Actuator

I am currently implementing the controls system for a dune buggy's electric continuously variable transmission

I joined Bruin racing Baja Fall Freshman year. We design and compete single seater offroad cars that are powered with a single cylinder (CHECK) lawnmower engine. In my opinion, the most interesting part of the car is our transmission. It’s two conical sheaves that transfer power to each other using a belt. When the primary sheaves are pushed together, the belt is forced to ride farther away from engine shaft and closer to the gearbox shaft. This transfers more speed and less torque to the wheels (Check). Most Baja teams choose to regulate the spacing between the sheaves by tuning a flyweight mechanism. Two years my predecessors decided an electrically controlled transmission would perform better. My job is to implement the control system of this transmission.

Insert photo or video of the transmission moving to show what exactly I’m controlling.

Since this is an ongoing project and I have done a good job documenting my work, I will write about this project chronologically in sort of a blog format.

**Winter Quarter Freshman Year**

My interest in controls began when I attended the previous controls lead talks on controls. These talks were theoretical and delved into differential equations behind controls. I also built an electric synthesizer using electronics and a microcontroller.

**Spring Quarter Freshman Year**

Tyler, the previous controls lead, would be graduating and start work at a space startup in San Francisco, so I applied to take his position. And despite the fact that I had no experience, nor had I taken any sort of controls class in school, I got the position. I also took a C++ class which gave me a much more solid foundation with coding than my self taught python.

**Summer before Sophomore Year**

Up to this point I hadn’t touched a single part of the car. School had been online, and I lived six hours from UCLA. I wanted to start working before school got busy and it was hard to know what to do without the actuator assembly in my hands. I made the trip down for a week to see the shop, get what electronics I needed and say hello to some of my friends in Southern California. I had the goal of getting the actuator to move before I left LA. When I got to the shop, I rooted around 50 boxes to find the one Tyler had dropped off. Inside there was his testing rig that he had been using to develop basic control code. We had decided to build our own actuator from scratch rather than use a stock one because (Why did we decide to make our own actuator from scratch?). It’s comprised of a brushless 3 phase 140 kV electric scooter motor, a motor driver called the ODrive, a Teensy 4.0 microcontroller, a digital encoder, hall effect sensors, hardware kill switches, and A 22.2 V LiPo battery.

Insert Wiring Diagram

The ODrive is a motor driver created by a guy in England who wanted to control high power motors with his circuit board and an encoder. I am unfamiliar why we went with the ODrive over other motor controllers. My guess and what I have found is that ODrive is relatively well supported and is very customizable if you are able to understand it. The ODrive has also been my biggest bottleneck. When I tried connecting the Odrive to my computer it was unrecognized. And that is how far I got during my entire summer.

**Fall Quarter Sophomore Year Weeks 1-3**

asdf

**Fall Quarter Sophomore Year Weeks 4-7**

DSF

**Fall Quarter Sophomore Year Weeks 8-11**