A Reflective Journey: Navigating Your Cumulative Experience at Iowa State University

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I arrived at Iowa State confident in my choice of study, Computer Engineering, and ready to start my college career with COVID-19 behind me. After attending my first CprE 185 lecture, I knew my confidence in choosing Computer Engineering as a major was well placed. After working on my own software projects throughout high school, I was familiar with problem-solving and coding but was ready to learn more. At the same time, I attended Destination Iowa State, eager to try out some of the different engineering clubs Iowa State had to offer. It was the PRISUM Solar Car that caught my attention. The combination of CprE 185 and my experience joining PRISUM Solar Car would set the stage for an exciting college experience that would teach me much more than I expected in a very short time.

I chose Computer Engineering because I wanted to take what I already had with my previous software experience and expand it by learning about the hardware it interfaces with. This is precisely what I'd come to learn about in the following years. Introductory classes on circuitry, such as EE 201 and CprE 281 gave me the first authentic look at what engineering hardware looks like. I learned the basics of circuits and eventually built on them to create useful hardware, like an IR remote control that used a high-pass, low-pass, and bandwidth filter to differentiate signals. I then built on my new knowledge of digital logic to create register files and timer circuitry to make a stopwatch complete with a lap feature on FPGAs. Of course, it was CprE 381 that really showed this off. This class felt as if it were two-in-one. We focused heavily on hardware units during labs, such as creating our own ALU. For homework, we had MIPS assembly software exercises. It all came together in one final project: we built our own processor to a simple MIPS standard and supported pipelined processes. Seeing the software I wrote in assembly be directly run on the processor that I designed is one of the unique Computer Engineering experiences I wanted coming to Iowa State with this major.

While learning a lot of new content across these many courses, I found what I wanted to specialize in with my Computer Engineering degree. My software background, compounded with my newfound knowledge of hardware, had set me up to specialize in embedded systems and embedded software. I was first exposed to this during my freshman year with PRISUM Solar Car. It was a steep learning curve for a freshman, but I was learning how to configure peripherals by editing registers to make the hardware do what I wanted. This could be configuring timer circuitry to interrupt the program to send out a CAN message to the motor controllers of the car to drive the car based on an ADC reading of the accelerator pedal.

Going into CprE 288, Embedded Systems I, was relatively smooth as I had already been exposed to most topics. This class had controllable Roomba vacuums that involved most of the embedded skills I had learned from solar car. Rather than writing this class off as something I already knew, I instead decided to create my own fun and challenge myself further. The labs were quick, and I was able to teach my partner and other students about topics they might be stuck on. I went further by setting lofty goals and functionalities for my final project. Despite this being a class I already had experience in, I spent more time in the lab than anyone else. It wasn't because I was struggling but because I was having fun. Our final project was a mix of

many features involving a visual telemetry complete with full mapping functionality, autonomous driving, piloting with a CprE 185 DualShock 4 controller, a supplementary battery, and tunes along the way. The projects I had worked on in solar car combined with the fun that I created for myself in CprE 288, set my love for embedded systems in stone.

The following summer, I got an internship at a company specifically focused on embedded software for sensors. In the interview, I spent much time detailing my efforts in solar car and CprE 288. I could apply what I had learned immediately on my first day of work. I found myself configuring C projects for a sensor with an LCD screen to show a heatmap generated with data from an IR thermal sensor. I was using UART interrupts like I had learned in class and SPI communications to the screen, similar to the SPI-based potentiometers I had used for a solar car project. This was confirmation that I was in the right line of work. It was clear to my employer that I had gotten an excellent education in this field, both from class and solar car, and I now am expected to work there full time after graduation.

While I have found my specialty, I've taken several classes to broaden my horizons. I took ComS 336 on 3D graphic renderings since I've always been interested in learning about this, even though it isn't directly related to my major. I took management classes to learn valuable knowledge in the event I become a manager of an embedded software team in the future, something I was starting to become familiar with in PRISUM. In CprE 308 I finally learned how to write multi-threaded programs and to better use the features an OS provides me. I also took ComS 309, a class that furthered my knowledge of the Git workflow, which has proven invaluable for my career and is applicable in solar car. It was also a full-semester group project. Working with multiple people on the same software was something I wasn't too familiar with at the time.

I plan to wrap up my college experience with a grand finale. I plan on taking CprE 488– a course that combines the teachings of many CprE courses (such as 381 and 288) into one big lab-focused course. It will be super challenging but enjoyable to navigate these labs. I'll be finishing up senior design which aims to develop a custom motor controller for users like PRISUM solar car or DIY ebike customers. This is a custom project my group proposed and is very passionate about. Combining embedded software with the electrical engineering behind driving a motor is fascinating. Finally, I will spend much time in the solar car club doing and learning about anything I can. This involves teaching many new members about embedded software, just as the team did for me as an incoming freshman. I'll also be contributing to other sub-teams unrelated to my work. For example, I've helped the composites team develop a mold for the next car, something I didn't get to learn about in class. I'll also continue to attend events and, especially, race: the main competition PRISUM solar car competes in for weeks over the summer.

Looking back on my decisions surrounding my college career, I can confidently say that I have no regrets and have learned so many amazing things. I chose the perfect major for me at the perfect university for me. I believe I chose the right club to gain experience in and that it'll result in me being in the right line of work. The lasting effects on me from my college career are everything I could've ever wanted and then some. I'm excited to finish my college experience, feeling complete and content with what I've done.