# Individual Capstone Assessment

## Introduction

For my senior design project, our team is going to be focusing on developing a conversational companion tool which serves as a personalized information resource for individuals with dementia or other cognitive impairments. We will essentially be providing a conversational interface service for managing personally significant memories. We intend to have extra features such as emergency/panic modes, information security levels, adaptive monitoring and conversation tailoring, and personalization features. From my individual academic perspective, I believe this project can fill a void that currently exists for individuals, mostly senior citizens, who may not have the awareness or the ability to navigate the basic parts of life without assistance. What we consider simple things like remembering names, people, passcodes, tasks, events, etc… becomes a chore and a source of stress for individuals with cognitive impairment. We aren’t really trying to solve the problem of physical assistance, mainly mental assistance, by proactively and reactively offloading memories or significant life information, which also allows us to apply our solution to other areas where individuals suffer similar effects. Helping those whose suffer from cognitive decline both allows them to maintain or increase their independence and is more efficient as it puts less stress on caregivers and the healthcare system overall. We want to do our best to provide a solution that helps those individuals live their life without having to stress or panic in situations they can’t recognize or remember for them.

## Curriculum

My college curriculum will play an important role in guiding the development and life cycle of our project. We’ll start with the first engineering class, Engineering Design Thinking 1 & 2 (ENED 1100, 1120). Portions of this class taught us the engineering design process, which is a framework for iterative problem solving. Material and skills learned from this class will help guide us through the project as we design, iterate, test, and refine our software solution repeatedly to perfect it. Following that, classes like Data Structures (CS 2028C), Intro to Computer Systems (CS 2011), Discrete Structures (CS 2071), and Programming Languages (CS 3003) have provided the foundation for actual programming skills and choosing the right tools for the task at hand. They were the foundation for learning how to use discrete data structures to solve problems, how actual systems interact and interface at a lower hardware level, and what tools are available to perform computational work. Building on that are Software Engineering (EECE 3093C), Database Design & Development (CS 4092), and Computer Networks (CS 4065). These classes went more in depth and covered more specific applications of various concepts and tools. Computer Networks taught us how systems connect and communicate over the internet, which we will have to utilize for our project as we link and use internet services. Software Engineering taught us how to best ethically design, implement, and test software specifically. Database Design & Development gave us the foundation for interacting with relational databases, which we will have to do as we implement certain functionalities for the solution.

## Co-op Experience

My professional experience will also play a big role in guiding the life cycle of our project. For my first two co-ops, I was a Software Development Co-op at London Computer Systems (LCS). During this role, I was on the API team for the first co-op, and the RMX Web team for the second co-op. These co-ops gave me the basis for developing modern applications and architecture for web-native applications. During the first co-op, I learned how to properly build, integrate, and test APIs and their related services, especially working in legacy systems. It got me familiar with the tech stack and the language-specific tools used. In the next co-op, I learned the other side of the coin, front-end web development, which consumed the very APIs that I had written in the past. I learned how to implement visual designs, build out user features, and work in a browser runtime environment with all its tools. Both experiences will serve me well as we go through this project. This project will need to interact with an API for authentication and interaction with the cloud, so learning API development proved valuable. This project will also need a mobile app / visual front-end component. While my experience was on the web and specifically web sites, mobile development is not too much different. You are still working within a UI with components that interact. This will be important become a mobile app will probably be the primary orchestrator between a wearable device and the services or APIs we will need to use to execute our solution. My last 3 co-ops were at Seven Hills Technology. During these co-ops, I have been on an extended project to develop a web-native online ordering platform for a local restaurant chain. Most of the work I do is still web development and API development, but now we are interacting with lots of other integrations and systems. This has prompted me to become more familiar with system design, integrations, and deployment of software. We were also regularly meeting with clients & project stakeholders, which has helped me improve my communication. These skills will prove useful as we architect the exact system for our solution with all its interactions, all to eventually deploy and publish our solution to the public. All these co-ops have provided me with a place to develop skills that I can use on this project. From more managerial skills to hard technical skills, each co-op has given me a valuable skill that I can apply to this senior design project.

## Motivation

I am incredibly excited to work on this kind of a project. There are a few new emergent technologies that we can use and start to integrate with which make this kind of solution very exciting. Particularly, Large Language Models (LLMs) will prove useful as we create a conversational companion as we will need to analyze and generate audio transcripts and voice scripts, respectively. Additionally, we may also get the chance to create some hardware or a very prototype device to mock as a wearable device, which means we get to work with wiring, networking, and communication protocols. I will also get the chance to do some mobile development, which I don’t have much experience in. Additionally, from a moral perspective, we are purely just helping people live their life easier by hopefully eliminating the hassle and confusion that may come with certain conditions. Providing this kind of service can only improve ones’ quality of life.

## Approach

To begin, we will need to design a solution. My preliminary approach will start with system design & architecture. How can we construct and create isolated components of a system that together coordinate to provide something larger? That is what we aim to solve in this project. We will start at the wearable device. If we are making our own wearable device, we need to physically construct the device with enough inputs and outputs to get everything we need. We will need a Bluetooth module to connect that to a phone application. If we are piggybacking on existing wearable, like an Apple Watch, we will need to use their architecture and guide to distributing software on that platform. Next, we will need to develop a phone application that the user will have an account on, and that the device connected to and utilizes. Next, we will need to have some sort of cloud AI agent running in an LLM in the machine that the user can converse against live. This API will accept connections from multiple different clients and will facilitate the user customizable interact between all the stores. At this API level we may have multiple different data integrates that become data sources the user can ask questions against. Our expected results will be the completion of components of the system that are imperative to its functionality, followed by the integration and testing of the system. As far as accomplishments go, we want to be able to ask a question, and the client will pull information from its internal data sources and memory to generate and speak an output. We also want to be able to generate a live report detailing how the user’s conversations have differed and changed over a period, which could showcase a metric for mental acuity. To self-evaluate my contributions, I will be following the standards that I use at work to the best of my ability. That includes unit testing when I can and performing more integration testing of systems to ensure my changes don’t break anything existing but augment old functionality with new functionality. If I can finish a feature without creating bugs in any other features, I will believe that I’ve done a good job.