Project Brief

Project Title: Independent Indoor Navigation for Individuals with Memory Loss
Author: Harsh Patel

Phrase 1:

Dementia and memory loss patients can get lost inside buildings that they visit frequently because they cannot form memories of the building's layout. This requires a caregiver or another person to help them navigate at all times.

Phrase 2:

The aim of this project is to engineer an app and/or a small device that can effectively and reliably lead someone with memory loss through a building without the need for a caregiver to help them.

Background:

Dementia is a term to describe different diseases and conditions that cause progressive and irreversible decline of different mental faculties (Heuvel, 2012). Symptoms of dementia can vary greatly, however, one of the most common and impactful symptoms of dementia is problems with retaining short-term memories (Alzheimer's Society, 2013). Often times, this means people suffering from dementia will not be able to form short term memories, such as forgetting the name of someone who introduced themselves recently, and even forgetting long term memories if the condition worsens.

Due to not being able to form memories normally, people with memory loss and dementia face many common problems that most people do not, which causes a loss of independence for these people. In the research article "Finding the balance: Living with memory loss" by Jean Gilmour, one of the three major themes that were shared between memory loss patients was a struggle to maintain control and independence. This is because they often have to rely on caregivers and other people for simple

One of the problems dementia patients face is wandering and getting lost, and even buildings that they visit frequently. This can cause people suffering from memory loss to have to be followed around by another person, such as a caregiver. According to the article "Awareness, requirements and barriers to the use of Assistive Technology designed to enable independence of people suffering from Dementia (ATD)" by Eleanor van den Heuvel, 20 caregivers out of 31 caregivers that responded to the question said that getting lost or wandering is a slight problem or a big problem. The article also stated that looking after someone with dementia took more hours per week and had a larger impact on the physical and mental health of the carer than other types of caregiving. This means that getting lost from wandering in buildings not only negatively impacts the person with dementia, but it also negatively impacts the caregivers who have to take care of the person.

However, most modern day navigation systems are based off of using satellites for navigating from point A to B. This type of navigation will not work in indoor areas because indoor areas, walls, and other objects in a building can block navigation systems (Koyun, 2018). Other methods of navigation, such as the WiFi-based positioning system, which has already been developed, calibrated, and implemented for two multi-floor buildings (Bell, 2010), would work much better in building environments.

By using techniques such as Dijkstra's Algorithm, which "solves the single-source shortest-paths problem... in which all edge weights are nonnegative" (Cormen, 2009), with WiFi navigation could be used to create indoor navigation for dementia patients, which would help them gain more independence and help out the caregivers who are helping the patients.

Experimental Design/Research Plan Goals:

Goals:
- Create a virtual map of buildings that people with dementia frequently visit.
- Give directions through a building from the user's current location to a selected location/
- Develop a method to make sure that the person with memory loss knows they have this app and can use it to navigate a building.

Experimental Design:
Participants will be asked to travel through a building with different assistive tools/methods and evaluate the app on different criteria.

IDV: Different types of help with navigating a route (No help with navigating, navigating using the help of another person that knows the route, navigating by using the app)

DV: The time it takes to complete the route.

Control Groups: No help with navigating and help from another person.

Experimental Group: Navigating by using the app

Risks: Participants will be asked to evaluate an app and walk around a building, so there are minimal to no physical or psychological risks involved.

Benefits: The experiment results will be used to help improve the design of the app.

Time for participation: 10-15 min.

Expected Outcomes: It will take the longest to navigate with no help through a building, and fastest with help from another person. Navigating with the app will be slower than without help from another person, but will be significantly faster than no help.

Survey Questions:
- How easy or difficult was it to navigate with the app?
- How easy or difficult was it to use the app?
- What improvements would you make to the app?

Potential Roadblocks:

People with memory loss might forgot that they have the app in the first place. A potential solution to this problem could be having a remainder be built into the code to remind the user, possibly after a certain amount of time or a certain distance walked.

Different building factors, such as the shape of the room and the thickness of the walls, make accuracy for indoor navigation difficult. This problem can be overcome by using already existing methods used for indoor navigation, such as Received Signal Strength (RSS) based technology.

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Timeline:

1. Develop the way to create and add virtual maps (it should be able to determine where you are in the building)
   a. Estimated Time: 2 Weeks
2. Develop the directional system that works in multiple types of buildings
   a. Estimated Time: 2 Weeks
3. Develop a rough outline of the app and its user interface
   a. Estimated Time: 1 Week
4. Bug testing for the previous parts to make sure it works effectively
   a. Estimated Time: 1 Week
5. Begin testing with other people for data on how well the app works and user feedback
   a. Estimated Time: 2 Weeks
6. Revise app based on feedback from step 5
   a. Estimated Time: 1 Week

Total Estimated Time: 9 Weeks
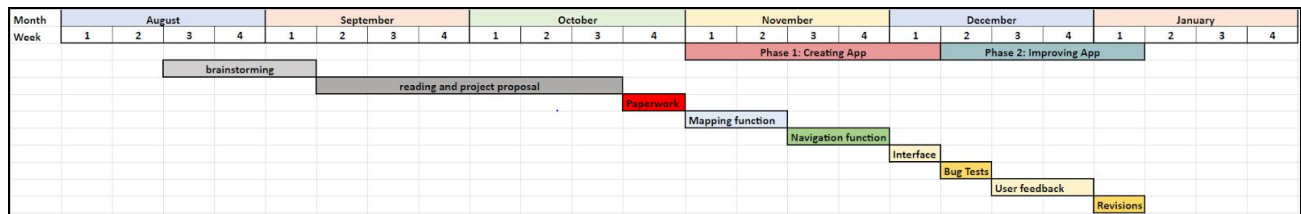
Background Knowledge Goals:

Date	Topic	Completed Date
9/9/2019	How big of a problem is people with dementia getting lost in places?	9/11/2019
10/16/2019	How can I code navigation for a building with multiple rooms?	10/20/2019

Additional Ideas:

Don't Want to Use	Why?
Organic bandaid that aids natural regeneration	Too different from what I want to do and lack of resources and background knowledge.

What to use to develop further?	Why?	Assumptions you're making with this	How can these assumptions be

		idea	changed?
An app that documents and shows accessibility features for people who need them.	It is very similar to the navigation idea, so it can probably be added on to it very easily.	That we know all the locations of accessibility features in a building.	Have a way to get the building layout with the accessibility features documented beforehand and then put that into the app for use.