# Individual Capstone Assessment

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The senior design project we have chosen addresses a challenge found in the healthcare industry by developing an assistive technology solution for seniors living with dementia. By integrating large language models (LLMs) into a portable device paired with a companion mobile application, we aim to create a memory aid that can help users maintain independence and quality of life. The system will provide personalized reminders for daily tasks, location awareness features, and contextual assistance tailored to each individual's routine and cognitive needs. From an academic standpoint, this project allows me to apply my knowledge of embedded systems, web development, and natural language processing to tackle accessibility challenges faced by people living with dementia. This work bridges computer science, healthcare technology, and user experience design. With this, it will allow me to use my past knowledge gained in these fields while expanding in areas such as natural language processing and UI/UX for a specific targeted population.

My coursework has provided a strong foundation in the technical systems required for this project's success. EECE 4029: Operating Systems and Systems Programming equipped me with essential knowledge of low-level system architecture, which will help in developing the embedded components of our dementia assistance device and ensuring seamless communication between hardware and software layers. CS 4092: Database Design and Development taught me how to architect and optimize data storage and retrieval systems, skills that will be needed for managing user profiles, task histories, and personalized reminder data efficiently. EECE 3093C: Software Engineering provided me with methodologies for managing development teams and collaborative problem-solving, which will guide our project management approach and ensure we follow best practices for version control, testing, and documentation. These courses collectively prepared me to handle both the technical complexity and collaborative nature of building an integrated LLM-powered assistive technology solution. The combination of systems-level programming, database optimization, and software engineering principles will enable me to contribute to creating a robust, scalable platform that can reliably serve seniors with varying technological comfort levels.

My co-op experience as a Software Developer at Seven Hills Technology directly aligns with the core challenges of our senior design project. During this role, I gained hands-on experience building mobile applications specifically designed for senior populations. This helped me learn how to create intuitive user interfaces that accommodate users who may be technically challenged or have cognitive limitations. I also developed expertise in API and software architecture design, focusing on building testable and maintainable systems that minimize errors through proper validation while remaining extensible for future enhancements. My work with cloud infrastructure taught me how to design scalable systems that can serve multiple users simultaneously and integrate IoT devices into cloud-based architectures, which will be essential for our device's connectivity and data synchronization capabilities. These experiences taught me the importance of user-centered design principles when developing technology for vulnerable populations, ensuring accessibility and reliability are prioritized over complex features. The combination of mobile development, cloud integration, and senior-focused UX design from my co-op will be directly applicable to creating our LLM-powered dementia assistance platform. This real-world experience working with senior users has given me valuable insights into their specific needs and limitations, which will inform our design decisions throughout the development process.

My motivation for this project stems from my personal experience watching my grandmother's deterioration through dementia and eventually Alzheimer's disease. During periods when she didn't have full-time care, the responsibility fell heavily on my mother, creating both emotional strain and practical challenges for our entire family. I witnessed firsthand how cognitive decline can rob individuals of their independence while simultaneously burdening their loved ones with the anxiety of ensuring their safety and well-being. This experience showed me the critical gap that exists between the onset of cognitive impairment and the need for full-time institutional care, where technology could potentially extend independence and reduce caregiver stress. I am excited to work on a solution that could help other families avoid some of the struggles we faced, potentially allowing seniors to maintain dignity and autonomy longer while providing peace of mind to their caregivers. The opportunity to combine my technical skills with this personal mission to improve quality of life for vulnerable populations makes this project particularly meaningful and drives my commitment to creating something truly impactful.

Our preliminary approach will begin with designing the foundational infrastructure and communication protocols between the embedded device, mobile application, and cloud services to ensure reliable data flow and system integration. Following the technical architecture phase, we will conduct extensive user research focused on understanding how cognitively challenged populations can interact easily and seamlessly with technology, incorporating insights from caregivers, healthcare professionals, and potential users themselves. The expected result is a system that enables caretakers to easily set up and monitor the device while measurably reducing the amount of direct care intervention needed, such as fewer instances of having to remind users about tasks or calm them during episodes of confusion. Success will be evaluated through real-world testing that demonstrates seamless integration into a person's daily routine, with metrics including user adoption rates, caregiver satisfaction, and quantifiable reductions in care-related stress incidents. I will know I have done a good job when our solution genuinely decreases the burden on families like mine while maintaining or improving the user's sense of independence and security. My contribution will be considered complete when we can demonstrate that the technology enhances rather than complicates the lives of both seniors with dementia and their support networks, creating a tool that families would genuinely want to incorporate into their care strategies.