjellså et al., 2022; Qian et al., 2021). A study by Faronbi et al. (2019) discovered that in the case of chronically ill older adults, informal caregivers monitor the health status of these older adults in real life in terms of medication and food intake as well as their hygiene. According to Currie et al. (2015), the informal caregiver’s care can be supplemented or even partly substituted by eHealth monitoring technologies resulting in a reduced caregiver burden and a maintenance of the independence of the older adults.

Sharma et al. (2021) have identified three types of eHealth monitoring technologies, which can be categorised into wearable, vision-based, and unobtrusive monitoring systems. Firstly, wearable monitoring systems are attached to the body, such as a state-of-the-art smartwatch or an innovative smart band-aid (Li et al., 2019; Sun et al., 2021). However, older adults uncover some issues regarding these wearable systems, such as less adherence to such a technology due to the invasive nature of the system or forgetting to wear it because of memory loss (Paolillo et al., 2022; Wang et al., 2020). Secondly, vision-based monitoring systems do not rely on regular cameras, but RGB cameras or a Kinect (Khanam et al., 2019). Similarly, to wearable systems, older adults experience problems with video-based monitoring. For instance, acceptance of video-based monitoring systems is lower due to privacy concerns (Arning & Ziefle, 2015). Additionally, these systems are accompanied by technical issues such as requiring the older adult to be in the line-of-sight and in static positions (Selvaraju et al., 2022; Sharma et al., 2021). Lastly, unobtrusive monitoring systems are promising technologies using radio frequencies. These unobtrusive monitoring technologies are being developed to be able to detect movements, respirations and heart beats while not being hindered by the issues established for the wearable and vision-based systems (Adib et al., 2015; Guan et al., 2023; Steele et al., 2009). However, there are still some limitations to these unobtrusive systems, for instance the subject must be in range of 8 meters and it cannot differentiate humans from other living-beings (Adib et al., 2015). Furthermore, it is not exactly known what the end-users, thus the older adults, believe and expect from this last type of monitoring system, especially an advanced system complemented with artificial intelligence (AI).

Artificial Intelligence in eHealth Monitoring Technologies

AI incorporated into any of the three types of monitoring systems can complement the current healthcare system, while alleviating the caregiver burden and improving the quality of care (Vayena et al., 2018). The caregiver burden is alleviated since the process of health monitoring is simplified for the informal caregiver because the caregiver is only required to help the patient when the system gives a warning which leads to time saving (Ali et al., 2023). In the case the older adult uses a wearable monitoring system, the caregiver might need to remind the older adult to adhere to the system, however this will still lead to time saving as the rest of the day the caregiver can rely on the AI in the system. Meanwhile, the quality of care is improved due to the earlier discovery of abnormalities in results compared to human monitoring since AI in monitoring systems uses logical-mathematical intelligence (Korteling et al., 2021). This type of intelligence compares collected data analytically in order to recognise patterns and abnormalities in these patterns (Pantano & Scarpi, 2022).

AI in eHealth monitoring technologies utilises a sense-think-act procedure (Taimoor & Rehman, 2022). Firstly, the system *senses* the physical activities or vital signs of the older adults autonomously using the monitoring technologies established above. Secondly, the system *thinks* about the data gathered from devices by following an algorithm. This algorithm is a finite set of instructions that help the AI system to perform tasks, which in the case of health monitoring is comparing results (Wang & Herath, 2022). According to Panch et al. (2018), the comparison of data and the recognition of patterns is performed through deep learning. Deep learning allows for personalisation of a monitoring system by using a data set of the older adults' earlier measurements in order to create a pattern (Taimoor & Rehman, 2022). This data set can either be used by the system through supervised learning or unsupervised learning. In the case of supervised learning, the AI system is trained to understand associations between input and output based on associations defined as interesting by humans, which limits it to the initial data set. Meanwhile, unsupervised learning teaches the system to create associations without predefined associations, thus making it easier to identify undiscovered relationships. However, unsupervised learning is more difficult to interpret, making it less transparent. Lastly, the AI system *acts* on the thinking process with a decision to share the output in the case of abnormality from the established pattern.

Disadvantages of Artificial Intelligence in eHealth Monitoring Technologies

Despite the usefulness of AI in eHealth monitoring technologies, some limitations can also be discovered. For example, privacy concerns are affecting the acceptance and adherence of ageing in place technologies (Peek et al., 2014). As mentioned earlier, AI in monitoring technologies relies on deep learning, which can use the user's own health data in order to establish a personalised pattern. However, this data can be breached resulting in concerns mainly caused out of fear that the information gathered by the monitoring technology is exploited by individuals that do not have the right to use the information (Ahmed et al., 2020; Boise et al., 2013). Other privacy concerns that were discovered are uncomfortableness with being monitored, the feeling of being controlled by the caregiver and the feeling of being powerless over the collected data (Alkhatib et al., 2021).

In addition, older adults expressed concerns regarding changes in their social lives. As demonstrated in research by Cesta et al. (2018), human contact should not be replaced by technology using AI, which is a common fear among older adults. For a majority of older adults, visits by formal or informal caregivers are the most regular type of contact they experience (Chung et al., 2016). By not having the caregivers visit the older adults, there is the risk that the older adult will not be seen and thus not implement the technology in their daily life (Skär & Söderberg, 2018). Kang et al. (2010) gives reason to the concerns of older adult by saying that caregivers are skilled people who consider biological, socioeconomic and clinical factors, whereas monitoring technologies are only able to examine physiological aspects. While these limitations for AI in general monitoring systems were discovered, there is a lack of knowledge on what the beliefs and concerns of older adults are for the unobtrusive monitoring systems that use AI. These beliefs are important to know in order to adhere to a User-Centred Design (UCD).

User-Centred Design

To prevent the beforementioned disadvantages and create a successful adoption, new technologies should adopt a UCD in the development phase. UCD focuses on the wishes and needs of the users, which results in an increased adherence to the technology (Chammas et al., 2015). Additionally, a UCD technology intends to decrease the effort needed to learn the technology to gain a satisfactory user experience. A systematic review by Duque et al. (2019) stated that a UCD with older adults is usually conducted through four stages, which are the requirements, design, prototype and evaluation. An example of a UCD for older adults can be discovered in a study by Willard et al. (2018), which first conducted interviews to determine the beliefs and requirements of the older adults, then a prototype was developed that was discussed and lastly a final design was evaluated.

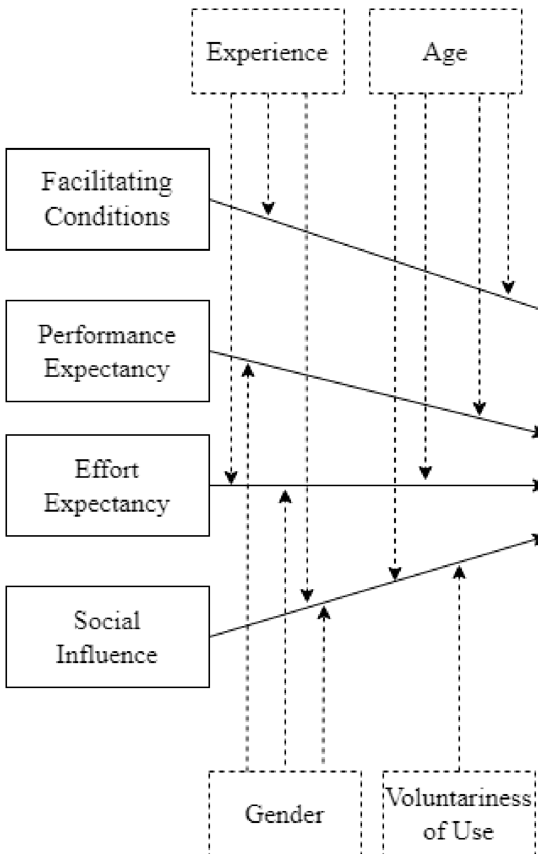
Models of Usage and Implementation of Technology

A successful UCD should result in increased adoption and usage of a system. By using models that predict the determinants for the usage and implementation of current and up-and-coming eHealth technologies, a complete overview of the beliefs of the user group for a UCD can be discovered. Examples of these models are the technology acceptance model (TAM), the unified theory of acceptance and use of technology model (UTAUT) and the Theory of Diffusion of Innovation (Harst et al., 2019; Pieterse et al., 2018). In this study, the UTAUT model is chosen as a guide since the UTAUT model combines the best elements of the TAM and the Theory of Diffusion of Innovations to gain view on the adoption of technology, which is able to explain the use of technology by 70% (Venkatesh et al., 2003). Additionally, the UTAUT model is the most recently developed model of the three and is more adapted to analyse the more recently developed technologies (Khechine et al., 2016).

The UTAUT model can be viewed in figure 1. In the model, use behaviour is influenced by behavioural intentions and facilitating conditions, which is the degree to which the user believes that the technology is supported by organisational and technical infrastructure (Venkatesh et al., 2003). Facilitating conditions and the opposite, which are defined as barriers, are especially important to measure since these directly influence usage and adoption (Bixter et al., 2019). The behavioural intentions are shaped by performance expectancy, effort expectancy and social influence. Performance expectancy is the degree to which the user believes the technology helps gain advantages in their daily life. These expectancies can be seen as the benefits of the system, whereas the opposite of performance expectancy is distinguished as the limitations of the system. These benefits and limitations are also essential to measure since they give concrete reasons for using or not using a system (Rouidi et al., 2022). Effort expectancy is defined as the degree to which the user associates the system with ease of use. Lastly, social influence regards the degree to which the user presumes others find the use of the system as important.

Figure 1

The UTAUT model



The Aim and Research Questions of this Study

Thus, a UCD is important for successful acceptance of new systems by adopting needs and wishes of users. As a first stage in a UCD, the users are questioned about their beliefs on the new product. While not all perceptions and issues on all monitoring systems are known, this study specifically focuses on the overall beliefs of older adults on unobtrusive radio-frequency monitoring systems since these monitoring systems are the most innovative and still in development (Sharma et al., 2021). Additionally, previous studies either target different users, like caregivers (Wrede et al., 2021) or different systems, like sensors (Boise et al., 2013). Hence in this study, the positive beliefs of older adults regarding unobtrusive AI eHealth monitoring technologies are questioned. Additionally, this research also aims to discover the negative beliefs that prevent the usage of unobtrusive AI eHealth monitoring systems. By adopting the determinants of the UTAUT model and the earlier established disadvantages as a framework for the interview scheme, an exhaustive overview on the beliefs is aimed to be discovered. Lastly, in order to add more context to the beliefs of the older adults on the innovative unobtrusive monitoring system, their motivations for usage of general smart home technologies (SHT) are investigated. By seeing which older adults use SHT and for what reason, the beliefs on innovative technologies can perhaps be partly explained. Based on these aims, the research questions are:

Research Question 1 (RQ1): What are the motivations of older adults ageing in place for using current smart home technologies?

RQ2: What are the positive beliefs of older adults ageing in place regarding the usage of unobtrusive eHealth monitoring technologies using artificial intelligence?

RQ3: What are the negative beliefs of older adults ageing in place regarding the usage of unobtrusive eHealth monitoring technologies using artificial intelligence?

Methods

Study Design

To address the research questions, a qualitative study approach was chosen, utilising individual semi-structured interviews. According to Kallio et al. (2016), semi-structured interviews are particularly useful when seeking to gain insight into the experiences and perceptions of interviewees. These types of interviews enable participants to freely express their ideas while still allowing the researcher to steer the conversation towards the study's aims (Adeoye-Olatunde & Olenik, 2021). Additionally, the flexible pacing of individual semi-structured interviews can be tailored to the needs of the interviewee, making them well-suited for older individuals (Corbin & Morse, 2003).

Participants

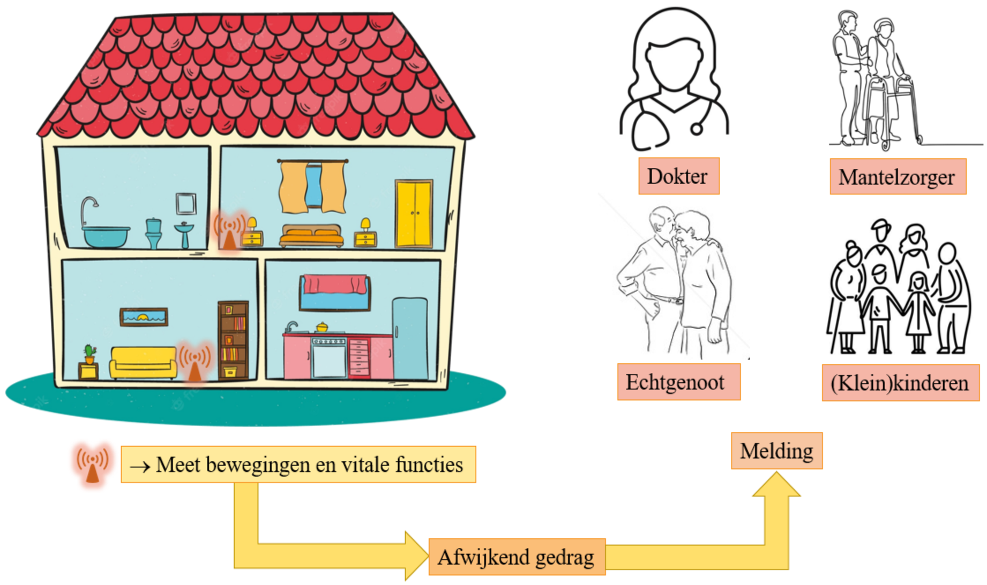
Participants were required to meet specific inclusion criteria, which are being individuals aged sixty or above, speaking fluent Dutch and ageing in place. Sixty year or older was chosen as the cut-off point since the WHO defines older adults as such (WHO, 2022) and ageing in place for the inclusion criteria means older adults that live independently as much as possible with as little help as possible (Pani-Harreman et al., 2021). Exclusion criteria included cognitive impairment and living in a retirement home, nursing home, or assisted living facility. Participants were recruited with a convenient purposive sampling, meaning that participants were selected based on characteristics fitting the inclusion criteria and their willingness and availability for the study (Acharya et al., 2013). A flyer requesting participation in the research was distributed by a fellow psychology student, who's grandmother lives in an 'aanleunwoning' (independent living near retirement home), where more older adults live. Living in an aanleunwoning is less independent than living alone, however older adults are not under constant supervision of caregivers, which gives them a large amount of independence and, thus can be seen as ageing in place. In addition, relatives of the researcher were asked to reach out to older adults in their social sphere about willingness to participate in the study.

Materials

This study used an interview scheme, which is displayed in Appendix A. The interview scheme consisted of fourteen questions regarding the research questions and was created in Dutch. Firstly, the interview scheme consisted of demographic questions to gather information on topics, such as age, gender, health status, living situation and contact with caregivers. Next, the interview scheme included a short explanation concerning the purpose of the study after which questions about the usage of and motivation for SHT were added. The interview scheme continued with an explanation regarding the unobtrusive monitoring system, in which the participants were introduced to figure 2. The image was created by the researcher without pre-testing the image on its content with the target group. The figure was accompanied by an oral explanation to ensure understanding amongst the participants. The explanation entailed what can be seen in the figure, stating how the system functions (e.g., by measuring through walls and establishing patterns), the size of the system and the concepts in the image and others such as AI. The figure displayed how the unobtrusive monitoring system is placed in the house. In addition, the figure showed that the system measures movements and vital functions and that in the case of abnormalities, a notification is sent to for example a physician, informal caregiver, husband/wife or children/grandchildren.

Figure 2

The unobtrusive monitoring system



After this explanation, the interview scheme included two questions regarding the general beliefs as well as four questions belonging to each of the four determinants of the UTAUT model. An example of a general question asked during the interview was 'What do you think this system can add for you?'. Furthermore, the interview scheme contained one general question concerning the negative beliefs of the older adults and three questions regarding privacy, loss of human contact and technological issues. The general question for negative beliefs was 'What are the hurdles for you that prevent usage of this system?' In addition to these questions, probes were prepared, such as 'Why do you expect this?' in order to get in-depth answers from the interviewees. During the interviews, probes like nodding and asking for clarification were used.

Procedure

Before data collection started, ethical approval was appointed on the 31st of March 2023 by the BMS ethics committee with case number 230328. Data collection started on the 18th of April 2023 and continued until the 25th of April 2023. The interviews took place in the homes of the older adults. Before the interviews started, the participants were first orally informed about the aims and activities of the study and their rights as participants. Then, the participants were asked to sign the informed consent form, which can be seen in Appendix B. This form is accompanied by an information sheet, in which all details regarding the rights of the participant were given. Afterwards, this sheet was given to the older adult in addition to a copy of their signed consent form. When the consent was given, the recording of the interviews started. The duration of the recorded parts of the interviews ranged from 10 to 17 minutes. The data was stored on the UT OneDrive of the researcher.

Analysis

In order to answer the research questions, this study used a thematic analysis. This type of analysis was performed in ATLAS.ti version 9.1.7.0. The analysis followed the six steps established by Braun and Clarke (2006). Firstly, the interviews were transcribed in an intelligent verbatim method by the researcher, in which personal data such as names and locations were anonymised. Afterwards, the interviews were read thoroughly to familiarise with the data. Then, initial codes were generated using an inductive approach. Codes consisted of multiple sentences or words that shared a similar meaning. For some sentences multiple codes were applied since the sentence conveyed both meanings of these codes. The next step involved creating potential themes deductively based on the UTAUT model. The themes were not created according to the UTAUT model but loosely based on it, since some determinants did not fit the gathered data. For example, the determinant of effort expectancy was not applied as a theme in this analysis since the participants could not be familiarised enough with the technology to fully understand the amount of effort needed. Likewise, social influence was also not incorporated in the analysis as theme since the participants namely answered the question regarding social influence with answers fitting performance expectancy. Following, the themes were reviewed to see whether they relate to the codes and the data set as a whole. The fifth step consisted of defining and naming the themes. In this analysis, the themes are motivations to use SHT, motivations not to use SHT, positive performance expectancy for themselves, positive performance expectancy for others, negative performance expectancy, facilitating conditions for use and barriers for use. The last step according to Braun and Clarke (2006) is to present the themes, which can be seen in the following section of this report. In the report, quotes were used to exemplify the themes. These quotes were translated into English and were selected based on which quote was the best representation for each code.

Results

Participants

The study included 8 participants consisting of 4 men and 4 women, whose ages ranged between 70 and 89 years old (M_{Age} = 79.9, SD = 6.7). The demographics of the participants are displayed in table 1. Five of the eight participants indicated having a chronic illness ranging from rheumatism to heart failure to hereditary motor and sensory neuropathy. Participant 8 received home care through the law social support, in which the helper aided once every two weeks by performing heavy tasks for the older adult. Furthermore, both participants who indicated to have an informal caregiver named their spouse as the caregiver, who took over tasks in the household and helped with the care of the older adult regarding their chronic illness. Participants 1, 6, 7 and 8 lived in an 'aanleuningwoning' meaning that there was easier access to the facilities of a nursing home for them. In the study, partners were included and interviewed separately as each of these participants added an unique perspective.

Table 1

Demographics of the participants

Participant	Age	Gender	Living situation	Chronic illness	Home care	Informal caregiver	Experience SHT
1	76	Male	Together	Yes	No	Yes	Yes
2	85	Female	Together	Yes	No	No	No
3	89	Male	Together	Yes	No	No	No
4	88	Male	Together	No	No	No	No
5	82	Female	Together	No	No	No	No
6	70	Male	Together	No	No	No	Yes
7	71	Female	Together	Yes	No	Yes	Yes
8	77	Female	Alone	Yes	Yes	No	No

Note. SHT stands for smart home technology.

Usage of Current Smart Home Technology

There are two themes discovered regarding the current usage of SHT, which are displayed in table 2. These themes are the motivation for using SHT and the motivation for not using SHT. The themes regarding motivation are unrelated to the UTAUT model. For each of these themes several codes were discovered.

Table 2

Overview of the themes and codes for usage of current smart home technology

Themes	Definition	Codes	Frequency of the themes
Motivation for using smart home technology	The reason why older adults opted for using SHT.	- External recommendation - Performance expectancy	5
Motivation for not using smart home technology	The reason why older adults did not opt for using SHT.	- Effort expectancy - Concerns of physical dependence - Maintenance of overall independence	3

Motivation for Using Smart Home Technology

Three of the participants had experience with SHT. Participant 1 made use of a smart doorbell, while participants 6 and 7 used remote-controlled lights and heating. As motivation for the technology use external recommendation and performance expectancy were mentioned, which can be seen in table 2. External recommendation was mentioned by all three participants owning SHT and it describes that someone recommends and expresses the importance of the technology which will lead to the purchase by older adults. Meanwhile, with performance expectancy older adults realise the benefits of the SHT to their lives which leads to motivation of purchasing SHT. An example of a benefit for the older adults is the possibility to turn on the heating when they are not at home.

Table 3

The codes in motivation for using current SHT

Codes	Definition	Quote	Number of mentions (by who)
External recommendation	Recommendation from an outside source to the older adult about using smart home technology	P1 "Somebody comes in your home, who recommends that."	3 (by P1, P6 and P7)
Performance expectancy	There is an expected benefit of using the technology.	P6: "Then I thought "that is a useful way". If you are not at home, you can still turn on the lights."	2 (by P6 and P7)

Motivation for not Using Smart Home Technology

For the theme of motivation for not using SHT, three codes can be discovered which are effort expectancy, concern about physical dependence and maintenance of overall independence as can be seen in table 3. Effort expectancy shows that the participant was familiar with SHT, in this case remote-controlled lights and heating. However, he was unsatisfied due to the effort required for it to function properly. Similarly, the older adult that mentioned concern about physical dependence was familiar with SHT, however did not want to use these systems as she thinks it will reduce her physical movement in the sense of less walking, which will make her more dependent. Moreover, this participant argued that it was good for her health to stay moving. Lastly, maintenance of overall independence shows that the older adult was proud to still be autonomous and that she did not want to give up this independence.

Table 4

The codes in motivation for not using current SHT

Codes	Definition	Quote	Number of mentions (by who)
Effort expectancy	Technologies require some amount of effort which prevents usage.	P6: "If you want to go to bed earlier, you must turn off all the circuits."	1 (by P6)
Concern about physical dependence	Users worry about becoming physically	P8: "I do not think that is necessary. I think a	1 (by P8)

	dependent on technologies.	human gets lazy from using such a system."	
Maintenance of overall independence	Older adults are still able to function independently and thus do not require technologies.	P5: "No, I am totally autonomous. I want to remain autonomous."	1 (by P5)

Positive Beliefs towards the Unobtrusive Monitoring System

Regarding the positive beliefs of older adults towards the unobtrusive monitoring system, the following three themes were discovered. Firstly, positive performance expectancy for themselves relates to the benefits that use of the system can bring to the life of the older adults. There is a second theme relating to benefits, which are the positive performance expectancies for others, which states the advantages for caregivers, family and others. The third theme concerns facilitating conditions for use which relates to the beliefs of older adults that promote usage of the system.

Table 5

Overview of the themes and codes for positive beliefs

Themes	Definition	Codes	Frequency of the themes
Positive performance expectancy for themselves	The benefits use of the unobtrusive monitoring system brings to the life of the older adult.	- Safety - Prevention - No more conscious withholding of health problems	35
Positive performance expectancy for others	The benefits use of the unobtrusive monitoring system brings to others.	- Replacement of care - Remote updates - Protection	12
Facilitating conditions for use	The beliefs of older adults that promote usage of the unobtrusive monitoring system.	- Familial support in technology use - Safety more important than privacy - Organisational support in technology use - Technical precision	10

Positive Performance Expectancy for Themselves

Table 5 displays the codes of positive performance expectations of the older adults' self for the use of the unobtrusive monitoring systems. Most of these expectations were associated with feelings of safety and prevention of health problems. The older adults mentioned that in the case they were alone and a monitoring system would be used, they would no longer feel invisible and their problems would be noticed, which gives them a sense of safety. Meanwhile, prevention was most of the time related to preventing to stay down after falling. However, other health problems such as wrong medication intake, passing out and lower blood pressure were also mentioned which could be prevented by use of the unobtrusive monitoring system. Lastly, participants 7 and 8 mentioned that whereas normally they would withhold information from their caregivers, the unobtrusive monitoring system does not allow for concealment. Both participants indicated having a chronic illness and make use of the help of a caregiver and thus might have experience with the troubles that hiding problems from their caregivers can cause.

Table 6

The codes for positive performance expectations for themselves

Codes	Definition	Quote	Number of mentions (by who)
Safety	Use of the system gives the feeling of always being guarded in case something goes wrong.	P2: "There is always someone who keeps an eye out for you." P5: "You don't have to fear that no one is hearing or seeing you."	20 (by P1, P2, P4, P5, P6, P7 and P8)
Prevention	Use of the system helps to prevent health problems (e.g., staying down after falling or wrong medication intake).	P1: "But the story was that my blood pressure got high. Then you walk three weeks with that, but such a system sees that immediately, I assume." P5: "Because very often you hear that somebody stays down for a while. Alone."	13 (by P1, P2, P3, P5, P6, P7 and P8)

No more conscious withholding of health problems	Due to use of the system, the older adults are not able to conceal their health problems.	P7: “An informal caregiver does not always know if I feel well or not because I can sugar-coat it. Such a system can see that.”	2 (by P7 and P8)

Positive Performance Expectancy for Others

Aside from the benefits use of the unobtrusive monitoring system has for the older adults themselves, positive performance expectancies for others were also named as displayed in table 6. The older adults mainly mentioned that use of the system could replace care currently given by formal caregivers and their family. Whereas participants 7 and 8 specifically referred to this advantage aiding formal caregivers since they noticed that there currently is a lack of caregivers, participants 4 and 6 mentioned the potential replacement of their families’ care through the system giving them more freedom. Remote updates are an important addition use of the system could bring to the social circle of caregivers, family and friends to make them aware of the health problems of older adults without seeking for direct contact. Three of the four mentions of remote updates came from older adult living in a ‘aanleuningwoning’, which is interesting as these participants are closer to care facilities compared to the older adults not living in a ‘aanleuningwoning’. Lastly, the older adults deemed that it was important for their social circle that the older adult was protected, which would also give the social circle a sense of safety. This is different from the code of safety as protection regards the feelings of the social circle instead of the older adult themselves.

Table 7

The codes for positive performance expectations for others

Code	Definition	Quote	Number of mentions (by who)
Replacement of care	Use of the system replaces care normally taken up by formal and informal caregivers, giving them more space.	P8: “There are so many complaints of too little people in healthcare … Such a thing is then very pleasant.”	5 (by P4, P6, P7 and P8)

Remote updates	The system helps the social circle to gain insight in the behaviour of the older adults from a distance.	P5: "It is certainly also good for them that if something is wrong that they know it, that they know that they should come here."	4 (by P1, P5, P6 and P8)
Protection	Use of the system gives the social circle a sense of safety that the older adult is protected.	P2: "Then they also have something that they can watch us with, which gives them a sense of security."	3 (by P2, P3 and P7)

Facilitating Conditions for Use

Table 7 displays the codes of facilitating conditions for the older adults for the use of the radiofrequency monitoring system. A majority of the older adults indicated that their family could help with possible issues that usage of the technology could bring, which is signified as the code familial support in technology use. Similarly, one participant assumed that an organisation that provides the unobtrusive monitoring system would aid the technology use of the older adults in case anything goes wrong. This participant uses a SHT and thus, might have experience with the organisational support use of these technologies could bring. Moreover, half of the older adults expressed that their need for safety, which was even greater than their need for privacy, was a facilitator towards usage. One participant explained that their safety at their age was more important to them than privacy. Lastly, the code of technical precision can also be discovered under this theme as the preciseness of the system breaks down the barrier of worrying about the functionality of the system.

Table 8

The codes for facilitating conditions for use

Code	Definition	Quote	Number of mentions (by who)
Familial support in technology use	The user assumes that their family can support them in their technology use.	P2: "I only have to call my daughter and she is here already."	4 (by P2, P4, P5 and P7)
Safety more important than privacy	The user expressed that safety was more	P4: "I think that at this old age if you can make	4 (by P1, P4, P5 and P8)

	important than privacy to them at their age	use of this to protect against harm. Then I do not find privacy important.”	
Organisational support in technology use	The user assumes that there some sort of organisational support which helps with the technology use.	P1: “If it malfunctions now, you will get a new one this afternoon, I think.”	1 (by P1)
Technical precision	Use of the system allows for more technically precise measures compared to human measures.	P4: "This has certain points that it follows … And this is exact of course and a human is not.”	1 (by P4)

Negative Beliefs towards the Unobtrusive Monitoring System

Two themes were discovered regarding the negative beliefs of older adults towards the unobtrusive monitoring system. Firstly, negative performance expectancy stresses the opposite of the positive performance expectancy and thus, the disadvantages use of the system brings are discussed. Meanwhile, barriers for use refer to the beliefs of older adults regarding the barriers that are accompanied by the system that hinder usage.

Table 9

Overview of the themes and codes for negative beliefs

Themes	Definition	Codes	Frequency of the themes
Negative performance expectancy	The disadvantages use of the unobtrusive monitoring system brings to the life of the older adult.	- Fear of human substitution - Invasion of privacy - Loss of data control	16
Barriers for use	The barriers of older adults that prevent usage of the unobtrusive monitoring system	- Logistical requirements - Unfamiliarity with the system - Reduction in familial or organisational contact	24

		- System becomes irrelevant	

Negative Performance Expectancy

In table 9 the codes for negative performance expectancy of the older adults regarding the radiofrequency monitoring system are shown. Fear of human substitution was associated to the concern of older adults that human contact was replaced by the system entirely. The participants implied that human contact was still necessary since it provides emotional support. When glancing at the demographics, all participants that mentioned fear of human substitution were women and indicated having a chronic illness. The other codes that signify the disadvantages usage of the system could bring to the older adults are both privacy related. Invasion of privacy displays a fear of older adults that the system will intrude their personal lives. This is then further connected by a fear that older adults are not able to control who is able to see the data and that data might be misused by third parties. It is interesting to note that participant 8 did not mind sharing health data in exchange for safety, but still wants control over who to share the information with.

Table 10

The codes for negative performance expectancy

Code	Definition	Quote	Number of mentions (by who)
Fear of human substitution	The older adults are afraid the usage of the system will replace the current human contact.	P2: "I think it is important that somebody comes by. Then you can say what is wrong exactly." P8: "The human aspect should never be lost, never."	8 (by P2, P7 and P8)
Invasion of privacy	The system will intrude the personal life of the user.	P2: "Someone else does not have to watch me, right?"	4 (by P2 and P7)
Loss of data control	The user fears that use of the system results in loss of control of their own health data, where	P7: "Because you hear so many of those things that you then purchase and then later said oh,	4 (by P2, P7 and P8)

	everybody can see the data.	they are watching. That seems to me not pleasant."	

Barriers for Use

The beliefs on the barriers of the participants of this study can be seen in table 10. The older adults discussed that certain external logistical requirements, such as costs and response from the caregivers group, first need to be attained before the system is used, otherwise a barrier to implementation of the system is created. In addition to logistical requirements, the participants implied that unfamiliarity with the system was a barrier for them since the older adults cannot hear from others about the system yet and thus, they cannot be convinced of the advantages of the system. Furthermore, two participants expressed a shift in the family structure, as well as the structure of current care organisations leading to worry about support for their technology use. These older adults expect that this change in structure results in less contact and thus less support in their technology use. Moreover, two older adults mentioned that the system would not be useful for them. The first older adult mentioned that when she becomes a widow she would choose not to continue ageing in place, instead opting for a retirement home. Meanwhile, the second older adult indicated that the system does not fit her illness, as she is limited in her movements due to the illness and the system does not remove these limitations.

Table 11

The codes for barriers for use

Code	Definition	Quote	Number of mentions
Logistical requirements	There are certain requirements tied to logistics that need to be solved before use of the system can happen.	P6: "Then there must be a response from the [caregivers]group." P8: "There are a lot of people who do not have it [Wi-Fi]." P8: "Because there are a lot of people that if you say you should buy such a thing and then there is often no money for it."	12 (by P3, P6 and P8)

Unfamiliarity with the system	The user has no experience or does not know anybody who has experience with the system, so they are hesitant to use it.	P3: "You have never heard of it; they still must invent it. You have never heard that someone enjoys it."	5 (by P2, P3 and P5)
Reduction in familial or organisational contact	Contact with family or a care organisation is less frequent resulting in older adults feeling less supported in their technology use.	P1: "Yes, we hope that we still get help [from the care organisation]. It is decreasing."	4 (by P1 and P4)
System becomes irrelevant	The system's functions do not aid the older adults with ageing in place and, thus becomes obsolete.	P2: "If I were to be alone here, I would not stay here. Then I will go. Then I get the help when I need it." P7: "But I will still be restricted [due to my illness]. It would not be useful for me."	3 (by P2 and P7)

Discussion

This study has three aims, of which one was to discover the motivation of older adults ageing in place for using current SHT. The results indicate that the main motivation for older adults to use SHT were external recommendation and performance expectancies. On the opposite site, there were also motivations for not using the SHT, which were the required effort needed for the system to work, worry of physical dependence on the system and maintenance of independence. The second and third aim of this study was to discover the positive and negative beliefs of older adults regarding unobtrusive monitoring systems. The older adults mentioned that safety and prevention were two important benefits use of the unobtrusive monitoring system bring to their lives. They also named that the potential replacement of care by the system was a benefit for the caregivers in the current situation. Meanwhile, there were also negative additions mentioned, such as the fear of human substitution in which the older adults feared a loss of humanity and emotional support. Next to these beliefs, facilitators towards the use of technology were also discovered. For example, support from family was named by half of the older adults, as well as a larger need for safety as compared to the need for privacy. Contrary to these facilitators, there were barriers like logistical requirements, such as costs, and unfamiliarity with the system leading to a smaller probability of system adoption and use.

Interpretation of Findings

In the results, some elements were named which warrant further exploration. For example, some older adults mentioned that an advantage of the unobtrusive monitoring system was that they would not consciously withhold information on their health problems anymore. However, this seems contradictory as older adults on the one hand want the unobtrusive monitoring system to share their health problems and be helped, but on the other hand they wish to keep their issues private as they normally conceal them from their caregivers. A study by Gagné et al. (2009) explains that feeling stigmatised is a large contributor to the concealment of illness and disability. Additionally, concealment might be caused out of fear of exclusion, feelings of dependence or not feeling valuable (Lingsom, 2008). While the wish of some older adults is to hide their health problems, it has been proven that sharing these problems with family and friends gives advantages in the disease management, care decision making and disease coping (Gallant et al., 2007). Hence, the choice of older adults to mention not being able to consciously withhold health problems as one of the benefits use of the radiofrequency monitoring system offers.

A second interesting result stated that the older adults discussed having a larger need for safety as compared to privacy. In the interviews with these participants, some mentioned that their age was a large factor for this change. These results contradict the claims made by Jaschinski et al. (2021), in which loss of privacy served as a significant predictor for attitude towards ambient assisted living technologies. This study by Jaschinski et al. (2021) measured loss of privacy in a quantitative method, in which older adults were shown an animation video to explain and show examples of ambient assisted living technologies. This quantitative methodology can explain why loss of privacy appears to be more important in that study since the answers of the participants are more predetermined without allowing for deeper explanation. Another study by Schomakers and Ziefle (2022) can be used to explain need for safety revealed in the current study, as they discovered that privacy concerns are often outweighed by security advantages for smart technologies used in ageing in place. The study further explained that privacy issues are mainly neglected for cases in which the technology offers life-saving benefits. Aside from these scientific source, legal arguments in favour of privacy protection can also be made. For instance, the European Union supports the protection of data through setting certain guidelines such as storage limitations and confidentiality (Wolford, 2022). Additionally, in the AI act of the European Union it is stated that the safety of medical devices using AI should be assessed and that high risk products are banned from usage. Thus, it is still important to protect the privacy of older adults and develop privacy sensitive systems from an ethical and legal standpoint and to secure increased acceptance of such technologies.

The last result discussed regards the negative beliefs of anxiety about technologies replacing humans, which was coded as a fear of human substitution. This fear is in line with research by Weegh and Kampel (2015), which indicates that acceptance of ambient assistance living technologies is lower if technology use leads to replacement of human contact. Fear of human substitution is often connected with a lack of human interaction that technologies bring to care receivers. Jaschinski and Allouch (2019) discovered that concerns about a reduction in human interaction stemmed from technologies causing an increase in social isolation, while lacking empathy and warmth. This is a serious fear amongst older adults and, thus developers and care organisations should take into account that acceptance of unobtrusive monitoring system will be lower if human contact is entirely replaced. Hence, it is important to make visible to the older adults that caregivers will always be around, proving that the system can be seen as an addition instead of a replacement. This, however, means that it cannot be guaranteed that the system will not be misused resulting in less visits from caregivers creating a disruptive living environment for older adults. Therefore, the care organisations need to realise and emphasise the need for human contact in order to create a pleasant situation for older adults.

Strengths and Limitations

Although this study presents interesting results regarding the beliefs of older adults on unobtrusive monitoring systems, it is appropriate to recognise the limitations of the research. First of all, the sample group contained nearly no older adults living alone. While these were contacted, only one accepted to participate in the interviews. Perhaps the older adults that refused to participate were afraid to invite a stranger to their homes. This might have impacted the results of the study since the beliefs of these alone-living older adults might differ from older adults living together. For example, fear of human substitution could have been more prevalent, since these older adults might lose their only contact, or privacy is more important to them, because they are alone and do not want to share information with strangers. Moreover, the sample size was too small since after the eighth interview saturation had not yet been reached. Thus, the results are impacted in a way that more interviews could have added different perspectives. Additionally, the beliefs of the older adults might not be fully developed yet since they might not have fully understood the system or since they could not experience the unobtrusive monitoring system as it has not yet been produced. This could have resulted in not mentioning beliefs regarding the system, as well as underestimating beliefs they currently have. For instance, the older adults currently named the need for safety as more important, but they might not have realised what the system actually measures and how this data is saved, which can result in different beliefs. When they experience the system, perhaps they find their privacy heavily impacted and wish to change the system. But it is still interesting to measure these beliefs at early stages, in order to develop prototypes. These prototypes can make use of these beliefs and can be tested to see how the beliefs of older adults change and what needs to be adapted for a successful product. In addition, the figure 2, which was used to explain the unobtrusive monitoring system in the interviews, might have caused confusion for the older adults. This could have led to less understanding of the system. In the future, the target group, in this case older adults, could be involved in the design process of materials for studies to ensure understanding amongst the target group. Lastly, the use of the UTAUT model can also be seen as a limitation of this study. The UTAUT model is mainly used for general technologies often missing the context needed to explain specific health technologies. Furthermore, the UTAUT model is able to explain for 70% of the user's acceptance and use behaviour, meaning that more determinants are needed to fully explain this behaviour. However, this study loosely followed the determinants of the model and created themes inspired by the model, but not according to the model. Therefore, the use of the UTAUT model most likely does not impact the conclusion of this research.

Despite the limitations, there are also certain strengths of this study. For instance, using the UTAUT model gave the study a broader overview in terms of questioning the participants and analysing the data. The UTAUT model gave direction for the questions during the interview, which guaranteed that most information was gathered. Additionally, in the analysis, the positive and negative beliefs could have been analysed just in terms of advantages and disadvantages, but due to the UTAUT model facilitators and barriers were also analysed. Thus, the UTAUT model allows for a more extended overview of the results. Furthermore, the relatively fit older adults in the study themselves indicated that they were able to understand and answer questions regarding the unobtrusive monitoring system. This proves that it is possible to teach older adults about new technologies, meaning that they can be included in the development phase of new products in order to create a UCD. On top of that, this is a new approach in understanding the beliefs on monitoring systems since normally caregivers or older adults using monitoring technologies are questioned on their attitudes.

Recommendations and Practical Implications

Since the current study analysed the beliefs of older adults qualitatively, these results cannot be generalised. Hence, in terms of future research, the current study can be used to develop a quantitative study in which codes are converted into items. By measuring these items quantitively, a generalised result can be reached which leads to a greater overview of the requirements needed for a design of the system. The codes of privacy and safety are important for such research, but also the less mentioned codes of this study such as not being able to consciously withhold health problems and fear of human substitution are crucial to measure in order to gain a greater overview of the beliefs of older adults on unobtrusive monitoring systems. Additionally, such a quantitative study could be introduced to more older adults who are living alone, which was a limitation of the current study. By including a wider range of participants, a greater overview is gained of the beliefs of older adults.

The present study further opens up questions regarding specific codes, such as the prioritisation of safety above privacy and the withholding of age-related health problems. For instance, the question of when safety is more important as compared to privacy has not yet been answered in this study. This question could lead to a more general research regarding the safety versus privacy debate, how older adults think about this debate and why and when they have their preference for one or the other. Additionally, the code of withholding age-related health problems gives rise to questions, such as why do older adults conceal health problem and how do older adults feel about technologies potentially revealing these health problems. While two older adults indicated this as an advantage of the unobtrusive monitoring system, others have not yet answered these questions. Hence, research regarding the concealment of age-related issues could be performed in order to increase the knowledge regarding this topic.

Conclusion

The findings of this study contribute towards a greater understanding of the positive and negative beliefs older adults have regarding an unobtrusive monitoring system that uses AI. These positive and negative beliefs can be used in the creation and the implementation of unobtrusive monitoring systems. In the creation and implementation of this new system, UCD should be prioritised. By further informing, questioning and discussing with stakeholder such as the older adults, caregivers and others, a successful implementation can take place leading to greater adoption of technologies. This greater adoption can then relieve the caregivers from their caregiver burden, while improving the health, safety and communication of the increasingly larger population of older adults who are ageing in place.

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Appendix A

Interview Schema

Goedemorgen/middag, vandaag wil ik met u een interview afnemen voor mijn scriptie aan de Universiteit Twente. In dit interview zal ik u vragen over uw overtuigingen en barrières ten opzichte van het gebruik van nieuwe monitoringssystemen die gebruik maken van kunstmatige intelligentie (AI), wat ik later nog duidelijker uit zal leggen.

Voordat ik u uitleg geef over deze systemen en vraag naar uw opvattingen, is het belangrijk dat u begrijpt hoe het onderzoek werkt en hoe de gegevens uit het interview gebruikt gaan worden.

- Ten eerste ben ik benieuwd naar uw ervaringen, overtuigingen en verwachtingen, wat betekent dat er geen goed of fout antwoord is.
- Graag maak ik een opname van dit interview zodat ik het kan overschrijven om het te verwerken in mijn scriptie verslag.
- De gegevens zijn beschikbaar voor mij en mijn scriptiebegeleiders Dr. L.M.A. Braakman-Jansen en Dr. J.E. Spook. De gegevens zullen na het overschrijven anoniem worden gemaakt, zodat er niet aan af te leiden is dat u de geïnterviewde bent. De gegevens zullen niet voor andere doeleinden dan het verslag worden gebruikt. Verder zullen de gegevens voor één jaar na het interview dus *[datum]* worden bewaard.
- Daarnaast is deelname aan dit interview vrijwillig en kan u uw deelname op elk moment terugtrekken.

Als u alle hiervoor genoemde punten en de voorwaarden in het informatieformulier begrijpt en hiermee akkoord gaat, mag u het geïnformeerde toestemmingsformulier tekenen.

Het interview bestaat uit vier delen en tussendoor zou ik telkens een beetje uitleg geven.

Algemene informatie:

Wat is uw leeftijd? Wat is uw geslacht?

Wat is uw burgerlijke staat?

Hoelang woont u al op deze plek?

Ontvangt u op dit moment thuiszorg? Hoe vaak per week? Waarvoor?

In hoeverre bent u op dit moment gezond?

Bent u onder behandeling bij een arts voor een chronische aandoening?

Ontvangt u ondersteuning van een mantelzorger? Wie?

Uitleg doel

Ik zou u nu even het nut van deze studie willen uitleggen. Mensen worden steeds ouder en vaak hebben ze op oudere leeftijd mantelzorgers en professionele hulpverleners nodig die hen helpen. Helaas zijn er de komende jaren steeds minder professionele hulpverleners en ook mantelzorgers beschikbaar. Als oplossing zijn nieuwe technologieën wellicht mogelijk, zoals monitoringssystemen, die ik dadelijk ga uitleggen. Maar eerst wil ik u vragen over uw algemene ervaring met slimme huishoudelijke technologieën die het huishouden makkelijker maken, zoals een op afstand bestuurbare verwarming of robotstofzuiger.

Ervaringen met huidige slimme huishoudelijke technologieën

Vraag 1. Welke slimme huishoudelijke technologieën gebruikt u?

Vraag 2 Waarom bent u begonnen met het gebruik van deze slimme huishoudelijke technologieën?

Vraag 3. Wat zijn voor u de pluspunten van het gebruik van deze slimme huishoudelijke technologieën?

Vraag 4. Wat zijn de verbeterpunten voor deze slimme huishoudelijke technologieën?

Uitleg over monitoren met radiogolven/geluidsgolven/Wifi en kunstmatige intelligentie

Voordat we verder gaan met het interview, zal ik u nog wat meer uitleg willen geven over een monitoringsysteem. Een monitoringssysteem is een eHealth hulpmiddel dat u kan helpen veilig en comfortabel te blijven wonen in uw eigen huis. Het systeem gebruikt sensoren en andere technologieën om informatie te verzamelen over uw dagelijkse activiteiten en gezondheid, zoals uw bewegingen, slaappatroon, bloeddruk en medicatie-inname.

Een monitoringssysteem dat nog ontwikkeld wordt is een op basis van geluidsgolven. Het systeem maakt gebruik van de geluidsgolven van het Wifi signaal dat al in uw huis is om internet te kunnen gebruiken. Om het systeem te laten werken komt er een klein kastje bij uw in huis zoals op figuur 2. Dit kastje kan de informatie dan verwerken. Dit is een klein kastje van 2 bij 5 cm dat *in uw huis wordt geplaatst, waarvoor er hoeft er niks verbouwd te worden. U hoeft dus niets op uw lichaam te dragen en er staat ook geen camera op u gericht. Het systeem kan zelfs door de muren heen meten, wat betekent dat u zich niet kan verstoppen voor de techniek.*

Met dit Wifi systeem kunnen grote of kleine bewegingen van u gemeten worden van een afstand. Het kan bijvoorbeeld registreren dat u ergens in uw woning bent gevallen. Ook kan het meten of u al gegeten hebt, of u gewassen hebt of in hoeverre uw dagelijkse ritme veranderd is. Ook zou het eventueel zelfs hartslag en ademhaling kunnen meten.

In het systeem zit kunstmatige intelligentie. Hierdoor kan dit kleine kastje op bepaalde vlakken denken en handelen zoals een mens. Het kastje kan hierdoor zelfstandig meten, maar ook over de uitslagen nadenken. Hiermee vergelijkt het kastje de huidige uitslagen met andere resultaten. Dat betekent dat het systeem heel goed patronen kan ontdekken in uw dagelijkse bewegingen. Het systeem 'weet' dan dat u bent gevallen ergens in huis en kan dan zelfstandig alarm slaan wanneer u daar een aantal minuten ligt. En verder kan zo'n systeem heel goed afwijkingen van uw dagelijks patroon ontdekken. Dat kunnen subtiele afwijkingen zijn die normaal gesproken misschien niet zouden opvallen (u loopt bijvoorbeeld iets langzamer naar de keuken dan anders), maar dit kan wel iets te betekenen hebben op lange termijn

Zodra er een afwijking, zoals één week niet gedoucht hebben, gemerkt wordt, gaat het systeem beslissen om een melding te sturen naar uw familie/zorger/etc.

Stel u voor dat u de komende 10 jaar thuis blijft wonen. Misschien gaat u lichamelijk of cognitief achteruit. Dat weten we niet.

Overtuigingen AI-radiogolven

Vraag 4. Wat vindt u van dit radiogolven systeem dat gebruikmaakt van kunstmatige intelligentie?

Vraag 5. Wat denkt u dat het systeem voor u kan toevoegen?

Vraag 6. Verwacht u dat u het gebruik van dit systeem uw leven zal verbeteren? **(PE)**

Probe 1. Waarom verwacht u dit (niet)?

Vraag 6. Wat verwacht u dat u zelf qua moeite in het systeem moet steken voor gebruik? **(EE)**
Vraag 7. Denkt u dat uw sociale kring het belangrijk zou vinden dat u dit systeem gaat gebruiken? **(SF)**

Probe 2. Waarom verwacht u dit (niet)?

Probe 3. Zou de sociale kring dan ook invloed hebben op uw gebruik?

Vraag 8. Verwacht u dat u genoeg hulp krijgt bij dit systeem om het te gebruiken? **(FC)**

Barrières AI Radiogolven

Ik ben nu ook nog benieuwd naar andere barrières die u zou hebben tegen gebruik van dit systeem.

Vraag 9. Wat zijn voor u de drempels die gebruik van zo'n systeem tegengaan?

Vraag 10. Heeft u zorgen over privacy, bijvoorbeeld het delen van gegevens, die gebruik van dit systeem voorkomen?

Probe 3. Wat zijn deze zorgen precies?

Vraag 12. Zijn er ook zorgen over het technologische aspect dat gebruik van dit systeem moeilijk zou maken?

Probe 4. Kan u die zorgen benoemen?

Vraag 13. Zijn er ook zorgen over het verlies van menselijk contact dat gebruik van dit systeem in de weg zou staan?

Probe 5. Wat zijn deze zorgen?

Appendix B

Information Sheet and Informed Consent Form

<u>Informatieblad voor onderzoek ‘Overtuigingen en barrières van 60-plussers over het gebruik van innovatieve monitoringssystemen die gebruik maken van kunstmatige intelligentie”</u>

Doel van het onderzoek
Dit onderzoek wordt geleid door Stijn Temmink
Het doel van dit onderzoek is om overtuigingen en barrières van 60-plussers over monitoringssystemen die gebruik maken van kunstmatige intelligentie te kennen.

Hoe gaan we te werk?
U neemt deel aan een onderzoek waarbij we informatie zullen vergaren door: één-op-één interviews die opgenomen worden en daarna getranscribeerd.

Potentiële risico's en ongemakken

- Er zijn geen fysieke, juridische of economische risico's verbonden aan uw deelname aan deze studie. U hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. Uw deelname is vrijwillig en u kunt uw deelname op elk gewenst moment stoppen.

Vertrouwelijkheid van gegevens
Wij doen er alles aan om uw privacy zo goed mogelijk te beschermen. Er wordt op geen enkele wijze vertrouwelijke informatie of persoonsgegevens van of over u naar buiten gebracht, waardoor iemand u zal kunnen herkennen.
Voordat onze onderzoeksgegevens naar buiten gebracht worden, worden uw gegevens zo veel mogelijk geanonimiseerd, tenzij u in ons toestemmingsformulier expliciet toestemming heeft gegeven voor het vermelden van uw naam, bijvoorbeeld bij een quote.

In een publicatie zullen anonieme gegevens of pseudoniemen worden gebruikt. De audio-opnamen, formulieren en andere documenten die in het kader van deze studie worden gemaakt of verzameld, worden opgeslagen op een beveiligde locatie bij de Universiteit Twente en op de beveiligde (versleutelde) gegevensdragers van de onderzoekers.
De onderzoeksgegevens worden bewaard voor een periode van 1 jaar. Uiterlijk na het verstrijken van deze termijn zullen de gegevens worden verwijderd of worden geanonimiseerd zodat ze niet meer te herleiden zijn tot een persoon.
De onderzoeksgegevens worden indien nodig (bijvoorbeeld voor een controle op wetenschappelijke integriteit) en alleen in anonieme vorm ter beschikking gesteld aan personen buiten de onderzoeksgroep.
Tot slot is dit onderzoek beoordeeld en goedgekeurd door de ethische commissie van de faculteit BMS.

Vrijwilligheid
Deelname aan dit onderzoek is geheel vrijwillig. U kunt als deelnemer uw medewerking aan het onderzoek te allen tijde stoppen, of weigeren dat uw gegevens voor het onderzoek mogen

worden gebruikt, zonder opgaaf van redenen. Het stopzetten van deelname heeft geen nadelige gevolgen voor u of de eventueel reeds ontvangen vergoeding.
Als u tijdens het onderzoek besluit om uw medewerking te staken, zullen de gegevens die u reeds heeft verstrekt tot het moment van intrekking van de toestemming in het onderzoek gebruikt worden.
Wilt u stoppen met het onderzoek, of heeft u vragen en/of klachten? Neem dan contact op met de onderzoeksleider.

Stijn Temmink
s.j.m.temmink@student.utwente.nl
+31 6 84266633

L.M.A. Braakman-Jansen
l.m.a.braakman-jansen@utwente.nl
+31 5 34896047

Voor bezwaren met betrekking tot de opzet en of uitvoering van het onderzoek kunt u zich ook wenden tot de Secretaris van de Ethische Commissie/domein Humanities & Social Sciences van de faculteit Behavioural, Management and Social Sciences op de Universiteit Twente via ethicscommittee-hss@utwente.nl. Dit onderzoek wordt uitgevoerd vanuit de Universiteit Twente, faculteit Behavioural, Management and Social Sciences. Indien u specifieke vragen heeft over de omgang met persoonsgegevens kunt u deze ook richten aan de Functionaris Gegevensbescherming van de UT door een mail te sturen naar dpo@utwente.nl.

Tot slot heeft u het recht een verzoek tot inzage, wijziging, verwijdering of aanpassing van uw gegevens te doen bij de onderzoeksleider.

Door dit toestemmingsformulier te ondertekenen erken ik het volgende:

1. Ik ben voldoende geïnformeerd over het onderzoek door middel van een apart informatieblad. Ik heb het informatieblad gelezen en heb daarna de mogelijkheid gehad vragen te kunnen stellen. Deze vragen zijn voldoende beantwoord.
2. Ik neem vrijwillig deel aan dit onderzoek. Er is geen expliciete of impliciete dwang voor mij om aan dit onderzoek deel te nemen. Het is mij duidelijk dat ik deelname aan het onderzoek op elk moment, zonder opgaaf van reden, kan beëindigen. Ik hoef een vraag niet te beantwoorden als ik dat niet wil.

Naast het bovenstaande is het hieronder mogelijk voor verschillende onderdelen van het onderzoek specifiek toestemming te geven. U kunt er per onderdeel voor kiezen wel of geen toestemming te geven. Indien u voor alles toestemming wil geven, is dat mogelijk via de aanvink-box onderaan de stellingen.

	JA	NEE
1. Ik geef toestemming om de gegevens die gedurende het onderzoek bij mij worden verzameld te verwerken zoals is opgenomen in het bijgevoegde informatieblad. Deze toestemming ziet dus ook op het verwerken van gegevens betreffende mijn gezondheid/ras/etnische afkomst/politieke opvattingen/religieuze en of levensbeschouwelijke overtuigingen/lidmaatschap van vakbond/seksueel gedrag/seksuele gerichtheid en/of over mijn genetische gegevens/biometrische gegevens.	☐	☐
2. Ik geef toestemming om tijdens het interview opnames (geluid/beeld) te maken en mijn antwoorden uit te werken in een transcript.	☐	☐
3. Ik geef toestemming om mijn antwoorden te gebruiken voor quotes in de onderzoek publicaties.	☐	☐
4. Ik geef toestemming om de bij mij verzamelde onderzoeksdata te bewaren en te gebruiken voor toekomstig onderzoek en voor onderwijsdoeleinden.	☐	☐
Ik geef toestemming voor alles dat hierboven beschreven staat.	☐	

Naam Deelnemer:

Handtekening:

Datum:

Naam Onderzoeker:

Handtekening:

Datum: