

## Individual Capstone Assessment

My senior design project, RTL-Level Secure Coding Against Hardware Attacks, is a continuation of the research I have been working on over the past summer. The project focuses on identifying vulnerabilities in hardware design at the register-transfer level (RTL) in order to protect systems against potential attacks. From my academic perspective, this work is about applying computer science principles I have learned in my coursework to detect unsecure code patterns and help create secure patterns before a hardware design is finalized. Some of my roles include developing detection algorithms, collecting datasets, and writing technical reports and research papers. My goal is to make hardware designs more resilient to hardware attacks as new methods for attacks are being discovered. Protecting against hardware attacks is just as important as protecting against software attacks because they can be just as damaging.

My college coursework has provided me with both the technical and communication skills necessary to contribute effectively to my senior design project. The course Intro to Algorithms gave me experience in designing and implementing efficient algorithms, which is essential when analyzing large hardware designs. Also, Technical Writing strengthened my ability to convey technical information and data clearly through reports and other documentation. This directly connects to the reports I have to write on my work and hopefully a research paper. My work in Artificial Intelligence courses emphasized the importance of a high-quality dataset to improve the accuracy of results. While I may not be training models, having a wide range of data for vulnerability detection will be paramount to improving the accuracy of my detection algorithms. Altogether, these courses have given me strong foundation in computer science principles which will guide me throughout the development of my project.

My co-op experiences have also played a key role in preparing me for this senior design project. Most directly, my most recent co-op was the beginning of this research, which got me started with hardware designs, vulnerabilities, and detection algorithms. This knowledge will obviously be very helpful for my work down the road. Before that, I conducted research in Spain which gave me a deeper understanding of the research process, even though the project focus was different. Both of these experiences have taught me how to approach open-ended problems and adapt to new challenges. My earlier co-ops have strengthened my coding practices and improved my critical thinking in solving complex problems. The combination of all my co-op experiences has formed me into a more capable programmer and a more effective problem-solver, which will be essential for this project.

I am motivated to work on this project because of the importance of secure hardware in protecting private data. As hardware attacks become more sophisticated, it is critical that designs are built securely from the beginning. I believe secure hardware is just as important as secure software in the role of safeguarding sensitive information. The initial approach I have taken is designing a static analysis tool that can scan hardware designs for patterns connected to known vulnerabilities. This method should provide an effective defense by flagging insecure code patterns early in the design process. In the future, I am also interested in exploring other techniques, such as using LLMs to enhance detection capabilities.

The expected result of my project is the creation of a tool that can be used to evaluate hardware designs for specific vulnerabilities at the RTL level. In addition to this, I also hope to write a research paper that summarizes my methods, findings, and impact of the work. To evaluate my contributions, I will measure the effectiveness of the tool through vulnerability detection accuracy. I will also reflect on the quality of my written contributions, including any research papers, ensuring that my work was clearly communicated. Throughout the project, I will work with my project advisor to determine the significance of the work I have accomplished. Using technical and academic performance as measures, I think I will be able to judge whether I have met my goals.