

THESIS PROJECT PORTFOLIO

Hope this won't take too Long: Smart Pet Feeding Station

(Technical Report)

Hey Alexa, How Do You Help Blind Customers?

(STS Research Paper)

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Bachelor of Science, School of Engineering

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Department of Electrical and Computer Engineering

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HEY ALEXA, HOW DO YOU HELP BLIND CUSTOMERS?

STS advisor: Kent Wayland, Department of Engineering and Society

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Technical Advisor: Harry Powell, Department of Electrical and Computer Engineering

STS advisor: Catherine Baritaud, Department of Engineering and Society

In my future work as an engineer, I want to work towards building technological systems that try to include as many types of people in its operation and utility as possible. I feel that disabled people are sometimes excluded from technologies when a simple addition might otherwise have helped some groups greatly. One example might be an elevator with only smooth buttons as opposed to one that includes Braille markings. One is nearly useless to a blind person while the other allows them to participate in the utility of the technology, and cost difference between the two options is negligible. In order to address this in a greater level of detail, my technical capstone project involves building a device which allows mobility challenged pet owners to care for their pets more easily and effectively. The sociotechnical research paper involves examining systems like the Amazon Alexa and their effects on Blind people.

As a Capstone Project group, we wanted to build a device that served disabled people in some way. I, together with Luke Orioli, Matthew Garrison, and William Mulquin, designed and built a functional pet feeding and watering station. The goal of the device was to be able to automatically resupply a food bowl for a pet with the appropriate amounts of dry food at the correct times as well as to maintain a specific water level in the water bowl. This device could allow disabled users, who might have a hard time bending down to reach something on the floor, to feed their pet more easily by loading the food in from the top and setting the appropriate defaults. We developed and printed a custom circuit board that interfaces the onboard Texas Instruments microcontroller with all peripheral devices, including sensors, pumps, a motor, a two-color LCD screen, buttons, and external power. The main body of the device was constructed out of a single sheet of plywood and cut into an L-shaped box with the food and

water bowls at the base of the box. We designed a custom weight balance to consistently measure the weight of the food in the bowl while keeping it level and stable.

The socio-technical paper was an investigation into systems like the Amazon Alexa and its specific impacts on Blind users of this technology. The research for this project consisted of five scholarly articles about specific areas in which blind people were affected by the Alexa as well as an interview with the original developer, Lucasz Osowski. Through this research, one fact I noticed was that the guidelines that tech companies like Amazon use in developing their voice systems was that they heavily stress a human-to-human conversation model as the target and they mostly avoid goals related to accessibility for the disabled. Multiple sources referenced the need for a greater level of customization and options. In the family setting, blind users were shown to benefit from the Alexa system, because it allowed them to play audio games with their family, to help out more with chores, to easily find necessary information, and to use timers and other features when necessary. In the area of Safety and Security, blind users were shown to have both major benefits and potential drawbacks, since they could have access to house lights and cameras, but with this comes the risk of a malicious attack in which someone else could gain unauthorized access to these house systems as well.

Through building a working prototype of a pet feeder and waterer, I gained a deep appreciation for the long and strenuous process of bringing an idea from a sketch in a notebook to a physical working device. I feel like this process and attention to every detail will benefit me in all my future projects. Through researching about how the Alexa system helps or hurts blind people, I came to appreciate and understand more about the types of features that blind people want in a piece of technology as well as the struggle that they go through when the desired

feature is not included. One key way this work can be built upon in the future is the technology of home automation systems and how they help all manner of disabilities live a more whole life.