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Senior Design

Capstone Assessment

The senior design project that I will be completing this year will be creating a privacy-focused voice assistant. Throughout my academic career, I've taken numerous courses which have introduced me to problems with privacy within technology. While voice assistant devices are cool to display and provide many useful functions, they come with multiple privacy drawbacks. For most consumer voice assistant devices, your voice data is recorded and sent to a 3rd party server to be processed. This means that your voice data is constantly being tracked and monitored by 3rd party companies, which can be an uncomfortable feeling for many. Additionally, these devices have microphones that are always on yet the code that operates these devices is proprietary. This means that there could be numerous bugs in the code running these devices that could be exploited to listen to any conversations happening in the room with the voice assistant. Because of these issues, my team and I will be creating an open source voice assistant that allows users to see all of the code and know exactly what is happening with their voice data. Additionally, the voice data will never leave the local network of the user which helps to make the device private and immune to 3rd party data leaks.

In order to complete this project, I'll be able to rely upon the skills gained in numerous CS courses I have taken. One of the first courses that will be important was the "Security Vulnerability Assessment" course that I took. This course outlined a number of common security vulnerabilities and how to defend against them. Since security is a central reason for our project, these skills will be vital toward making a successful product. Another course which will be important to help successfully complete this project is the "Introduction to Networking" course that all CS students are required to take. In that course, we learned about how to safely communicate between client and server devices across a network. For our project, we will be communicating within a local network so this knowledge will be used. Finally, the "Python Programming" course will be very important toward the completion of this project. In the python course, I learned how to properly use the programming language. Many of the libraries that we will be using for local, offline speech detection and text to speech are available in python, so we will be using python as our primary language. Additionally, this language can be run on a small device like a raspberry pie very easily which will be important when installing this software on a small, low-cost device.

My professional work experience over the past few years will also be beneficial toward working on this project. Working first at the Kroger Company as an iOS Developer, I learned how to collaborate with a large team of software developers on a single project. This includes using git, leveraging features like merge requests to make sure that the project's version control is used properly. After working as a software developer, I had the opportunity to work as a Digital Product Manager at Kroger. In this position, I was responsible for identifying new features for the company's app and website and wrote user stories and acceptance criteria to define the new features. These skills will be critical for our team's success during the planning stages, and I hope to take the lead on writing user stories using the knowledge that I have built up working as a product manager.

I am very motivated to take on the challenge of making my own voice assistant. First, I feel like voice assistant devices are awesome for the functionality and ease of use that they provide, but I've been apprehensive about installing one into my own apartment because of security concerns. By building my own solution that keeps my voice data on the local internet

only, I will feel much more comfortable to run a voice assistant device. Next, I think that this project fits my skill set very well. Between my ability to write great user stories and acceptance criteria at work, or my personal involvement in python projects at Hackathons, I think that my skills will let me be a big contributor during this project. I'm also excited to learn more about local networking. I've always wanted to set up my own home server and setting up a client and server application for this project that run on the local network will help me to gain and grow those networking skills. Finally, I'm very motivated to work with the other people involved with this project. Alex and Ethan have been friends of mine in CS for years, and it will be exciting to collaborate with them throughout the year. Additionally, Dr. Franco has been one of my favorite professors over the years at UC, and I think he will give us excellent feedback regarding the security and privacy aspects of our design.

The preliminary approach for getting this project working will be to use python to create a client and server application. The client will be very light weight, meaning that it can be installed on any device from a low-power raspberry pi to a powerful desktop. From there, the data will be piped securely across the local network to a server application running on a more powerful piece of hardware. This will allow us to locally decipher the voice data of the user to determine what action should be taken. We will perform the action and send the result back to the client, which will then use text to speech to inform the user that the action was taken. Our initial idea is to run the client on a raspberry pi, with a speaker and microphone built into a small custom enclosure. In the end, I expect that our voice assistant will be functional, work quickly, and most importantly will be safe and secure to use. I will evaluate my own contributions toward the project by tracking my progress toward these outlined goals, and by making sure that I attend all group meetings.