Project Portfolio

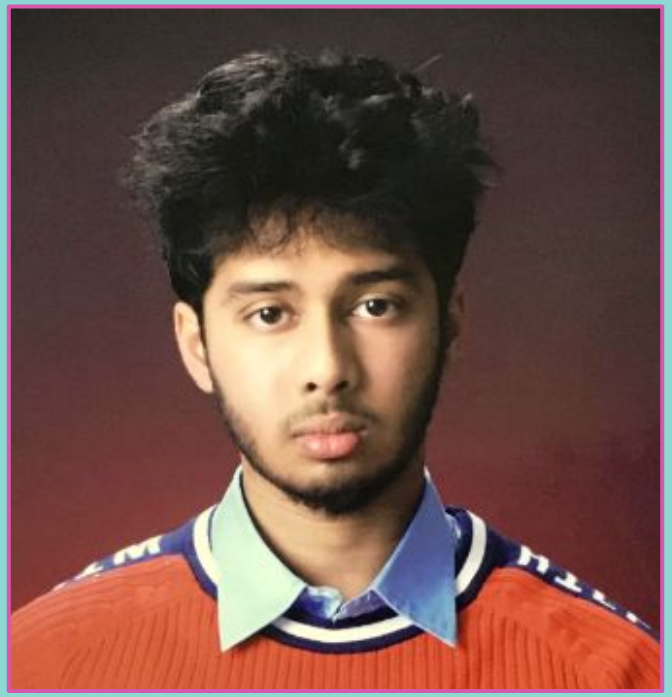
Ahnaf Naheen

Introduction and Aspirations

I am entering my third year of Electrical Engineering, minoring in Computer Engineering.

I've always had a passion for **robotics** and **embedded systems**; looking at how low level hardware and firmware impacts the various electrical systems in today's world.

Ice hockey has also been a major part of my life since 8 years of age. I currently play in the SCRHL men's league.



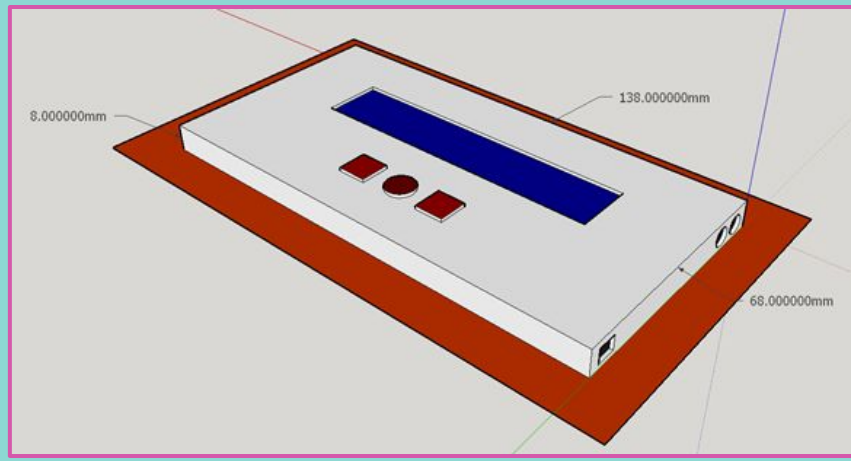
Future Career Goals

- Pursue **Engineering innovation** through changing **medical technologies**
- Contribute to the development of a Brain-Computer Interface (**BCI**)
- My inspiration stems from individuals who are paralyzed from spinal cord trauma

Project One - Heart-Rate Music

This is an ongoing personal side project where I am developing a device that plays music based on the user's heart rate. I am working with **embedded microcontrollers** , specifically **PIC18 microcontrollers**, to design the prototype. Furthermore, I am using the **MPLABX** environment to work on the code and software. I am hoping to turn this project into a marketable product in the near future.

- The device uses **Interrupt Service Routines (ISRs)**, to give time for various functionalities such as measuring the user's heart rate, system sleep, etc.
- The microcontroller also implements an **Analog-to-Digital Converter (ADC)** when the heart rate is converted to discretized audio bits.



Initial concept of the device.

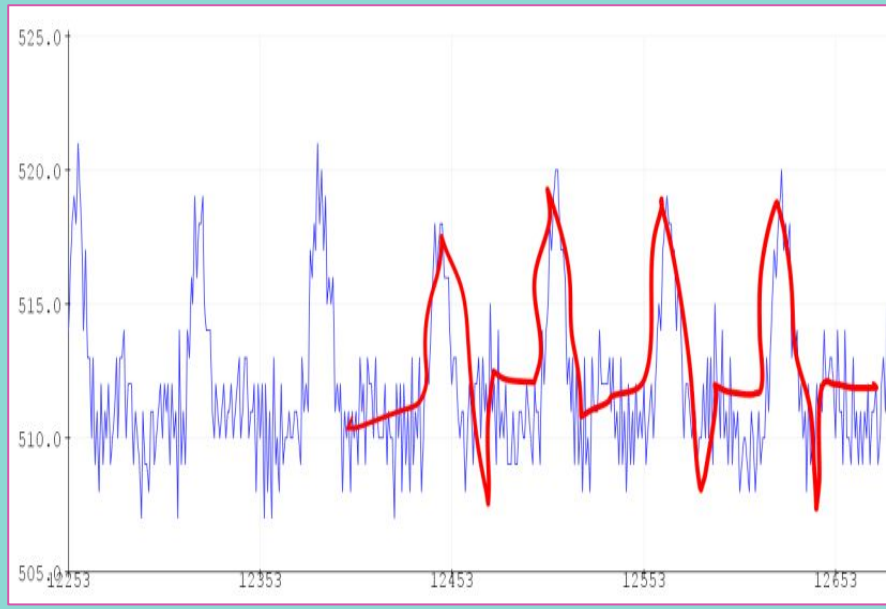
Project One - Design Process

https://github.com/naheenahnaf/Heart-Rate-Music

I initially spent many hours of research on how to tackle the **problem** and coming up with a **solution**. This is especially true when designing the heart rate sensor via a **photodiode/IR diode** assembly and cascading **active frequency filters**.

Most importantly, learning how to work with microcontrollers, such as **configuring bits** and setting up **registers**, eventually lead to learning key concepts such as **ISRs** and **timing peripherals**, **GPIO**, etc.

Project code and progress can be seen on the linked GitHub repository.



Test read of my heart rate (red).

Project Two - Electric Motorcycle

- This is currently an ongoing project with the Zeus Electric Motorsport team at the University of Calgary.
- I am on the **motor-controller** subteam, and my job involves implementing the central communication system between the bike and its components.

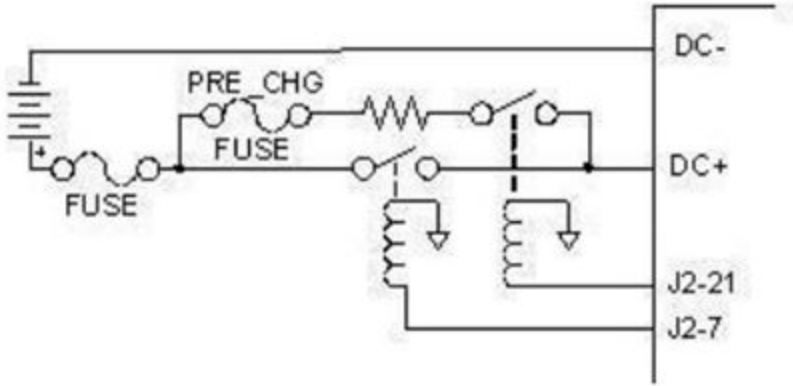
- The motor-controller system must overlook vital motor functionalities such as **torque** and **RPM**, and controller functionalities between the driver and machine, such as **acceleration**, **brake**, **reverse**, etc.

Project Two - Design Process

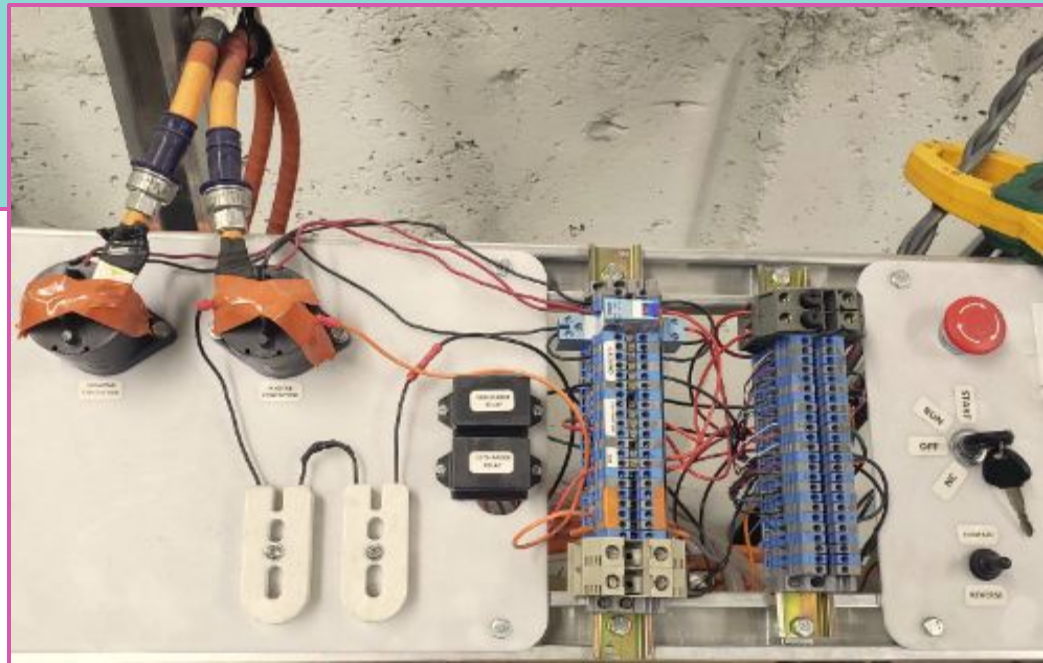
- Careful planning and drafting of a **schematic** is essential to successfully building a **prototype**.
- Pre-charge circuit (below) safely starts/charges the motor-controller.

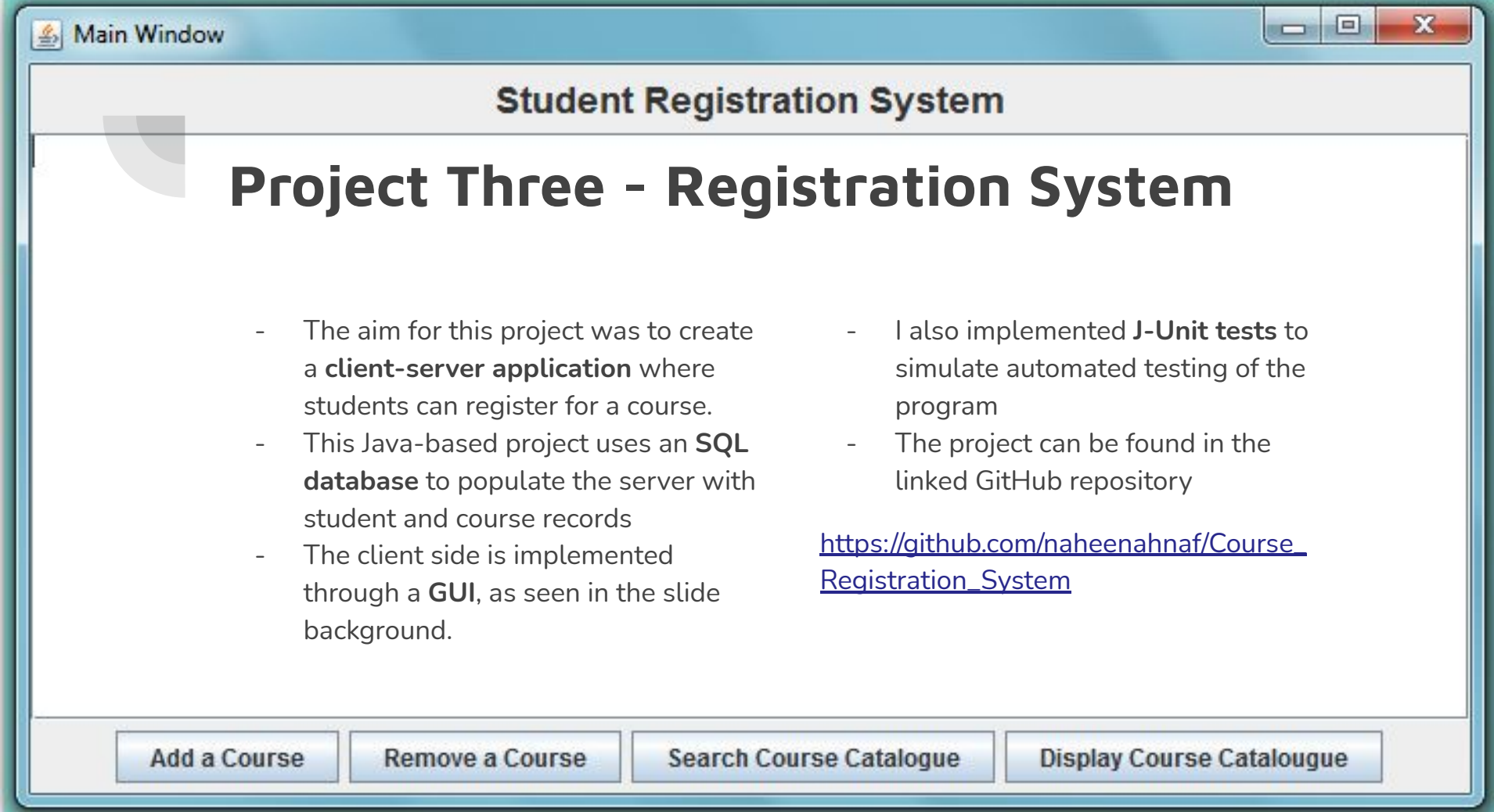
- The prototype must be **tested** numerous times for any faults

Pre-Charge Circuit Schematic



Pre-Charge Circuit





Project Three - Registration System

- The aim for this project was to create a **client-server application** where students can register for a course.
- This Java-based project uses an **SQL database** to populate the server with student and course records
- The client side is implemented through a **GUI**, as seen in the slide background.
- I also implemented **J-Unit tests** to simulate automated testing of the program
- The project can be found in the linked GitHub repository

https://github.com/naheenahnaf/Course_Registration_System