Health Smart Homes: User Perspectives

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Introduction

• Smart Home is a living area that uses interconnected sensing devices to monitor and control the physical environment.
• In 2017, 3.8 million Australians were aged 65 and over is expected to reach 8.8 million by 2057 (AIHW).
• “Health Smart Homes” can be used to help ageing people to remain living independently longer.
Research Aim

- To identify the perceptions of users of Health Smart Homes to support ageing by reviewing the literature.
- Four topics identified as relevant to user perception occur widely in this literature:
  - Functions
  - Services
  - Benefits
  - Implementation.
Methodology

- **Literature Search**
  
  *Sources:* PubMed, Google Scholar, and Scopus.
  

- **Keywords & Search Criteria**
  
  "smart home" OR "ubiquitous home" OR "automated home"
  
  OR "ambient assisted living"
  
  AND
  
  "aged people" OR "gerontechnology" OR "ageing population"
  
  AND
  
  "quality of life" OR "self-management" OR "self-care".
Methodology

- System architecture
- Independent living
- User requirements
**Inclusion Criteria**

- Published in English and available in full text from peer reviewed journals.
- Books, PhD or Master theses, lecture notes and duplicate articles.
- Included participants aged > 65 years.

**Exclusion Criteria**

- Papers focusing on telehealth and m-health.
Functions

1. Physiological Health Smart Home Monitoring
2. Functional Health Smart Home Monitoring
3. Social Interaction Health Smart Home Monitoring
4. Safety Health Smart Home Monitoring
5. Cognitive Support Health Smart Home Monitoring
Results

1. Physiological Health Smart Home Monitoring
   • Four papers described use of physiological measures such as vital signs to monitor health status of elderly people.
   • User Perceptions:
     - Self-management
     - Behavioural patterns
     - Quality of life.
Results

2. Functional Health Smart Home Monitoring
   - Two papers described use of functional measures to determine the Activities of Daily Living (ADL’s) such as routine work, nutrition, sleep patterns.
   - **User Perceptions:**
     - Quality of life
     - Usability
     - Functionality.
3. Social Interaction Health Smart Home Monitoring

• Two papers described elements such as cognition and speech to support human communication needs.

• User Perceptions:
  - Interpersonal relationships
  - Well-being
  - Usability.
Results

4. Safety Health Smart Home Monitoring
   - Two papers described the use of posture recognition and mobility analysis to provide a fall detection system.
   - **User Perceptions:**
     - Quality of life
     - User-friendly
     - Compatibility.
Results

5. Cognitive Support Health Smart Home Monitoring

- Four papers described the use of mobility and behavioural patterns to contribute to a supportive environment.
- **User Perceptions:**
  - Quality of life
  - Accessibility
  - Efficiency.
## Study results for user perceptions in Health Smart Homes

<table>
<thead>
<tr>
<th>Paper</th>
<th>Operational Model Functionality</th>
<th>User Requirement</th>
<th>System Architecture</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>[13]</td>
<td>Cognitive assistance for participants social-activities and daily activities</td>
<td>Usability, quality of life</td>
<td>Inbuilt Smart Home</td>
<td>Interpersonal relationships, community life, physical, cognitive behaviours</td>
</tr>
<tr>
<td>[14]</td>
<td>Monitoring the activity, diet and exercise compliance of diabetes patients</td>
<td>Accessibility, quality of life</td>
<td>Inbuilt Smart Home</td>
<td>Self-management education, low cost health-assistance, behavioural monitoring</td>
</tr>
<tr>
<td>[19]</td>
<td>Monitor senior adults’ daily behaviours and the living environment</td>
<td>Feasibility, quality of life</td>
<td>Inbuilt Smart Home</td>
<td>Interoperability, behavioural monitoring</td>
</tr>
<tr>
<td>[20]</td>
<td>Monitor the physical and cognitive function</td>
<td>Acceptance, perception</td>
<td>Inbuilt Smart Home</td>
<td>Self-management, behavioural monitoring</td>
</tr>
<tr>
<td>[16]</td>
<td>Motivational gaming system to increase the physical activity of elders with complex chronic conditions</td>
<td>Scalability, integrity, user-friendly</td>
<td>Inbuilt Smart Home</td>
<td>Self-management</td>
</tr>
<tr>
<td>[21]</td>
<td>Monitor the physical activity</td>
<td>Functionality</td>
<td>Home automation</td>
<td>Behavioural patterns</td>
</tr>
<tr>
<td>[24]</td>
<td>Monitor inhaling, exhaling and heartbeats</td>
<td>Adaptability</td>
<td>Inbuilt Smart Home</td>
<td>Self-management</td>
</tr>
<tr>
<td>[22]</td>
<td>To assist mobility impaired patients</td>
<td>Efficacy, user compatibility</td>
<td>Inbuilt Smart Home</td>
<td>Quality of life, self-efficacy and safety</td>
</tr>
<tr>
<td>[18]</td>
<td>Monitoring an elderly person in a fall detection system</td>
<td>Compatibility, ease to use</td>
<td>Integrated Smart Home</td>
<td>Quality of life</td>
</tr>
<tr>
<td>[12]</td>
<td>To regulate indoor air quality through control of external environment.</td>
<td>Low-cost solution</td>
<td>Proposed Smart Home</td>
<td>Quality of life</td>
</tr>
<tr>
<td>[17]</td>
<td>Multimodal sound corpus acquisition labelling used for sound and speech recognition.</td>
<td>Compatibility, ease to use</td>
<td>Sweet Home project</td>
<td>Wellbeing, reliance</td>
</tr>
<tr>
<td>[23]</td>
<td>Monitor various memory disorders, sensory problems</td>
<td>Accessibility, efficiency</td>
<td>Home automation</td>
<td>Quality of life</td>
</tr>
</tbody>
</table>
Key Findings

- Health Smart Homes can empower elderly people, caregivers and healthcare professionals for improving longevity of life.
- Health Smart Homes can motivate the participants to stay healthy at home.
- A targeted conceptual framework for such usability studies in future research would help to improve the acuity with which impacts on quality of life of consumers could be assessed.
Conclusion

- **User involvement** is needed in all stages of Health Smart Home system design, implementation, and testing to achieve end user satisfaction.
- There is generally an emphasis in Health Smart Homes research on the *technical aspects* rather than in meeting user needs.
- Lack of knowledge on user profiles, clinical effectiveness and integration within existing Health Smart Home systems will influence our future research on organizing a proposed “unified framework”.
THANK YOU