Week 8: Elderly Care 2.0 User Acceptance Test Plan

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# Elderly Care 2.0

## Problem Statement

Senior citizens live longer than ever and want to defer moving into nursing homes until later in life. Transitioning into elderly care comes as a double edge sword. On the one hand, nurses can provide 24-hour care. This assistance could mean the difference between life and death (e.g., during a fall). On the other hand, the services are prohibitively expensive, nearing $90,000 annually (Tan et al., 2020). Additionally, these facilities lack the personalization available within one’s home. Further, specific individuals with diseases like dementia and Alzheimer’s require even greater levels of attention.

Traditionally, addressing the situation requires increasing human capital, such as adding more traveling nurses or family member oversight. However, this solution increases health care costs and collects limited patient health samples. These infrequent visits might miss critical issues, especially with the most reluctant to relocate. Alternatively, researchers are exploring wearable IoT devices. Those sensors provide mechanisms for requesting assistance and receiving continuous monitoring. There are many limitations to wearable solutions, most notably that the person must remember to wear them. This requirement is particularly concerning during the early stages of memory loss.

## Advancing the Status Quo

Amazon Go enables customers to purchase goods from physical stores without requiring cashiers (Amazon, 2021). Their solution uses Deep Neural Network (DNN) algorithms that process real-time video streams. Wankdhede et al. (2018) assessed the system’s sophistication through a series of shoplifting test cases. Their failure to steal any items provides evidence that real-time video monitoring is an effective real-world tool.

Medical services need to design similar systems for monitoring senior citizens within their homes. This capability would narrow the level of care gap between nursing homes and private residences. Extending the patient’s duration in familiar settings has numerous benefits, both psychologically (e.g., consistent routines) and economically (e.g., deferring private health care costs). Additionally, the elderly care facilities would increase profits through fewer nurses providing higher-quality care to more patients. The assisted living homes also reduce their capital requirements (e.g., fewer physical beds), further lowering the barrier to market expansion.

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| Problem Statement | Many scenarios would benefit from artificial intelligence within the household.   * Monitoring children * Translating multi-lingual speech * House arrest supervision * Enhanced elderly/disabled care * Providing a health index |
| Purpose Statement | Design and implement a secure, reliable, and private system for recording and auditing the house. The system uses a collection of commodity IP cameras and Raspberry-PI controllers.  Users can interact with the system via mobile, Alexa/Google Home assistants. |
| What makes this study unique | There are four core reasons:   1. Purpose-built for home monitoring vs. generic home security 2. Existing tooling is mediocre, prohibitively expensive, and invasive (e.g., wearables) 3. Compares the performance of 3(?) different computer vision strategies 4. Uses a semantic metadata model to drive decisions versus raw content (ensuring privacy controls) |
| What is the value proposition | It takes a village to raise a family, and those resources are rarely available. The camera-based system provides those missing capabilities to smart houses (e.g., babysitting and translation) |
| Why should researchers and practitioners care | 1. Amazon Go proves that computer vision can replace low-skilled staff (e.g., cashiers). Now other smart offices are beginning to adopt those same technologies. 2. However, there is little adoption of home automation due to privacy, quality, and cost concerns. 3. Providing more insights into the lifestyle quality can improve morale and over family health |
| Provide evidence from the literature | See README.md |
| Why does the proposed item not yet exist | The current state of the art system is:   * Detail * Detail * Detail   However, these capabilities are still lacking   * Skill * Skill * Skill   This discrepancy exists because of   * Reason * Reason * Reason |
| How will you measure improvements |  |
| What are the core contributions to the body of knowledge | 1. Proposed system architecture for home monitoring and automation 2. Performance analysis of 3(?) different computer vision-based algorithms 3. Case-study spanning an individual house and its collective data |
| What artifacts will you produce | 1. Python-based implementation of an OpenCV Smarthome automation solution 2. Keras-based implementation of 3(?) video analysis algorithms 3. Quantitive description of the Qualitative metadata collection results |
| User Acceptance Testing | |
| How will you test the solution | The UAT needs to confirm   1. Meets User Requirements 2. Reliability, Validity, & Effectiveness 3. Security and Integrity |
| Include systems diagram |  |
| Explain the diagram and its components |  |
| Data Collection Process |  |
| Evaluation Process |  |