**Individual Capstone Assessment**

As part of our senior design project, I am collaborating with a group of four students on an endeavor sponsored by GE Aerospace. Our project examines the challenge of designing a control system with embedded artificial intelligence (AI) and machine learning capabilities while also developing “guardrails” that verify safe operation in a safety-critical applications such as aerospace. Since there are no aerospace industry standards published regarding AI use in safety-critical systems, the objective of our work is to integrate AI into a sample control system while also demonstrating confidence that the control system can operate in a manner that is safe under all conditions. Furthermore, we will be closely flipping ideas and learning from an advisor GE to help translate our theoretical knowledge from our courses into practical real-world engineering problems.

The courses I have taken at the University of Cincinnati have prepared me well to offer input to this project. In courses such as Data Structures, Object-Oriented Programming, and Design and Analysis of Algorithms, I acquired the basics of writing code that is efficient and maintainable, and that I can use to tackle complex problems in a manner that is thoughtful and methodical. In more advanced courses, such as Introduction to Artificial Intelligence and Deep Learning, I was introduced to a few key aspects of the AI portion of our project, such as what it means to train a model, supervised learning, and neural networks. In addition, I took courses such as Operating Systems and Computer Networking, which helped me understand how low-level systems interact together in a way that would help when embedding AI as part of a real-time control application. Overall, my coursework has prepared me to apply both algorithm-oriented thinking and systems-wide knowledge in the overall design of our control system.

In addition to my academic education, my co-op experiences have given me important technical skills and professional development that will be beneficial for this project. As a Software Engineering Intern for Siemens Digital Industries Software, I gained experience using C++14/17/20 extensively, migrating legacy applications, creating multithreaded applications, and building REST APIs to support back-end work. This gave me exposure to modular design skills, testing skills, and Agile collaboration. Moreover, when I did a Data Analytics Internship for Vasista Enterprise Solutions in Hyderabad and used cloud platforms such as AWS Redshift, Glue, and QuickSight, I automated workflows and created dashboards. From all these experiences, I developed problem-solving skills, a breadth of experience with a cross-discipline team, and confidence in using AI and data analytics on large-scale systems. Both co-op experiences also taught me to balance technical precision with business requirements, and will influence how I approach safety and reliability in our capstone project.

I am very excited to do this project because it gives me the opportunity to apply something I love (artificial intelligence) to real-world safety-critical systems. The aerospace context adds an extra element of excitement for me because I have to design solutions where a small mistake could lead to big consequences. A project that could help determine the guidelines for AI safety in aerospace systems is all the more reason for me to work to my fullest potential. I'm also looking forward to learning from our GE Aerospace advisor and working with my teammates. We will be working together in a cross-functional team, which is what I hope to do in my work in the future.

To begin with the project, my general strategy is to understand the baseline control system model and approximate ways to integrate AI techniques, whether through supervised learning or reinforcement learning, responsibly. I anticipate providing assistance to both the design of the AI components and developing the verification framework that checks for safe operation. For me, success will mean that our system exhibits improvements through AI, and also shows it can function within a prescribed safety envelope. To assess my contributions, I will check that my code is reliable, documented, and meets technical and safety functionality. At the end of the day, I know I have done a good job if my teammates, advisor, and end users can trust the system to work as intended, and it does not add enormous new risk.