PUCK on a Smart Phone

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INTRODUCTION

- Smart technologies that extend the amount of time that individuals can live independently by increasing functional independence are of significant value.
- Older adults prefer an independent lifestyle and autonomy in their homes.
- Prompting technologies can be used to help older adults complete IADLs and maintain a greater sense of independence and daily functioning
- Usage of recorded human voices are natural, acceptable and less stressful than machine voices.
- Phones can be carried around and outside the home as opposed to a touch screen anchored in a central place in the house.
- Prompting technologies may be used to help older adults complete IADLs and maintain a greater sense of independence, improve daily functioning, and minimize caregiver burden.
- We expect that young adult participants will rate PUCK on a smart phone more positively than PUCK on stationary laptop computers.

DESCRIPTION of PUCK

Prompting Users and Control Kiosk or PUCK is a prompting system developed at the CASAS Lab with a goal of reducing caregiver's burden to give any form of intervention to a smart home inhabitant so that an activity could be completed successfully.

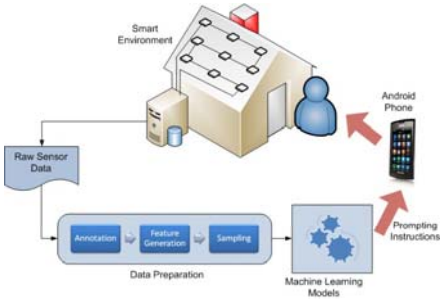

Figure 1: System Architecture

PUCK Service

In order to ensure that PUCK reaches the mass and proves to be helpful for both the caregivers and the users, this project aims at developing an infrastructure for a service. Following are the major components of the service:

Caregiver Web Interface

- A caregiver would be able to control the cuing instructions using a web interface from a distant location.
- Caregiver would be able decide the rules based on which the prompts should be given to a user.
- The rules that the caregiver chooses can be both time based and context aware.

Phone Application

- The Android phone application is used to deliver different modes of prompts like, audio, video and multimodal, to the user.
- For now it would be fully function within the range of the smart environment wireless network.

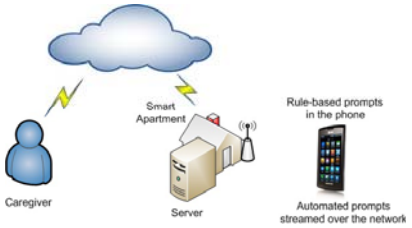

Figure 2: PUCK Service

Figure 3: PUCK Screenshot

- Outside the network of the smart environment, the phone would work only on the prompts that are preloaded on it.
- It does not have any decision making capability on the gravity of the prompts.
- On receiving an emergency message from the server, the phone will automatically dial a phone number to reach the caregiver or any other family member.

Server

- The server is the brain of the entire system which uses a middleware infrastructure to communicate with the phone in real time.
- Ability to translate the rules set by the caregiver into a prompt deliverable form.
- Storage of majority of the prompt media files and can play them to the phone over a live stream.
- Implementation of a machine learning model that would predict which prompt to fire when.

EXPERIMENTATION METHODOLOGY

Participants

- Participants will be recruited from the Psychology Subject Pool at Washington State University and from the general population of healthy younger adults
- Exclusion criteria will include a history of head trauma with permanent brain lesion, current or recent (past year) psychoactive substance abuse, history of cerebrovascular accidents, and known medical, neurological or psychiatric causes of cognitive dysfunction (e.g., epilepsy, schizophrenia).

Procedure

- Participants will complete IADLs IADLs within a smart environment (Table 2). Using a graded hierarchy (e.g., indirect, direct, multimodal), cues will be generated for each step needed to complete the 6 IADLs.
- Participants will perform the activities six times each.
- In addition, in some of the cases the participant will simulate an activity error such as wandering, skipping a step, or using an incorrect tool.
- When our Smart Environment detects an error in activity completion an audio prompt will be automatically played that directs the participant in the correct way to complete the task.

Table 1: Six Activities

General/Handyman Activity: Sweep the kitchen and dust the dining room and living room	**Household Chore:** Wash the kitchen countertops with a sponge and dish soap and put the sponge in the drying rack to dry
Water Plants: Fill a watering can and water 3 plants located around the apartment	**Hygiene:** Wash hands in the kitchen sink, choosing correct soap and using paper towels to dry
Medication Use: Read directions and fill a 7 day pill holder with pills	**Meal Preparation:** Fill a glass of water and prepare a bowl of soup for a friend

- The participants will be asked at the end of the session to complete a questionnaire providing feedback on the acceptability of the timing and mechanisms used for prompts.
- The cues will be pre-recorded and stored on the server. The PUCK system would deliver the cue when an error in activity completion occurs.
- Possible errors could include:
  - oPerformance of steps for other activities and not the current one.
  - oSteps irrelevant to the current activities are being performed.
  - oAn atypical amount of time has elapsed since the initiation of the current step.
  - oThe participant perseverates on or fails to initiate the current step
  - oThe participant performs the current step incorrectly or in an order that would prohibit accurate completion of the activity
- The hierarchy of cues given will always begin with a *verbal indirect cue* designed to orient the participant back to the task (e.g., "It looks like only one type of light bulb should go in the dining room table lamp") followed by a *verbal direct cue* designed to aid with activity completion (e.g., "Check the dining room table lamp to see what wattage light bulb to pick") and then a *multimodal cue,* involving a *direct verbal* cue paired with a *visual cue,* delivered on a laptop showing a person completing the step of the activity (e.g., a video appears of a person checking the lamp to see the wattage and then taking the correct box of light bulbs out of the cupboard along with verbal direct cue).

ANTICIPATED OUTCOME

- We will compare our questionnaire data with data from participants in a similar study who will receive cues through stationary laptop computers in the smart apartment.
- We anticipate that participants who receive cues through the phone interface will respond more positively than those who receive cues through laptop computers.

FUTURE WORK

For our current work we could run a simple phone application that plays the prompts on the basis of a predefined time. As a part of the work over the next semester, we would have a fully functional phone application. We would also have the caregiver web interface ready so that we can test on the experience of the caregiver. We have the fully functional server that would be used in this study. However, the smart phone middleware interface needs to be finalized.

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