CS486C – Senior Capstone Design in Computer Science
Project Description

Project Title: AT@ Home: An automated advisor for assistive technologies	
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Project Overview:

A big challenge for any society is how to help people age safely while staying in their homes and communities. Do you ever think about what life will be like as you age? Will you be dependent upon others to carry out your life activities? Do you have loved ones who have disabilities and find daily tasks difficult to achieve independently? Have you ever wondered about the origins of technologies such as voice recognition and word prediction? Many technologies, readily available today, had their origins in or were greatly influenced by the disability field. Specific technologies (known as assistive technologies – AT) have been created to support people with disabilities to have full access to life activities.

In the U.S. alone, there are some 65,647,905 people over the age of 60 – approximately 20% of the population and the percentage is increasing rapidly due to aging baby boomers and lower birthrates. Of this number, it is estimated that 35%, or almost 23 million individuals, have at least one disability. Many of these older individuals may benefit from the use of AT to remain independent and age in place. However, a huge problem in this area is that while there are thousands of assistive technology products that have been developed (with more every day), many older adults have limited ways to discover potentially helpful AT options, due to the fact many are not very tech-savvy nor connected to channels of dissemination for new technologies. Inventing an effective and user-friendly solution to this problem is what this Capstone project is about.

The current COVID-19 pandemic underscores the importance of having access to technology and the challenges imposed on people who lack this access – especially those living in rural or remote areas. Older adults and adults aging with disabilities are highly vulnerable populations, not only due to the functional limitations as consequences of a broad range of medical conditions, but they face greater risks and health impacts due to the effects of social distancing and the implications of no or limited access to technology for social engagement and obtaining goods and services that are temporarily unavailable or too risky to acquire through traditional in-person encounters.

The goal of **AT@Home** App is to help individuals who are aging and have disabilities (inclusive of those with long-standing and acquired/age related disabilities) to identify assistive technology options (e.g., talk to text, screen magnification, sound amplification, one-handed cutting boards, non-slip bowls, memory aids &

voice activated environmental controls) that promote and support independence in daily living activities typically carried out at home.

The **AT@Home** app's vision is to harness interest in a self-directed mobile application to provide individualized AT solutions that address identified barriers and support safe independence in daily living activities for older adults and adults aging with a disability. While some older individuals are comfortable with seeking information independently, they often encounter two challenges. One, a lack of knowledge about concrete AT solutions and strategies applicable to their specific needs, and, two, they become overwhelmed by all of the choices that an internet search provides. Streamlining and organizing solutions and strategies into a digestible and informative app format, will address these issues as well as the needs of persons who are inexperienced with online information searches.

By using an engaging and accessible graphical interface that represents rooms in a home, the app will serve as a self-guiding, decision-making tool allowing the user to input his or her information to identify daily living tasks that are difficult/unsafe to carry out or identify areas within the home that are not accessible due to intrinsic or extrinsic factors. The app will then suggest commonly available AT options to mitigate those challenges.

In summary, we envision an App that can effectively be used by individuals with disabilities who are aging (and/or by persons who support them) and walk them through the process of determining their assistive technology (AT) needs and thus possible solutions. As examples, AT use can impact the ability to participate in telemedicine through the use of AT such as hearing aids and screen magnification. AT can positively impact mobility and by extension, socialization through the use of low-tech walkers and high-tech power wheelchairs. AT can help a person stay in their home through the use of medication reminders and environmental controls. Thus, the AT@Home App has the potential to be extremely beneficial to the targeted audience and their capacity to safely age in place.

Like many mobile applications, this one communicates with a cloud-based server that hosts the user profiles and the database of AT technologies. We will also require a basic "administrative interface" to manage the system and this backend, i.e., a simple web application that system administrators can use.

Ideally, development of the mobile app will be based on a cross-platform development framework (e.g., Ionic, React Native) to allow both Android and iOS apps to be generated from the same codebase. Some features that will be required in the software product, ordered by priority, included the following:

Level 1: Minimum viable product

- secure system for users to create accounts;
- a visual interface, modeled after the layout of a stereotypical "house," where users enter their "profile", e.g., a step-by-step process where users move through the virtual "house" indicating disability areas and functional problems they are experiencing (self-identification of person/task/environmental barriers to independence in the home), and what they may have already tried;
- a database that contains commercially available devices and which rooms/disabilities they are applicable in;
- a database that contains a listing of assistive technology programs across the U.S. with basic contact info for each;
- A simple administrative interface of some sort, to allow admins to view/delete users, as well as add/delete AT items from the database.

- a results interface, where the user is led back through the virtual "house," which now depicts available/suggested devices based on the user's already-entered "profile," the available device database, and daily living activities typically performed in that space;
- a second results interface, where users would be given a location-based suggestion for an AT center to contact to "learn more" about a particular device.

Level 2: a complete and usable product

- A more complete GUI-based administrative interface (webapp) for user management and system configuration. Also allows sys admins to authenticate, and then to search/view the catalog of AT devices, inspect and edit entries for any device, and add new devices to the database as they become available;
- notification system so that all users that might have interest in a newly added AT product would be notified by email (including a link to the web app) and/or push notification;
- a way for users to log in to previously entered profile, view what AT they have opted for, and edit and print/share that information;
- a way for users to ask questions about a particular AT device, with those questions automatically forwarded to appropriate local AT Center staff, and any responses to question would auto-add a question/answer to the FAQ for that device;
- way for users to rate their satisfaction with devices, indicate how they have benefitted from the device, and indicate how the devices were paid for;
- a smarter/multi-factor AT recommender system that takes into account not only room/disability but other profile factors (age, severity, ratings from other "similar" users, etc.) to recommend appropriate AT.

Level 3: Extras (stretch goals)

- Implement an anonymous, private online forum with topics centered around particular disabilities and/or AT device;
- Live chat/video/audio function during set times to connect with AT professionals or other users of app;

Design will need to explicitly take into account the unique needs of this user population: simple UIs with plain language, larger fonts, and simple workflows; functional across a range of phone and tablet devices.

Knowledge, skills, and expertise required for this project:

- Basic database design, configuration, and installation knowledge to support the backend.
- Development of graphical user interfaces in web-based systems, including end-user testing/refinement.

Equipment Requirements:

- There should be no equipment or software required other than a development platform and software/tools freely available online.
- Client will provide access to appropriate datasets, models, and other domain-related elements needed.

Software and other Deliverables:

- The software applications as described above, deployed and tested successfully with real data. Must include a complete and clear User Manual for configuring and operating the software.

- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally documented codebase, delivered both as a repository in GitHub, BitBucket, or some other version control repository; and as a physical archive on a USB drive.
- User manual written for researchers (i.e. those depositing code) and non-technical users, covering installation, configuration, and updating of the core database. Also covers operation of the app, including installation and configuration/connection to database

Figure 3. AT@Home conjecture map