

A Feasibility Study Examining Older Adult Needs within Smart Home Sensor Deployments



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As older adults age, they are faced with numerous challenges that hinder their independent living such as symptoms resulting from chronic health conditions, reduced mobility, social isolation and cognitive decline.¹ Recent developments in smart home technology designed to detect and record individuals' activities and status within their living spaces present a unique opportunity to improve their health and wellness.² Although there have been reported benefits resulting from the use of smart home technology,^{3,4} the deployment of sensor systems has often been limited to laboratory settings due to practical challenges such as managing multiple sensor installations. Furthermore, it becomes challenging for these new technologies to generate data that can be presented and visualized in a comprehensible and efficient manner so that older adults themselves can access and interpret information about their activities of daily living. In this study, we deployed commercially available sensors to community-dwelling older adults' residences using the Lab of Things platform for connected devices.^{5,6} The primary goal of this study was to understand the information and visualization needs and preferences of older adults when presented with actual sensor data collected from a 2-month deployment within the home.

Methods: We are recruiting older adult (65 and older) participants through collaboration with local retirement facilities in Seattle to take part in a 2-month deployment study. Eligible participants have to be community dwelling older adults (including residing in an independent living facility), able to give informed consent, and able to read and write English. The participants are given a choice to choose the sensors they would like to have installed within their home. The sensors are commercially available and consist of a Door/window sensor and a Multi-sensor (collects data on motion, temperature, luminosity, and humidity), and a Foscam IP camera. Participants have to select at least one sensor to be eligible for the study. We use a secure platform, Microsoft's Lab of Things,^{5,6} for collecting and managing data from the sensors. We conduct three interview sessions one at baseline, one at 1 month, and another at exit. During the interviews we engage participants within the design of data visualizations derived from the sensor data through a participatory design approach. This involves asking participants to provide feedback on iterations of the design and also to generate ideas for alternatives to the visualization. The interviews also seek to gather participant perspectives on sensor use within the home, in particular addressing issues of intrusiveness, perceived value, and information needs from the visualization. All interviews are audio-recorded and transcribed for content analysis. We also gather demographics and collect participants' self-reported daily activities (IADL), the participant's perceived health and well-being (SF-12), and life-space mobility (LSA), and e-health literacy (eHeals) during baseline and exit interviews. The University Institutional Review Board approved all study procedures.

Results: The study is currently ongoing. To date five older adults have been recruited and have finished mid-point interviews. The mean age (SD) of the participants is 91 (4.9) years old. All of our participants have a Bachelor's degree or higher. Our findings so far demonstrate the need to develop interfaces that truly match users' needs and expectations. Furthermore, as participants have commented, the processing of visualized information requires that users understand the context of this assessment (e.g., when data were collected, how they can be used to inform decisions, what the clinical implications of patterns changes may be). We will present recommendations for the design of user interfaces and visualization prototypes based on the iterative feedback provided by our participants.

Discussion: The innovation brought by the smart home technologies can significantly impact the future of home healthcare. With more and more older adults showing interest in smart home technologies,⁴ the home healthcare industry needs to think about integrating smart home sensors in their care plan. In order for smart homes to become widely used, we need to ensure that the information generated by such passive monitoring systems is easily accessible and understood by all stakeholders, especially older adults, if the use of technology aims to empower them rather than simply monitor every one of their movements.

Conclusion: Despite the potential of smart home technology, there remains a challenge in increasing acceptance and usage of these technologies particularly among older adults. Our work highlights that the effective visualization of smart home data is key to the success and ultimate adoption of smart home applications to support aging in place.

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