

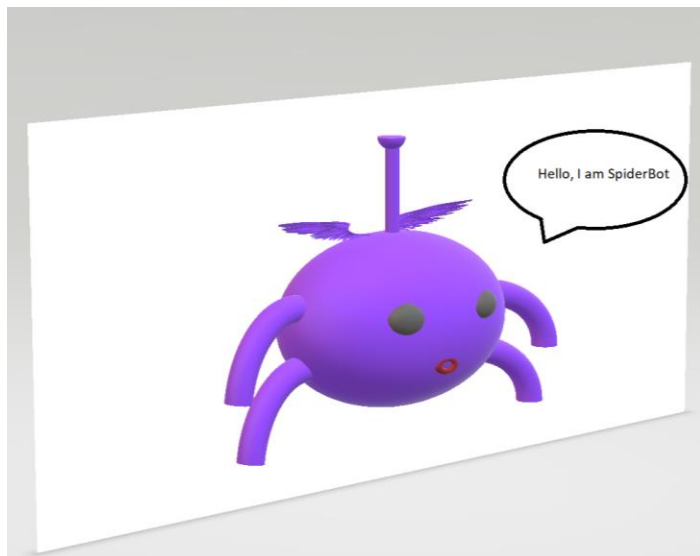
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Project Part 5: Complete Prototype

Use Case for Underserved Persona

Suzie just got this system and she wants to set it up and clean her living room. This is the first time she has interacted with the system.

Screen 1: Welcome

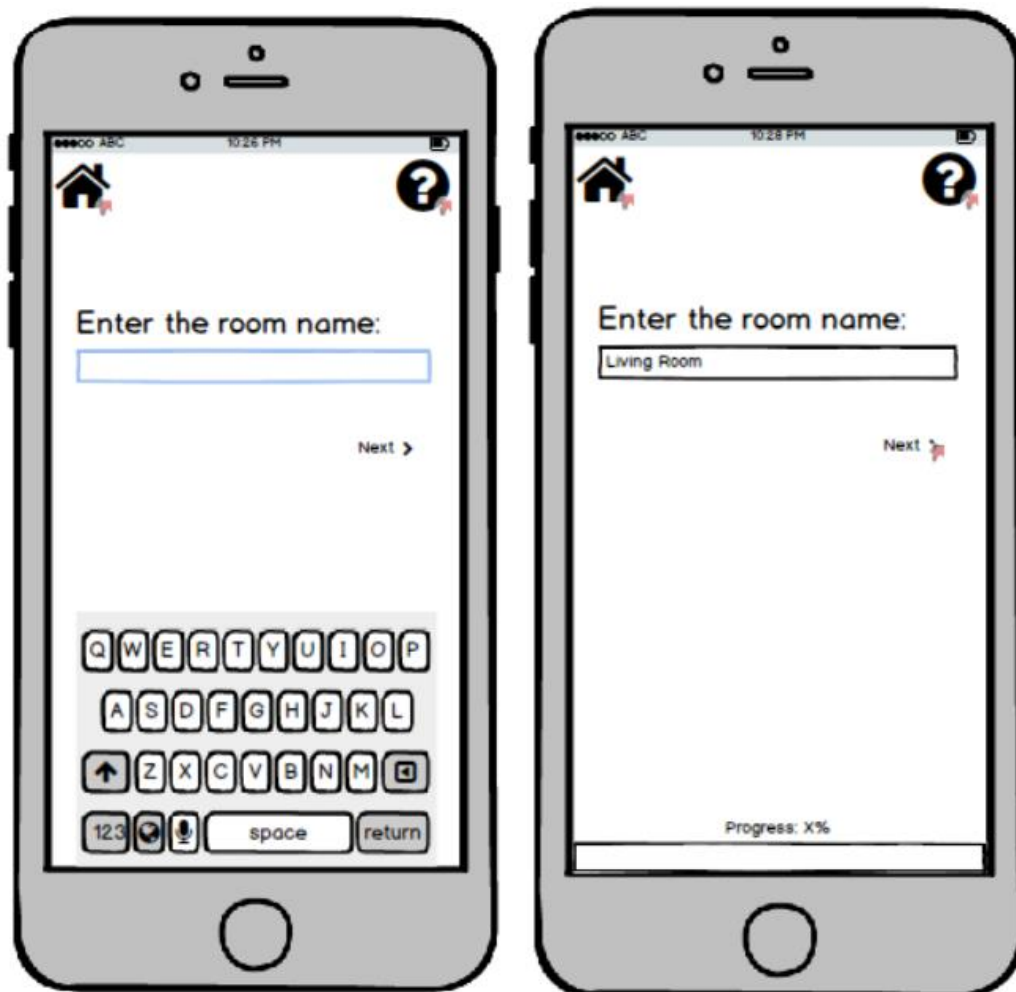


Robot says, *"Hello, I'm SpiderBot, your cleaning companion. My purpose is to keep your home tidy and clean. To get started, say or select 'Begin First-Time Setup'. You may say 'Quiet' at any time to turn off my audio."*

User selects or says, *"Begin First-Time Setup"*

Robot says, *"Let's get started."*

Screen 2: Room Selection



Robot asks, "Let's set up a room for cleaning. Are we currently in the room you would like to set up? If so, please say or type the name of the room. If not, please go to the room you would like me to clean and I will follow you there."

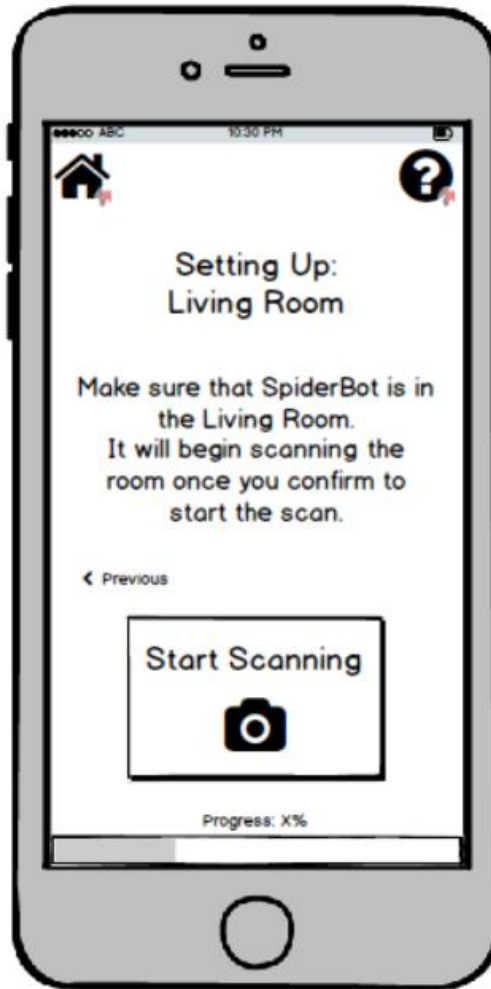
User says or types in, "Living Room"

Robot says, "Ok, 'Living Room'. Say or select 'Next' to continue."

User selects or says, "Next"



Screen 3: Configure Room



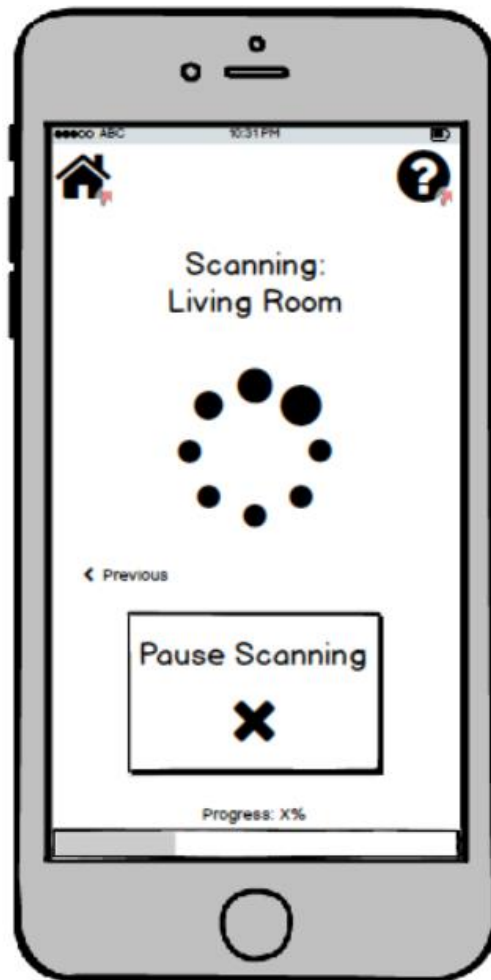
Robot says, *"I am ready to scan the living room. Doing so will allow me to learn where everything goes. If there are currently objects out of place, please put them away now. Pets or people other than yourself should vacate the room before I start. To continue, say or select, 'Start Scanning'"*

User selects or says, *"Start Scanning"*

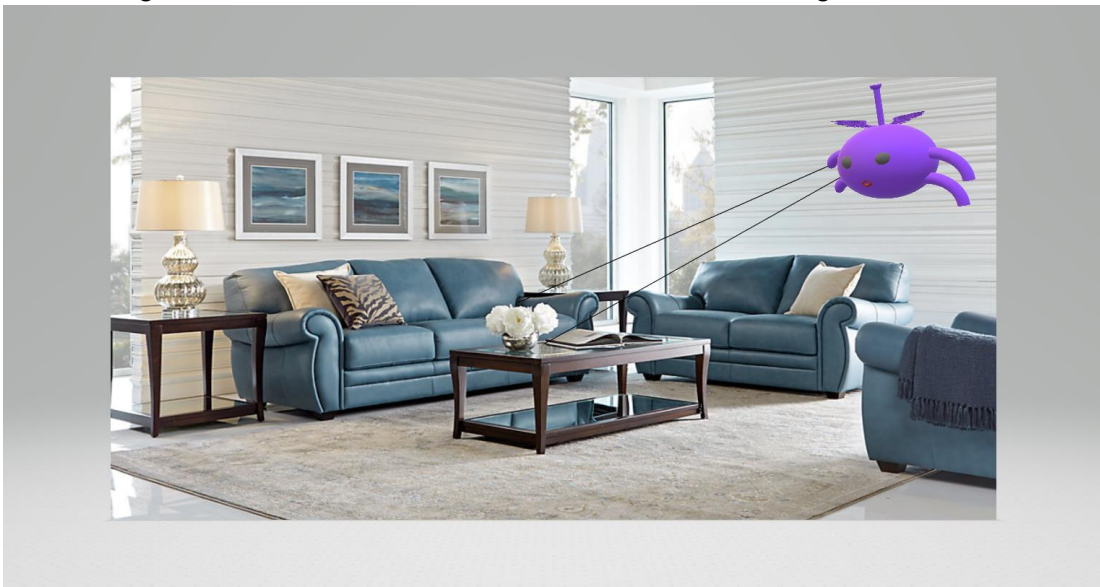
Robot says, *"I will now scan the room. At any time during the scan, you can say or select 'Pause Scanning'"*



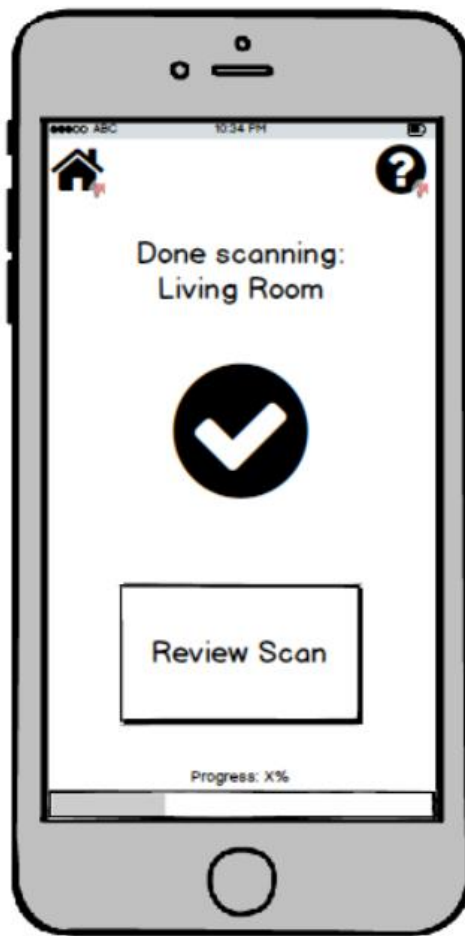
Screen 4: Scanning



Robot Image 1: Robot flies across the room and starts scanning the room

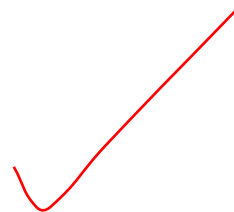


Screen 5: Scan Finished



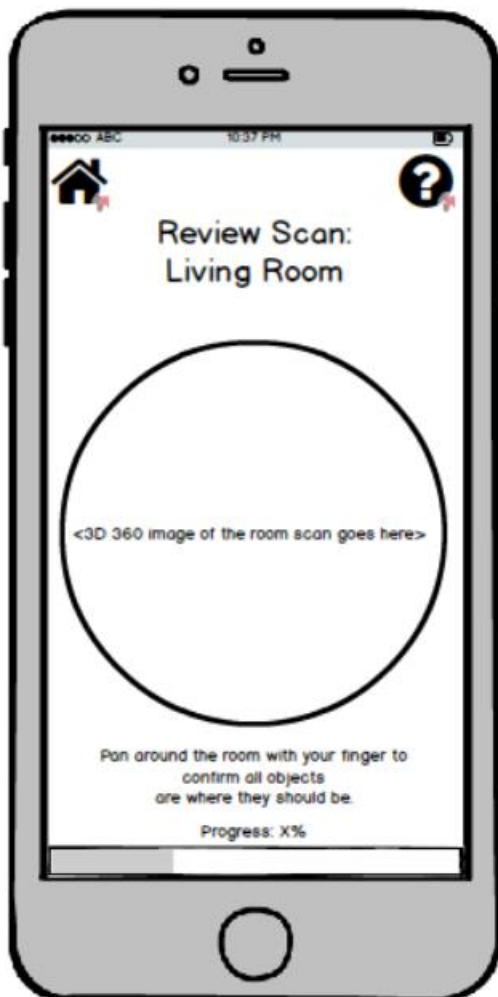
Robot says, *"I have completed my scan. Now let's review my scan to make sure I have everything right. Say or select 'Review Scan' to continue."*

User selects or says, *"Review Scan"*



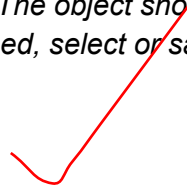


Screen 6: Review the Scan



Robot says, "I have created a 3D model of the living room. I have tried to identify all objects and where they belong. If an object is shaded, that means I will put the object back where it belongs during cleaning. If there are objects you would like me to clean around and never move, please select them on your screen. I will never move any object except the shaded ones."

Robot says, "If I missed an object, please select it on your screen. The object should become shaded. Once you are finished, select or say, 'Done'"



User selects the objects that are to be opted out

User selects or says, "Done"

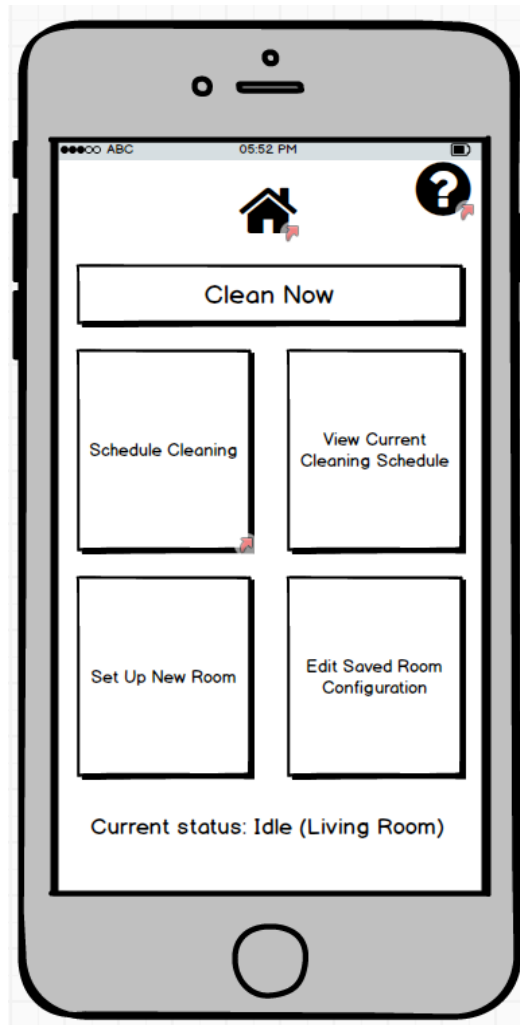
Screen 7: Configuration Saved



Robot says, *"I have saved your configuration, and will use it in the future when you tell me to clean the living room. Thank you for completing my set up! If you have any questions or I am not doing a great job simplifying your life, please feel free to call our support line at <SPI-DER-BOTSUPPORT> or email <spiderbotssupport@us.com>. I will now take you to the home screen so that you can tell me when to schedule cleanings."*

(Screen transitions without user input to the home screen when SpiderBot is done.)

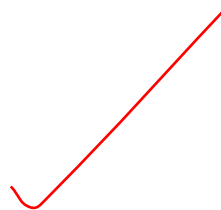
Screen 8: Home



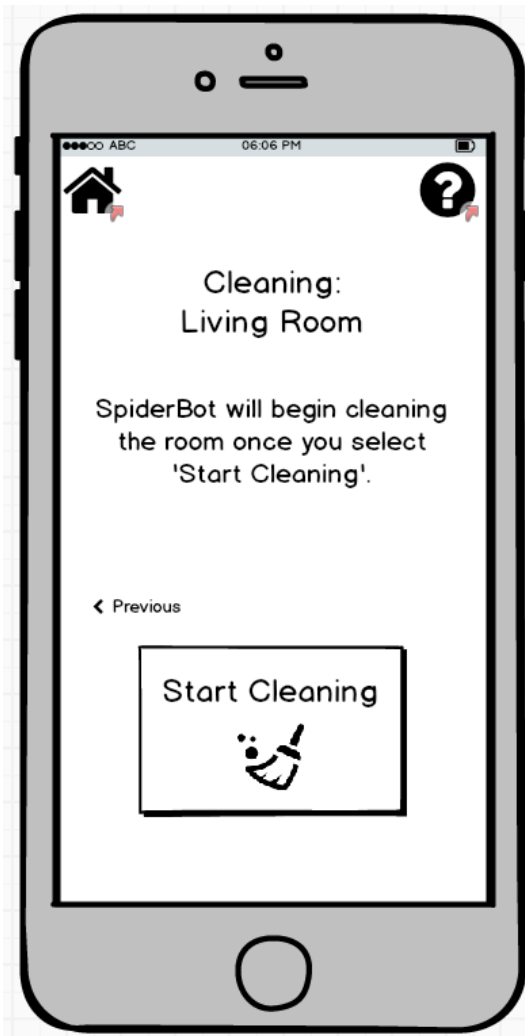
Robot asks, *"What would you like to do? Clean now, schedule cleaning, view current cleaning schedule, set up new room, or edit saved room configuration?"*

User selects or says, *"Clean Now"*

Robot says, *"You have selected 'Clean Now'"*

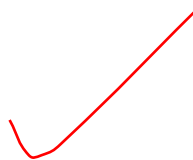


Screen 9: Cleaning Confirmation

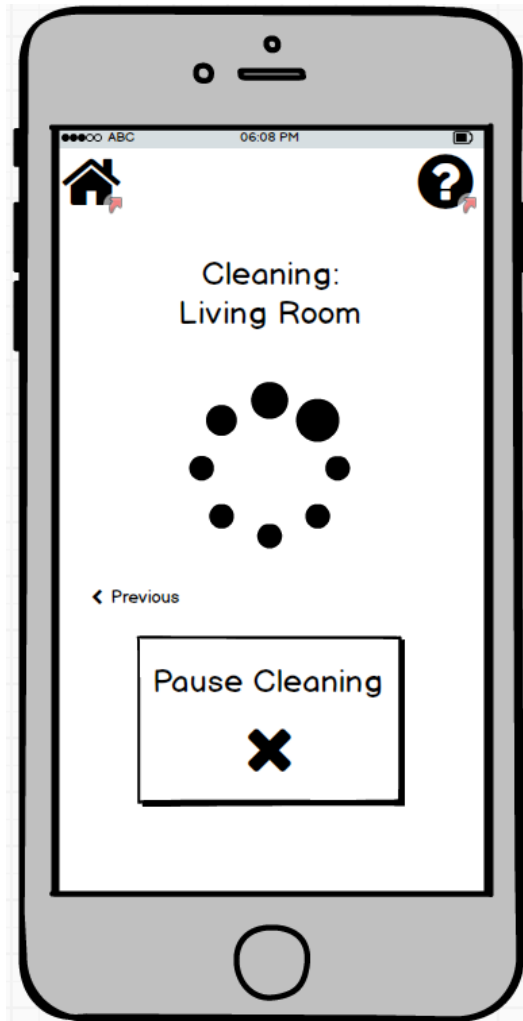


Robot asks, *"Would you like me to begin cleaning the living room? Say or select 'Start Cleaning'"*

User selects or says, "Start Cleaning"

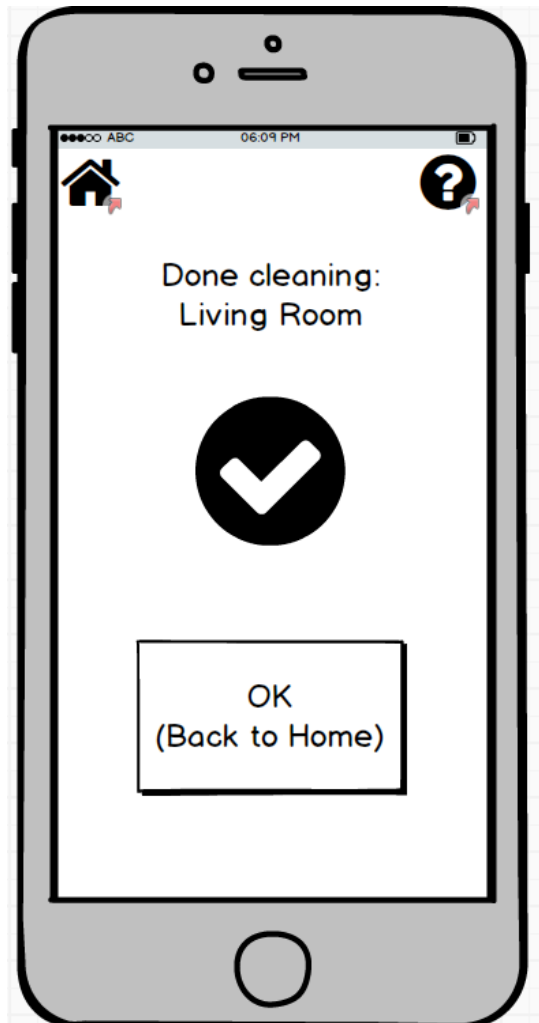


Screen 10: Cleaning in Progress



Robot says, "I will begin cleaning the living room now. At any time, you can say or select 'Pause Cleaning' to make me stop."

Screen 11: Cleaning Complete



Robot says, *"I have finished cleaning the living room. Say or select 'OK' to return to the home screen"*

User selects or says, "OK"

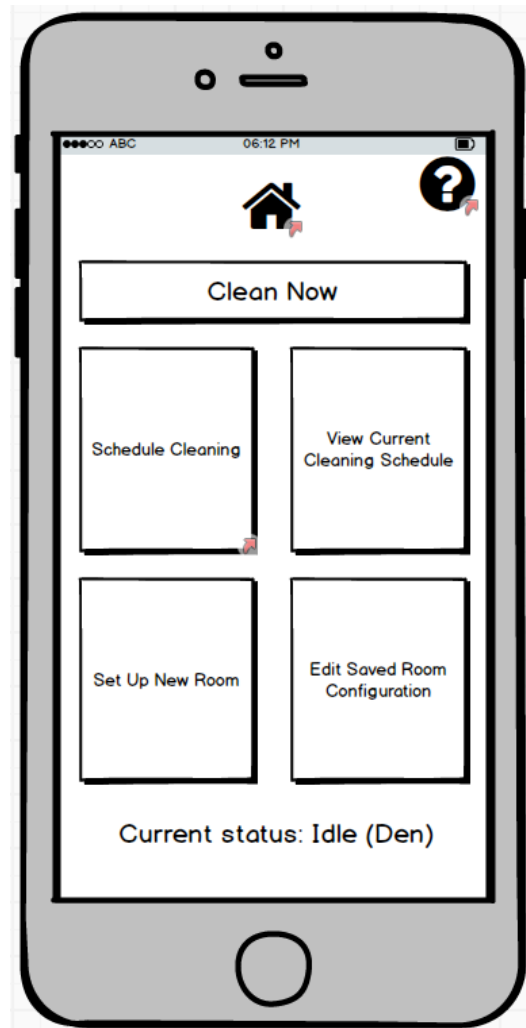
<end use case>



Use Case for Mainstreamer (Ted)

Ted wants to schedule a day and time for SpiderBot to tidy a room for which there is already a saved configuration. He has a vacuum attachment that he'd like to use.

Screen 1: Home



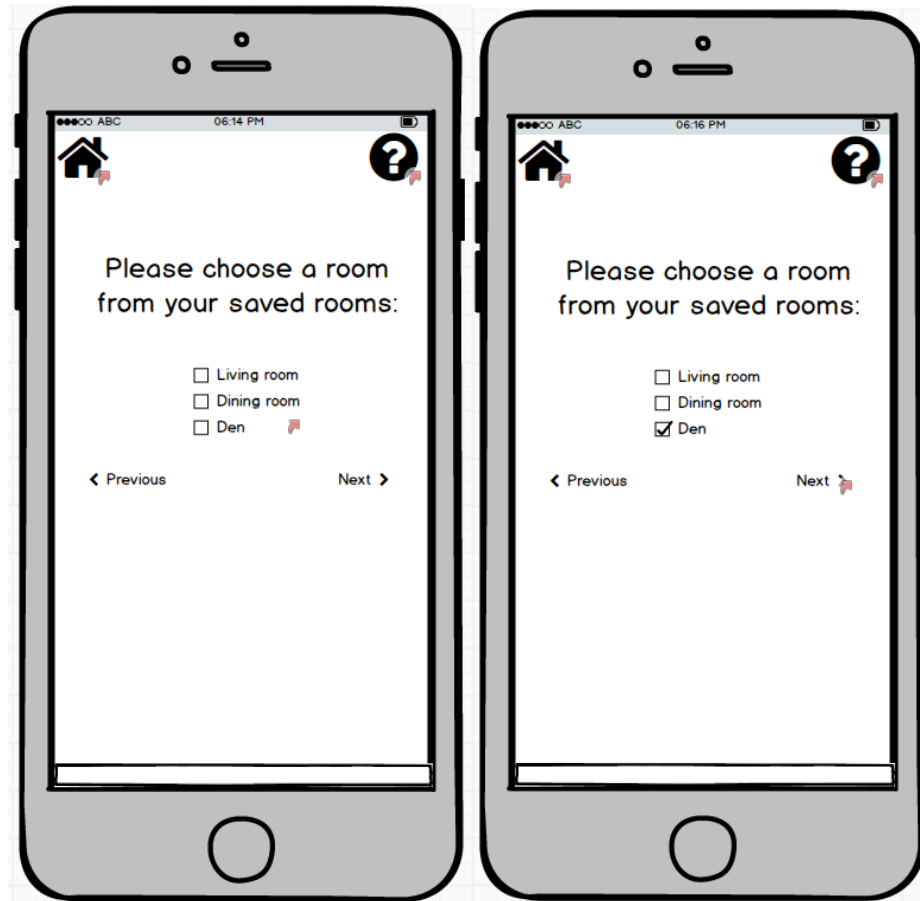
Robot asks, *"What would you like to do? Clean now, schedule cleaning, view current cleaning schedule, set up new room, or edit saved room configuration?"*

User selects or says, *"Schedule cleaning"*

Robot says, *"You have selected 'Schedule clean'"*

Screen 2: Choose a room (from saved)



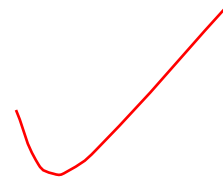


Robot asks, *“Which room would you like me to clean? Living room, dining room, or den? You may also say or select ‘Previous’ at any time to return to the previous screen. You can say or select ‘Home’ to go back to the Home screen.”*

User selects or says, *“Den”*

Robot says, *“You have selected ‘Den’. Say or select ‘Next’ to continue.”*

User selects or says, *“Next”*



Screen 3: Select add ons (optional)

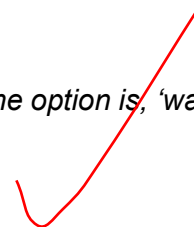


Robot asks, "Would you like me to use any add-ons? If so, the options are 'vacuum' and 'waxer'. Or, say or select 'Next' to continue"

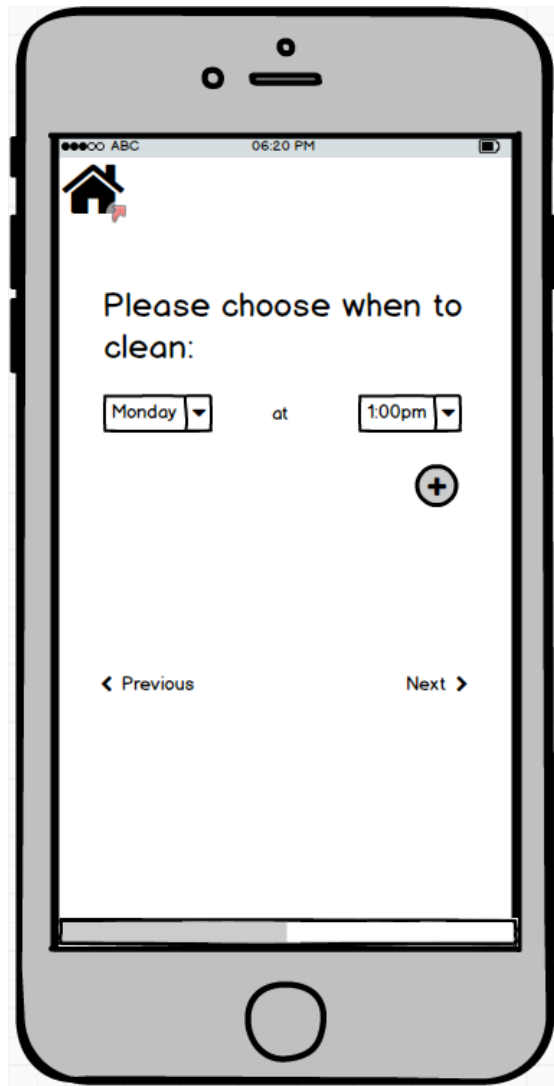
User selects or says, "Vacuum"

Robot asks, "Would you like me to use any other add-ons? The option is, 'waxer'. Or, say or select 'Next' to continue."

User selects or says, "Next"



Screen 4: Choose cleaning time



Robot asks, *"Which day of the week would you like me to clean on?"*

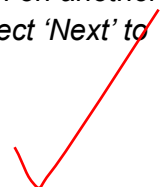
User selects or says, *"Monday"*

Robot says, *"When on Monday would you like me to clean?"*

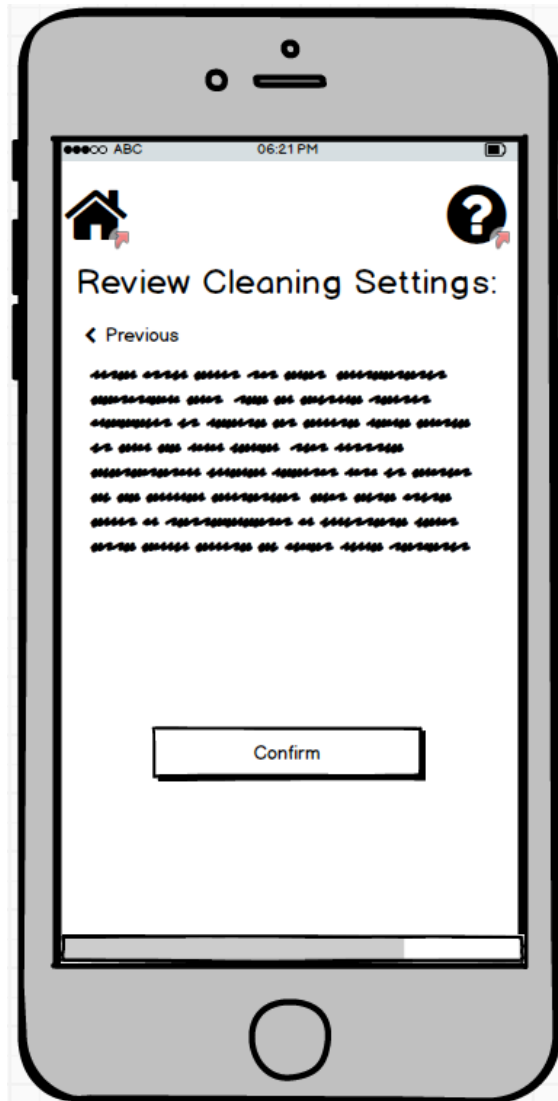
User selects or says, *"1pm"*

Robot says, *"I will clean on Monday at 1pm. Would you like me to clean on another day? If so, please tell me which day or select the 'add' button. Or, say or select 'Next' to continue."*

User selects or says, *"Next"*



Screen 5: Review settings screen

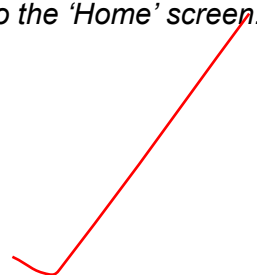


Robot says, "I will clean the den on Monday at 1pm. I will use the vacuum add-on. Is this all correct? If so, say or select 'Confirm'. If not, say or select 'Previous' to return to an earlier screen."

User selects or says, "Confirm"

Robot says, "Cleaning scheduled confirmed. I will now return you to the 'Home' screen."

<end use case>

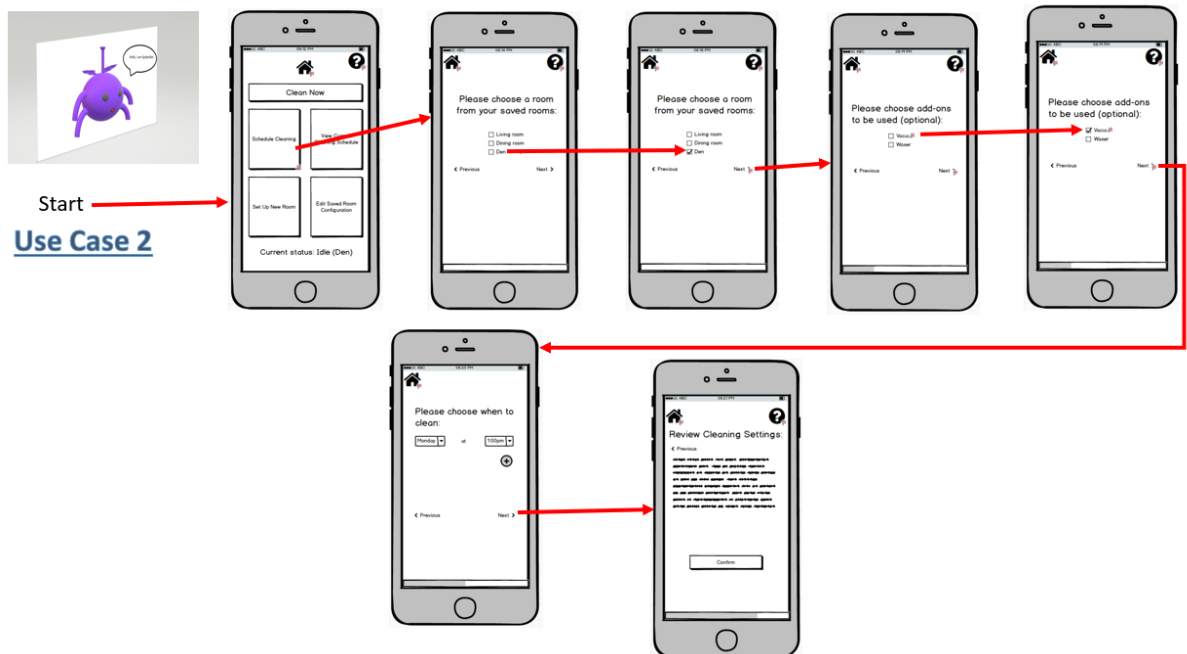


$$\frac{10}{10}$$

Use Case1 (underserved persona)



Use Case 2 (For Mainstreamer)



Design Decisions

5/5 One of the design decisions that we made was to change the shape of the robot itself. We had received feedback that the previous shape might surprise someone or be mistaken for a lamp, so we changed its shape to something smaller that could sit on the floor and look more like a decoration. We came up with the SpiderBot design because it seemed like something that one might see as almost a toy, while it still had arms that could help it move around and pick up objects.

Attributes (2): Physical/Visual Ability, Technology Preferences

Given that Suzie has trouble recognizing things due to her DR, we wanted to make sure that items in scanned rooms would be recognizable in the scanned model. So, we decided to have the image of the scan shown be an actual picture of the room, with her own familiar furniture and objects, so that she could more easily identify them.

We struggled for a while with how the user was supposed to review the scan of the room, given that Suzie might not be able to see parts of the screen to confirm. We settled on having the scan show up as a 360 image that the user can drag around to interact with it (example here: <https://theta360.com/spheres/samples/fdb3dc10-8935-11e7-bcdc-064087ff3472-1>). This would mean that the image viewer could stay in one place on the screen (which supports Suzie's preference toward static interfaces over dynamic ones) and allows her to pan the view of the room so that if something is covered by spots, she can move it to a location where she can see it. Having an actual image that represents the spatial properties in the room helps with the metaphor of seeing the scan as the room layout as well.

We also wanted to make sure that there was plenty of audio responses, and have the possibility for voice cues for when Suzie is having a lot of trouble with vision and doesn't want to wrestle with it. In addition, Suzie is used to screen readers, so she will feel comfortable interacting with a device that is reading to her. All of these decisions were based on our research, which got us that people with vision impairments like auto-generated content and like being able to have audio feedback.

Attribute: Emotional State and Well-Being

We wanted to make sure that doing each task would be quick and easy so that Suzie would not have to worry about remembering how to do it or how fast she does it, given that those are two of her attributes. With a menu to view scheduled cleanings, Suzie won't have to remember how and when she normally sets them. SpiderBot also helpfully reports its status on the home screen (Cleaning/Idle and in what room) so that she can check on it at any time and not have to worry about what it's up to.

In addition, we provide a way to go back or undo actions on every screen and at every step. We also provide a persistent help icon in the upper right corner of the screen that adapts to the user's current page they're on when they request help. We will inform the user of this during

setup. All of these features will help make Suzie less stressed out as she interacts with the prototype - she can always call up a help screen, and she doesn't have to worry about making the wrong decision and not being able to cancel it.

Attribute: Financial Stability and Status

As shown in our prototype of Ted's use case, it is optional to use add-ons. Spiderbot will still tidy up just as well without them. This comes from the research we found that suggests DR patients don't have a lot of spare money to spend on extras and add ons. Rather than try to sell one unit that did everything the user could want, we made the robot modular so that add-ons can be bought as the user recognizes the need for them (or not at all). This decreases the cost of the base unit and makes it more affordable for Suzie.

Feedback: Dr. Burnett

When we spoke to Dr. Burnett about our persona's attributes, she was confused about the name we used for Suzie's technological preferences. We were calling it "Use of Technology", and she wasn't able to readily distinguish between that and "Physical/Visual Ability". After talking it over briefly and explaining the two concepts, Dr. Burnett suggested we change the name of the attribute to "Technology Preferences" to avoid clearly delineate the two facets.

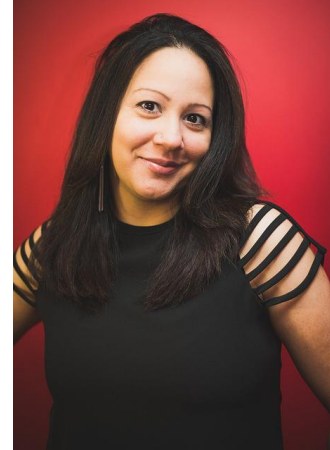
Feedback: Design Jam 1

Our classmates gave us some good feedback from the first Design Jam. One idea that we ended up implementing was a change in the robot's design. Originally, we basically had a claw arm on wheels that rolled around the room. Multiple of our peers pointed out that that design might be a bit scary or offputting - definitely not something you'd *want* to have rolling around your home. They pointed out that it might negatively impact Suzie's perception of the product, given her Emotional & Mental Well-Being facet.

To counteract this, we changed the design of the robot to SpiderBot (see above) - a cute, talking animal-like bot that has a face to make it seem more relatable.

Suzie (Susan) Williams

- 32 years old
- Librarian at the Spokane public library
- Lives in Spokane, Washington



Background:

- Suzie is a senior librarian for the Spokane public library. She has worked there for the past 10 years. At her job, she works with the library's internal database software on a regular basis to locate books for patrons and check materials in and out.
- Suzie isn't the kind of person to own a large number of gadgets, but she does have a smartphone because she likes the convenience that it provides with its constant connectivity.
- Suzie has been married for 8 years. Her two children, aged 7 and 5, go to the same elementary school.

Attributes

Physical/Visual Ability

- Suzie was diagnosed with Type 2 diabetes 5 years ago [4.d]¹. Her vision has been getting blurrier for a while now, but three months ago Suzie started having spots covering her vision [1.c]², which at worst cover half her visual field. Her vision has been getting even worse over the last three months [1.c]³.
- Because of the blurriness of her vision, and the spots that now cover roughly half of her visual field, Suzie has trouble performing day-to-day tasks like driving, reading, and recognizing faces [1.c]⁴ [3.b]⁵. She no longer trusts her ability to drive, and has to have her husband take her to work when he used to drive the kids to school (so her kids now have to take the bus) [3.c]⁶.
- In general, tasks that Suzie could do easily before are now slower for her [3.c]⁷. She trips over and runs into things much more often than she used to [3.c]⁸.

¹ "It is inferred that PAD and PDR are concomitant morbidity in patients with diabetes." [4.d]

² "Symptoms include seeing spots or floaters." [1.c]

³ "Diabetic Retinopathy causes progressive damage to the retina." [1.c]

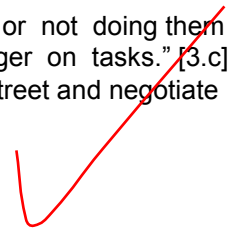
⁴ "Symptoms include blurred vision." [1.c]

⁵ "decreased visual acuity have foregone many other important life aspects such as work, reading and sports.... Life Impact - Difficulties recognizing faces." [3.b]

⁶ "I had to arrange for someone to drive me and pick me up." [3.c]

⁷ "Particular complaints ... included not being able to do things they used to do or not doing them as well, taking longer to do things and having to be slower or concentrate longer on tasks." [3.c]

⁸ "Many also found it challenging to move in crowded places, avoid tripping, cross a street and negotiate uneven pavements or suspended objects." [3.c]



Technology Preferences

- Outside of what she is required to use for her job, Suzie tends to use technology mainly for email and social media [2.b]⁹ - she is an avid poster on Facebook and Twitter, and tends to like apps that pre-generate posts for her, so that she only has to press a button to send it off [2.b]¹⁰.
- Because of her DR, she prefers to spend her free time *not* staring at screens, since she can only really look at a screen for an hour before her eyes get tired [2.h]¹¹. To avoid this problem, Suzie prefers audio interfaces and feedback over visual interfaces. For instance, she would rather listen to an audiobook than read the same book on her Kindle [2.h]¹².
- In addition, her diabetes occasionally causes her to experience numbness in her hands, which can make using a touchscreen difficult (though not impossible if the icons are large enough) [4.h]¹³.

Emotional State and Well-Being

- Suzie has a busy life, with stressors coming from her career and, since she was diagnosed with DR, the changing status of her vision [3.a, 3.c]¹⁴.
- At work, she is hoping to get a promotion to Head Research Librarian but is now worried her decreased ability to see will decrease her effectiveness at helping library patrons in a timely manner, and may even result in the loss of her job [3.c, 3.j]¹⁵. Already, she feels stressed when a patron is waiting and seemingly impatient. She is emotionally on edge because of her DR [3.c]¹⁶, and so is especially sensitive to things going wrong at work.

⁹ "We find that visually impaired users participate on Facebook (e.g. status updates, comments, likes) as much as the general population [...]" [2.b]

¹⁰ "The top keywords from photo captions suggest that many of the photos uploaded by visually impaired users are automatically created by other apps instead of the users themselves." [2.b]

¹¹ "I try not to exceed about an hour a day, as my small amount of useful vision will get too strained." [2.h]

¹² "Then finally, before I head to bed, I will either listen to the talking news or an audio book provided by my local mobile library." [2.h]

¹³ "Others may have symptoms such as pain, tingling, or numbness—loss of feeling—in the hands, arms, feet, and legs." [4.h]

¹⁴ "Many felt stressed about their vision and reported that it was 'always on their mind'. Others described feeling scared when unexpected events occurred such as sudden loss of vision from a haemorrhage. Several participants described situations in which they felt vulnerable, disconcerted or nervous. Others described feeling extra pressure to maintain their vision so they could continue to care for their family." [3.c]

"When the blood vessels burst or something you can't see anything and it's very scary." [3.c]

"It's still hard to carry on life as normal everyday because it's the first thing I think about when I wake up, and the last thing I think about before I go to sleep. I thank god everyday that I wake up and can still see." [3.a]

¹⁵ "Many participants stated that they had stopped working prematurely as a result of their DR." [3.c]

"John similarly struggled to cope with the impact of sight loss in his role as a worker and provider for his family. He described giving up work as 'awful' and that he worked all his life 'just to throw it all up'." [3.j]

¹⁶ "Several participants reported feeling depressed due to their DR and some even admitted to having suicidal thoughts. Others described feeling sad or low, upset, emotionally raw, miserable and devastated.

- After work on Fridays, she goes to trivia night with her friends but wishes the event happened earlier the evening since she has difficulty with night vision [1.c, 3.c]¹⁷. She worries about embarrassing herself in front of her friends by running into things [3.c]¹⁸.

Financial Stability and Status

- Suzie has a middle-class income. She is a frugal shopper, and one of her financial goals is to put money in savings for retirement and also into her children's college funds. However, since being diagnosed with DR, she hasn't been able to save as much because of increased costs [3.c]¹⁹ related to her condition.
- Suzie doesn't feel comfortable driving herself to appointments because of her vision [3.b, 3.c]²⁰, and also because her eyes are dilated at every appointment [3.c]²¹. Because her husband works, she often has to use Uber, taxis, or other types of hired transportation to get to her appointments [3.c]²². Her retinal specialist is located 5 hours from her home [3.a, 3.c]²³, so transportation costs can be very expensive [3.c]²⁴.

Social Interactions

- Suzie feels like she is placing a strain on her and her husband's relationship whenever she has to ask for help because she can't see or read something clearly [3.c]²⁵. She

Other negative emotions included 'loss of motivation', 'hopelessness', 'loss of pleasure in things', 'missing work or hobbies' and 'loss of spontaneity.' [3.c]

¹⁷ Symptoms of DR include not being able to see well at night.

"Attending social events in the evening was particularly difficult for participants due to poor night vision. Consequently, many participants reported feeling socially isolated and staying home most of the time." [3.c]

¹⁸ "Safety concerns included fear of tripping, falling and bumping into things." [3.c]

"Several participants also felt embarrassed when they had to ask a stranger for help or made a social faux pas." [3.c]

¹⁹ "Participants reported several direct financial implications as a result of their DR, including reduced income from loss of employment or restricted work hours, the cost of purchasing glasses or visual aids and the cost of treatment and specialist care. Incidental costs included those associated with attending DR-related appointments such as parking or loss of income, having to hire help such as cleaners or taking taxis and making mistakes such as breaking things, being taken advantage of or accidentally incurring fees from businesses." [3.c]

²⁰ "Participants described a range of symptoms and impact. Difficulty driving, especially at night, and trouble reading were noted with all levels of severity." [3.b]

"The diverse emotional reactions revealed in our study, such as frustration, uncertainty, fear of becoming blind, concern about driving [...]" [3.c]

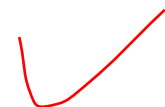
²¹ "Having multiple treatments, attending frequent appointments and having dilating drops at every clinic appointment were burdensome for many participants [...]" [3.c]

²² "Incidental costs [...] included those associated with attending DR-related appointments such as parking or loss of income, having to hire help such as cleaners or taking taxis and making mistakes such as breaking things, being taken advantage of or accidentally incurring fees from businesses." [3.c]

²³ "Worried to death I started searching for a new retina specialist. Specifically, one that would talk to me. Fortunately I found myself 4 hrs away at Bascom Palmer." [3.a]

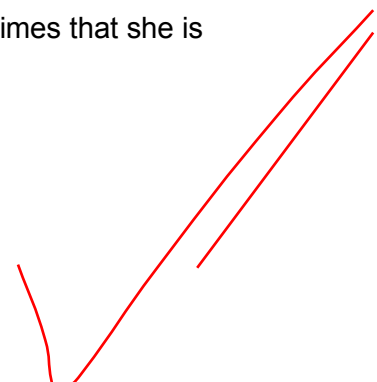
²⁴ "Incidental costs [...] included those associated with attending DR-related appointments such as parking or loss of income, having to hire help such as cleaners or taking taxis [...]" [3.c]

²⁵ "Considerable strain on personal relationships, particularly with partners, was reported by many participants due to the frustrations of day-to-day living and needing more support." [3.c]



worries that her DR is causing her to be a burden on others, and as such prefers to figure things out on her own before asking for help [3.b, 3.c, 3.j]²⁶.

- Due to complications from her DR, Suzie has found herself relying more on social services than she did previously [2.i]²⁷. For instance, the level of DR that Suzie has allows her to collect a small disability check each month to cover the times that she is not able to work for the entire day [2.i].



²⁶ “The loss of independence and mobility associated with decreased visual functioning and visual loss were major concerns.” [3.b]

“[...] reliance on family members made other participants feel burdensome and like non-productive adults.” [3.c]

“Well I just feel I’m a hindrance now. I have accepted it as well as I can” [3.j]

²⁷ “The loss of vision has been associated with numerous deleterious outcomes, from decrements in self-report of function, use of social services, nursing home admissions...”[2.i]

Ted (Theodore) Robertson

- 49 years old
- Formerly a middle school PE teacher, but now retired
- Lives in Sacramento, California



Background:

- Ted grew up in Sacramento and recently retired from his position as a PE teacher at the middle school he attended as a child. Because he has been in the area so long, he has developed strong ties to the community.
- Ted was married in the past, but his wife passed away about 10 years ago. His two adult children now live about an hour's drive away in smaller suburban towns.

Attributes

Physical/Visual Ability:

- Ted has perfect 20/20 vision, and has never had to use any corrective lenses or undergo surgery for a visual impairment.
- His knee occasionally pains him, especially when trying to be flexible or work out a lot, but not enough to prevent him from being active. On the weekends, Ted coaches a local little league team.

Emotional State & Well-being:

- Ted is overall happy with his life and where he is. Since he is retired, he doesn't have any stressors coming from his job. Ted doesn't have many time commitments at the moment, so he generally feels pretty relaxed. He sometimes experiences prolonged sadnesses when thinking about his wife who predeceased him 10 years ago, but it has never developed into anything serious like depression.
- To stay emotionally fit, Ted keeps himself busy with some or other activity, however trivial, like reading the news and participating in local community events and organizations.

Technology Preferences:

- Ted uses his smartphone or laptop every day to check his email, read the news, and browse the internet for various subjects of interest. He also likes to try to keep up on business trends and the economy to help him make good investing decisions.
- Ted has a FitBit that was given to him by a friend, and he uses it to make sure he's hitting his daily step goal and staying as active as possible.
- He also participates in fantasy football leagues with old friends and coworkers.

Financial Stability & Status:

- Due to an inheritance from a family member, Ted was able to retire early. He lives comfortably and independently in his own home, with plenty of space for get togethers and people to stay overnight.
- Ted tries to keep his savings above what he needs to live for the next couple months,

with the rest put into investments on the stock market. He likes investing in both long-standing reliable companies and hip new startups.

- Ted likes to send money to his now grown up children on their birthdays or when they need it, since it does not affect his overall financial status to do so.

Social Interactions:

- Ted tries to be an active part of his community through sports, playing on the local co-ed baseball team and coaching the local youth league.
- He often meets friends for coffee to catch up with them, and he tends to like going out at night with friends because “that’s when the fun things are happening”.

