User-Centered Implementation of Motion Tracking Sensors for People with Visual Impairments and Blindness

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A great amount of attention has recently been paid to a proactive healthcare approach. For example, patients are active in managing health conditions on a daily basis, and chronic conditions are prevented with promotion and disease prevention strategies that patients are allowed to navigate and control. Thus, it becomes critical for patients to directly monitor their own daily living activities and assess the degree to which the activities are deviated from the norm.

Today, there are a variety of technologies available (e.g., motion tracking sensors, less invasive computing, and artificial intelligence) contributing to detecting accurately and collecting adequately various activities of daily living (e.g., gait characteristics). For instance, Microsoft Kinect sensors are often employed in monitoring and analyzing a wide range of human behaviors in natural settings (e.g., home).

A smart home is considered as an effective intervention to promote home-based selfcare; however, many studies on smart home technologies focused merely on mathematical models (e.g., Monte Carlo algorithms, hill climbing algorithms, and genetic algorithms) to determine ideal locations to install sensors in the home. A lack of attention has been paid to the user-centered approach; that is, a systematic analysis of the end users' living and working contexts, users' preferences, tools, tasks, users' capabilities and limitations that affect the system designs, developments, and implementations. Without in-depth consideration of the end users' contextual needs and concerns, any technology would be eventually abandoned by users, resulting in becoming useless technology despite technical advancements. The user-centered approach should be adopted for such ambient intelligence and smart home concepts via rigorous scientific methods, i.e., not simply relying on a computational modeling or a human common sense only.

This study aims to advance knowledge of how sensor technology (e.g., Microsoft Kinect) should be implemented in the home of people with disabilities, particularly older adults with visual impairments and blindness. A convenience sample of older adults with visual impairments and blindness participated in this study. A researcher visited each participant's home and conducted a semi-structured interview to obtain a deep understanding of their daily living contexts. Their living environments were also observed in terms of environments (e.g., types of housing and rooms), tasks (e.g., activities of daily living), tools (e.g., household goods), people (e.g., residents and visitors), organizations (e.g., living alone and with others), and interactions with aforementioned factors. The interview lasted approximately 60 minutes. The participants' comments were audio-recorded to capture all details and transcribed for content analysis, and also the observation was recorded by making notes and quick sketches.

This study offered a set of guidelines that would be useful for researchers and professionals in determining on how to implement sensor technology for older adults with visual disabilities in the home. The guidelines were constructed by comprehensively reviewing various factors such as tools, people, environment, and tasks.

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