

GroundMemo

Intelligent Home System for Seniors with Memory Loss

TEAM MEMBERS AND ROLES

Interviews, brainstorming, task analysis, scenarios and storyboarding were each done in part by four team members: **Shadman Abedin, Allison Chou, Celina Hipolito, and Will Wang.**

PROBLEM AND SOLUTION OVERVIEW

A common problem faced by aging citizens is **memory loss**. Regularly forgetting things can impair a person's ability to complete daily tasks done efficiently, if at all. Memory loss includes a wide spectrum of symptoms, so for this project, our group focused on senior citizens with mild memory loss, who live in their personal home and are still mostly mobile and able to communicate. Our solution is a system of **sticker trackers paired with smart floor tiles**. The seniors and their families put the stickers on objects commonly lost or interacted with. If an object is lost, the stickers can relay their location to the floor which shows the way to the lost object. If it is time to complete a task, the floor will notify the user by displaying a reminder on the tiles, pointing them to the direction of the task.

DESIGN RESEARCH GOALS, STAKEHOLDERS, AND PARTICIPANTS

Our design research consisted of three interviews with caretakers of seniors with memory loss. The participants were:

Participant 1 - Lee: a Semi-structured interview. 21 years old. 2 years of caregiving experience at local assisted living home.

Participant 2 - Wang: a Structured interview. 65 years old. Took care of his 83-year-old mother who had experienced memory loss for 3 years at home.

Participant 3 - Chen: a Semi-structured interview. 57 years old. Took care of his father who had experienced short-term memory loss for 2+ years.

We decided to speak with caretakers because their role is to help seniors with their daily routines, which is a role we want to support with our solution. They are also more accessible than actual seniors with memory loss and are usually able to reflect and analyze their own experiences more deeply than the seniors.

We conducted interviews because they were the more efficient way to hear about the participants' experiences. Our approach with pure interviews was originally going to supplement with a contextual inquiry in a local assisted living home, but the logistics of the visit never lined up. We were still able to find intriguing themes from just the interview data.

DESIGN RESEARCH RESULTS AND THEMES

Individuals with memory loss are very diverse

Memory loss is a wide spectrum, and even focusing on mild memory loss yields a large variety of symptoms and needs. The individuals being cared for in all of our cases had different needs and responses to experiencing memory loss. Participant 1 works with a resident who is socially apt but forgets important cues such as needing to use the bathroom. This resident feels confused and scared when experiencing memory loss. Another resident in the same unit has mild confusion across the board but become irritable and frustrated when experiencing memory loss. We made sure to address underlying causes of these varying symptoms in order to help as many people as possible.

Familiarity is the best way to help someone experiencing memory loss

All of our participants agreed that talking about familiar aspects of a person's life, especially family, are helpful in helping someone to remember or calming someone who is distressed because of memory loss. Participant 1 would talk about a resident's grandfather who was a dentist to remind her to brush her teeth. Participant 2 would use photo albums to help the individual remember names and basic information about people. Participant 3 would show the individual photos to improve their mood. This theme told us that if our solution is to be interacted with by the individual with memory loss, it would be important to incorporate as many familiar interface elements as possible.

Caregivers want to make sure these individuals are well without watching all the time

All of our participants were concerned with things that happen to individuals with memory loss when they are not being watched. Participant 1 performs safety checks in the residents' rooms every 2 hours, but worries about things that happen between the checks. For instance, if someone is found in their room distressed and is unable to communicate why, it will be much harder to help that person. Participants 2 and 3 care for people with memory loss at home and worry about them while at work. The inability to know what these individuals are doing at home can lead to forgotten tasks such as taking medicine or repeated tasks, such as cooking a meal that has already been prepared. Even with hiring a daytime caretaker, Participant 3 would constantly worry about their father at home. Our design should focus on giving caretakers peace of mind on the appropriate completion of tasks while not being too intrusive on the individual with memory loss.

ANSWERS TO TASK ANALYSIS QUESTIONS

1. Who is going to use the design?

We are focusing primarily on seniors with short-term memory loss who live in their own home (i.e., not an assisted living home). Based on our research, it seems that memory-impaired seniors who do not live in nursing homes face particularly difficult memory-related problems since they do not have 24/7 care available to them. Instead, they must rely on themselves, a family member, and/or a hired caretaker who is around regularly or occasionally. We also wanted to focus more on mild memory loss, since individuals with severe levels of memory loss are more likely to already be in an assisted living facility.

2. What tasks do they now perform?

From our interviews, it seems that the individuals with memory loss attempt to perform regular daily tasks, such as waking up, eating, taking medications, performing a hobby, exercising, shopping, bathing, and sleeping.

3. What tasks are desired?

Our interviewees report that the individuals with memory loss have difficulty executing some of the tasks above. Due to forgetfulness, they may forget to take medications, turn off running water, or buy groceries. A solution to remedy this forgetfulness and to help these individuals perform daily tasks more easily is desired.

4. How are the tasks learned?

Daily tasks are generally performed for many years out of habit. However, as we learned from our interviews, sometimes things change which can throw off a routine, e.g. being prescribed a new medication. This may confuse the individual with memory loss. Furthermore, though routines may have been performed for years, short-term memory loss can prevent an individual from remembering whether they have already performed a given task.

5. Where are the tasks performed?

From our interviews, the majority of tasks seem to be performed at the home of the individual with memory loss, e.g. taking medications, eating, and bathing. There are also some daily tasks performed outside the home, such as grocery shopping or doctor visits. From our interviews, these outside visits were commonly accompanied by a caretaker.

6. What is the relationship between the person and data?

We collected data from the individuals and the objects that they interact with. Those data mainly include but not limited to: motion, location, and individuals associated events. We want our data collection to be effective in devising a solution while also allowing the individual as much privacy as possible. We are currently thinking of devising a solution that collects data from objects around the

individual's environment instead of data from the individual itself. For example, we may collect data from appliances or items that the individual regularly uses.

7. What other tools does the person have?

Our interviews have revealed that existing tools to assist individuals with memory loss are fairly archaic. Current tools include pen and paper to write down reminders and information, phone calls from the caretaker to the individual in order to ensure that daily tasks are successfully completed, sticky notes, and in-person reminders. Photos and photo albums are also used in order to recall information, with information sometimes being written down on the photo itself.

8. How do people communicate with each other?

Based on data from our interviews, caretakers and the individual with memory loss primarily communicate in-person or on the phone. The individuals with memory loss seem to tend to not have a lot of experience with technology, so verbal communication seems to be the preferred method of communicating. However, our project is shaping up to focus more on the individuals with memory loss and their interactions with the environment, so we will also be examining nonverbal communication methods.

9. How often are the tasks performed?

Some tasks, such as taking medications and eating, were reported to be performed on a daily basis. Other tasks, such as grocery shopping or visiting a doctor, occurred more irregularly, such as weekly or monthly.

10. What are the time constraints on the tasks?

A few tasks are very time sensitive, such as taking medications, which may have to occur at a certain time every day (e.g. one of our participants took care of an individual who had to take blood-pressure medication every day during lunch). Other tasks seem to be more flexible, such as shopping.

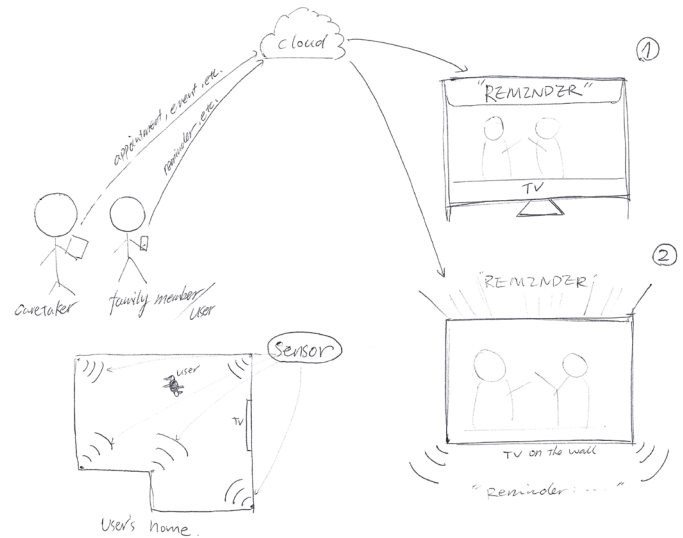
11. What happens when things go wrong?

In general, if an individual forgets to perform a task, it will just be forgotten about and remain unperformed. Depending on the task, this could have varying consequences. For example, with forgetting to take medications or forgetting about a doctor's visit, an individual's health may be negatively impacted.

PROPOSED DESIGN SKETCHES (3X4)

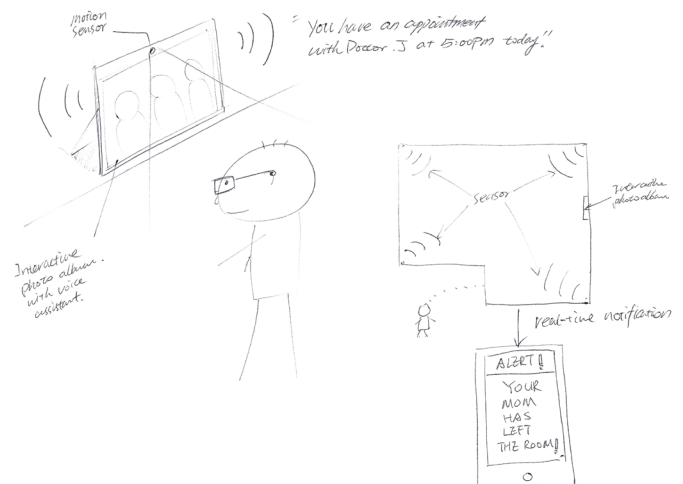
Concept 1 - Television Notification System

This is a notification system attached to a television that gives visual and audio reminders as the user watches a show. Reminders would be set up by a caretaker or the user's family members or user themselves. If set by a caretaker, the reminder would have the option to include a voice recording so a familiar voice will remind the user. The caretaker can also record a video of themselves which will be displayed by the TV, to add another layer of familiarity. This solution would be able to remind the user of things such as appointments, scheduled events, medication and be paired with sensors in the house to remind them to do laundry or turn off the oven. There are two methods of displaying notifications: either by replacing ads with reminders or by projecting behind the television.



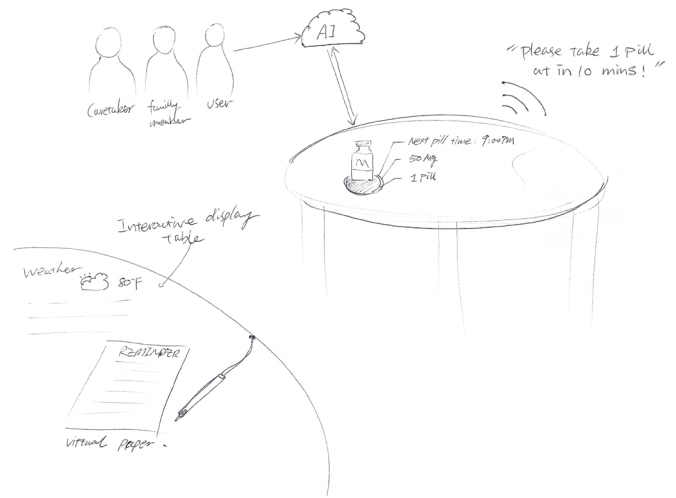
Concept 2 - Home Sensor System

This is an intelligent home sensor system with an interactive UI. Multiple sensors are set up around the home to enable the wellbeing of the individual and grant a peace of mind to the caretakers. The sensors are paired with an interactive photo album. By default, the photo album shows pictures of loved ones, but it also functions as a voice assistant that can record and process individuals' information and request to remind them of the important things. This sensor system can also detect whether the individual is in the room, as well as alert the caretakers when there is an emergency. For example, the sensor by the door detects and alerts caretakers if the individual leaves at an irregular hour. If the individual falls, sensors will be able to detect this emergency and alert the caretaker and/or family members.



Concept 3 - Smart Table

We also looked at a smart table that interacts with an individual who has mild short-term memory loss. It has easy and desirable user input through a virtual paper representation and a smartpen. The table will then parse and sort this information. When that information is required, an embedded voice assistant will issue a reminder. This voice assistant also acts as basic AI, that can answer simple questions (e.g. what is the weather today?). This table would also be detecting medicine containers being placed and taken off of the table to understand how the user is taking their medication. If there are issues with frequency or dosage, the embedded voice assistant will remind the user, their caretaker, and/or their family members of the correct way to take the medicine.



Selected Design

Our selected design deviates from all three of our initial designs and focuses on creating smart stickers and custom smart tile floors for the homes of individuals with memory loss. Each sticker has GPS tracking built into it, and reminders can be associated with the sticker either online or through a phone application. The smart floor detects movement and will lead the user to an upcoming task/reminder via a series of lights programmed into the floor. Furthermore, a sticker can be placed on the user itself and can alert a caretaker if the individual with memory loss has left their residence. We considered each of the three previously discussed designs, but believed that each had its own problems, e.g. they could be in a different room and not hear any alerts, as is the case with the smart table. We believed that the smart stickers and floor tiles were an unobtrusive and simple way to help fix some of the problems that individuals with short-term memory loss are going through.

WRITTEN SCENARIOS

Scenario 1: GroundMemo helping with reminders

Maria is an 80-year-old retired teacher who lives alone. She likes to spend her time at home watching sports, reading, and chatting with old friends on the phone. Maria has noticed that she has become noticeably more forgetful over the course of the past year or so. She can't seem to remember simple tasks, such as when she needs to take medicine or when she needs to make her weekly phone call to her daughter. Her daughter, Anna, lives close by and has become worried about her mother's deteriorating memory. She is especially concerned because Maria suffers from high blood pressure and needs to regularly take her medication in order to stay healthy.

Anna recently had GroundMemo installed in her mother's home, a decision that she is very happy with. She puts smart stickers on everything from her mother's medicine bottle to her mother's phone. She also alerts Maria's doctor that a smart sticker has been placed on Maria's medicine bottle. Maria's doctor is able to directly go in through the GroundMemo website and program in the times every day when Maria should be taking her medicine. This reminder is then relayed to the smart sticker on the medicine bottle via the cloud.

Maria is supposed to take her medicine at 12 pm daily. She is usually watching television on the couch at this time. Now, every day at 12 pm, the ground in her home lights up and beeps, showing her the path to the smart sticker on the medicine bottle. Maria gets up and follows the lights to the medicine bottle. The smart sticker display shows Maria exactly how many pills she should be taking. Maria takes the pills, the lights on the ground shut off, and Maria is happy and healthy!

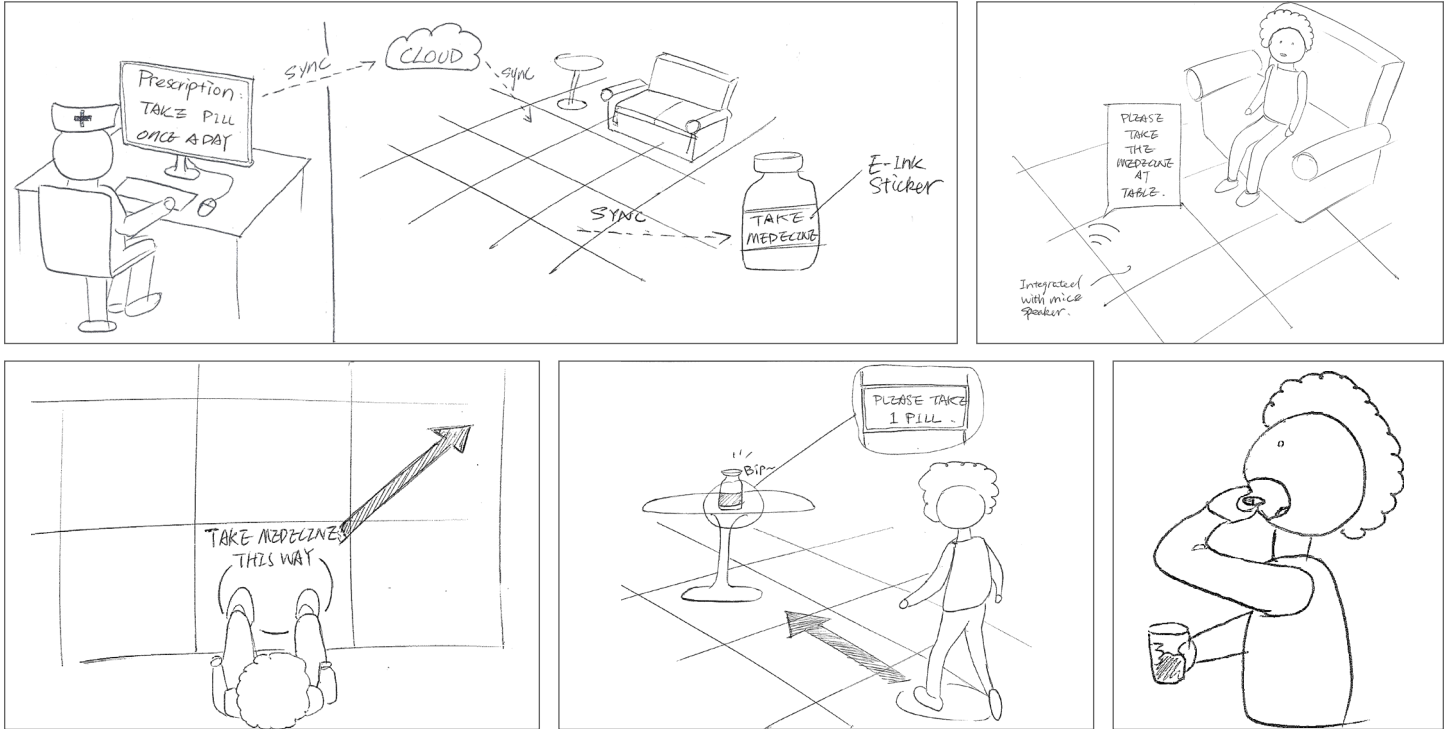
Scenario 2: GroundMemo notifying caretakers when wandering occurs

Daisy is a 75-year-old woman who lives with her son, Marco. She suffers from short-term memory loss and occasionally accidentally wanders out of the house and into the street. This has Marco very concerned, especially since he works full-time as an accountant downtown and cannot be around 24/7 to check on his mother's whereabouts.

Marco installs GroundMemo in the home that he shares with his mother. Every morning before he leaves for work, he places a smart sticker on his mother's shirt. Since the smart sticker has a GPS, combined with the smart floor's movement tracking, Marco can detect whether Daisy has exited the home. If she has, Marco receives a notification on his phone via the GroundMemo app and can rush to wherever his mother is to make sure she is safe and sound.

STORYBOARDS OF THE SELECTED DESIGN

Scenario 1: GroundMemo helping with reminders



Scenario 2: GroundMemo notifying caretakers when wandering occurs

