



Fall 2022 Project Proposal

Rensselaer Motorsport Software Suite

Benjamin Rome (Project Lead)	romeb@rpi.edu
Levi Hlavac	hlaval@rpi.edu
Chris Sherlock	sherlc@rpi.edu
Katie Sears	searsk@rpi.edu
Luke Williams	willil14@rpi.edu
Tom Petr	petrt@rpi.edu

[GitHub](#)
[Website](#)

Description

Rensselaer Motorsport is one of the premiere engineer groups on campus. This club has existed for over 30 years and has seen top-5 finishes in global competitions around the world. In its history, Rensselaer Motorsport has seen many talented mechanical, aeronautical, and other engineers. However, there has never been a large focus on the data analysis portion of the team. Usually, this is an afterthought as the first order of business is building a car. This year, we will be focusing heavily on the software design that will allow us to make faster cars moving forward in the future. This project will focus on several different smaller internal projects as well as the keystone project that will allow us to develop faster cars: a lap time simulation.

This lap time simulation project will allow students to model a three degree of freedom race car and hopefully a fourteen degree of freedom model later on. Once this model has been incorporated into code, we can tweak hyperparameters in order to find correlations between different variables, and develop a faster car in the future. We will also have several members working on the firmware that will allow the car's internal computer to run well. These will also be expanded on momentarily

Goals

- Create a three DoF car model that can run on a variety of endurance, autocross, acceleration, and skidpad courses
- Validate model with prior car information and prior testing information
- Create a track model that can automatically segment based on corner radius
- Create and optimize a tire temperature testing rig using several Raspberry Pi compute modules and 12 individual IR temperature sensors
- Build firmware that will be used by the car in order to collect data and allow the car to run
- **Stretch** Build a 14 DoF car model to run on the previously mentioned courses
- **Stretch** Use computer vision to take a picture of a course and automatically create a csv of (x,y) coordinates that can be turned into a track using our software

Milestones

End of September 2022

- Get all members into the GitHub org
- Begin work on car and track models
- Finish a basic acceleration track
- Work on the physics models in an Excel sheet or Python script
- Analyze current firmware implementation and decide to rewrite or expand

End of October 2022

- Add skidpad track
- Begin validation of model using prior data
- Create GG plots of the car with different tire configurations
- Initial design of implementation for firmware and what control is going to be needed

End of November 2022

- Start work on autocross track implementations
- Work on automatic segmentation of tracks for use with the car model
- Continue validation as new tracks are added
- Ensure model is correct dating back to RM21
- Finish writing functional implementation of firmware that can be tested and come up with testing plan

End of December 2022

- Ensure documentation is up to date
- Prepare to continue project in the Spring
- Project presentation prep