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Personalized Trip Planner for Seniors - GetGoing

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FINAL RESEARCH REPORT

Personalized Trip Planner for Seniors - GetGoing Final Research Project Report

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Language Technologies Institute.

The goal of the GetGoing system is to provide seniors with an easy to access means of getting transportation in Allegheny County. GetGoing was developed into a fully functioning system. It went through several iterations of user feedback (from various sources including AARP, and most recently UPMC) and development.

ACCOMPLISHMENTS

Some of the features and design decisions that make it specifically easier for seniors to use are summarized below:

Confirmation of understanding. GetGoing confirms that the user understood the system output, and had sufficient time to write it down if they desire. This addresses the concern that older users be able to comprehend and retain instructions. This feature was strongly requested by AARP.

Slower Synthesized Speech. By inserting pauses prior to synthesizing the speech signal, GetGoing helps to make its utterances more understandable for individuals who process speech more slowly.

Attention-Grabbing Prefix. GetGoing inserts an attention-grabbing prefix prior to providing important information. Since as we grow older we are less and less able to multitask, this feature gives users a heads up that it is speaking and enough time to switch attention, tune out distractions and focus on the system output.

Barge-In. Allowing users to interrupt the system shifts control of the dialog toward the user. Since senior users may be unfamiliar with voice-based assistants, barge-in allows them to correct system mistakes without having to wait for the system turn to finish. This avoids the user's turns getting "out-of-sync" with the system.

Flexible Dialog Manager. GetGoing's dialog manager, based on the RavenClaw framework, is flexible in the order of turns. This flexibility is in part due to our generalized natural language understanding, which is a deep learning model that relies on language embeddings pre-trained on large amounts of text (including all of Wikipedia). The flexible

dialog manager allows users to easily correct the system, provide information out of turn, or fill multiple slots at once. This makes the dialog more natural.

Telephone Connection. GetGoing's user interface is the telephone, which reduces the entry barrier for senior users who may not own a smartphone or may be uncomfortable using one.

In its current state, users can call a publicly-available phone number and ask the system for directions in Allegheny County.

After feedback from presentations to AARP, OSHER management and some former directors of senior centers, in order to make GetGoing easier to use, the following features were added:

Installed a more complete list of bus stops, and more monuments in the Pittsburgh area

Skipped explicitly confirming what the user had just said at every return for the recognition results with higher confidence

Refined instructions for first time users, with examples and less repetition, thus giving the system more robust audio speech recognition for time and location

Improved step chunking, so if the user asks the system to repeat something, the system now only repeats the latest step instead of including all the earlier instructions

Created more natural direction delivery, with no more long addresses and odd abbreviations

Adjusted the prosody output, with key information being more emphasized with a louder voice

Created a separate development branch, and te phone number for the all-user mode (no specific accommodations for seniors). This aids in demos of the system and for testing

Retrained the Natural Language Understanding (NLU) model so now it recognizes more different ways of saying "continue", and "repeat", and better answers to yes/no questions

We were to get users for GetGoing and gather data, then, using that data, create a function that makes GetGoing adapt to individual users (do they prefer the system to speak very slowly/quickly, do they want much detail in the directions or little, etc.). However, with the advent of the pandemic, no one was venturing outside, especially seniors, and so we turned our attention to two aspects that are also important: getting good directions to hospitals when the directions from Google, etc are not sufficient (where is the entrance to the hospital? once I enter the hospital, where do I go?). We also began work on accessibility, changing the directions to a given site to include information that wheelchair-bound or low-sight users would need. To accomplish these goals we began to work with colleagues at UPMC (hospital access) and pathVu (accessibility).

We have, for hospital access:

Added alternative routes to the UPMC Presbyterian campus (several hospital buildings, based on suggestions from employees who manage the campus and individuals who give directions at the information desks. We recorded directions from three receptionists with proper direction information in order to automatically transcribe them into GetGoing-useful terms and backend lookups

Provided a plan based on arrival time instead of departure time and oriented toward the final location (especially in hospitals)

Met the director of volunteer & community services and patient Relations to plan for future collaboration

Built a pipeline to integrate the human route descriptions we collected into system descriptions

Evaluated the reformatted route description with human subjects

Submitted a paper on this work to Interspeech. The paper is still in review at the writing of this report.

We have, for accessibility:

Created an accessibility branch that provides wheelchair-friendly routes around the UPMC Presbyterian campus based on expert suggestions.

Collaborated with the pathVu company on accessibility mode, meeting with the CEO and the director of technology of the company to regularly to discuss ongoing collaboration

Used the company's routing API to provide alternative directions to Google Maps

Set up different accessibility user types (wheelchair, cane, low vision)

Started decoding geometry information into text routing description to determine where the user is located in a manner that can be orally communicated to them

PARTNERS

OSHER life long learning, AARP of Southwestern Pennsylvania, UPMC, pathVu

IMPACT

Tech Transfer

Since GetGoing has been developed as a senior-friendly system, many of the features can be separated out into a layer. This layer could potentially be applied onto other existing spoken dialog systems to make them more accessible for the senior population. A disclosure of intellectual property for ABLE (AccessiBility LayEr) was submitted to the CMU Center for Technology Transfer and Enterprise Creation on June 13th, 2019. We had a meeting with representatives from the Center for Tech Transfer on August 19th, 2019. After this discussion, a provisional patent was filed on September 3rd, 2019.

PRESENTATIONS and PAPERS

Presentations

We demoed GetGoing in November 2018 and again in November 2019 at the Mobility 21 showcase.

Yulan Feng gave a talk on GetGoing at the 2020 CMU Symposium on AI and Social Good

We prepared for the system demo at SXSW 2020, which was cancelled due to the pandemic

Yulan Feng presented GetGoing at "Transit Data Madness" hosted by Port Authority and Code for Pittsburgh, connected with data scientists from UPMC clinic team and project director of UPitt's Regional Data Center.

Papers

Shikib Mehri, Alan W Black, Maxine Eskenazi, 2019, CMU GetGoing: An Understandable and Memorable Dialog System for Seniors, Dialog for Good Workshop (DiGo) at SIGDIAL 2019, https://arxiv.org/abs/1909.01322

Yulan Feng, Alan W Black, Maxine Eskenazi, 2020, Towards Automatic Route Description Unification In Spoken Dialog Systems, submitted to Interspeech 2020.

DATA

Get Going collected paid user data for the DiGo paper and has made it publicly available at https://github.com/DialRC/GetGoingData/.

OUTCOME

A fully functional and publicly accessible transportation information system for seniors. A provisional patent filing.

ISSUES

The goal of the last period of work was to collect as much data from real users as possible and then to use to personalize the system. Since the advent of the Covid19 pandemic, people, especially seniors, have not been traveling. Instead of data collection and personalization, as mentioned above, we began work on precise instructions to hospitals (as described above) and giving information about the best path to take to a given destination for people who have low vision and/or use a wheelchair.