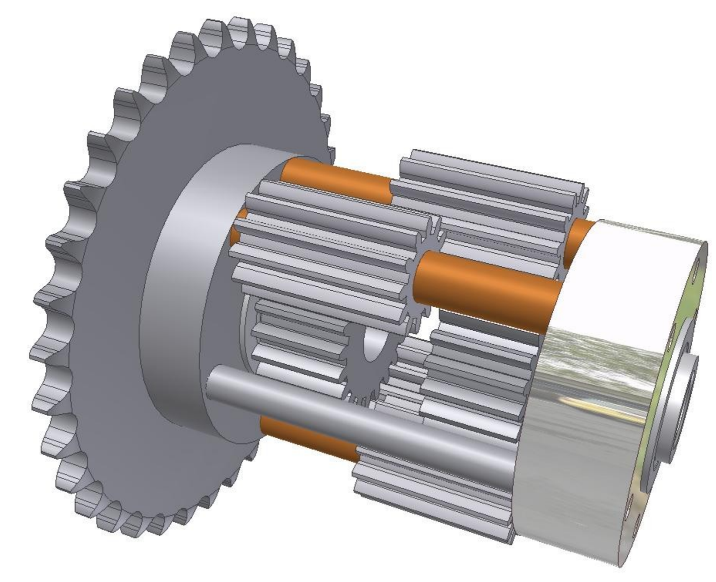
MITMECHE

Experimental Transport

The open, collaborative nature of MIT student workspaces occasionally produces examples of unconventional engineering. In such environments, students often aid eachother in constructing strange or uncommon works. These two projects below are examples of what has emerged from MIT when such creativity is combined with tool and equipment access.

LOLrioKart is a MIT student project which has attracted a significant amount of publicity. The original vehicle was constructed from a supermarket grocery kart as a joke. However, continuous improvements and modifications turned it into a serious engineering effort. The kart became a testbed for custom mechanical and electronic components.

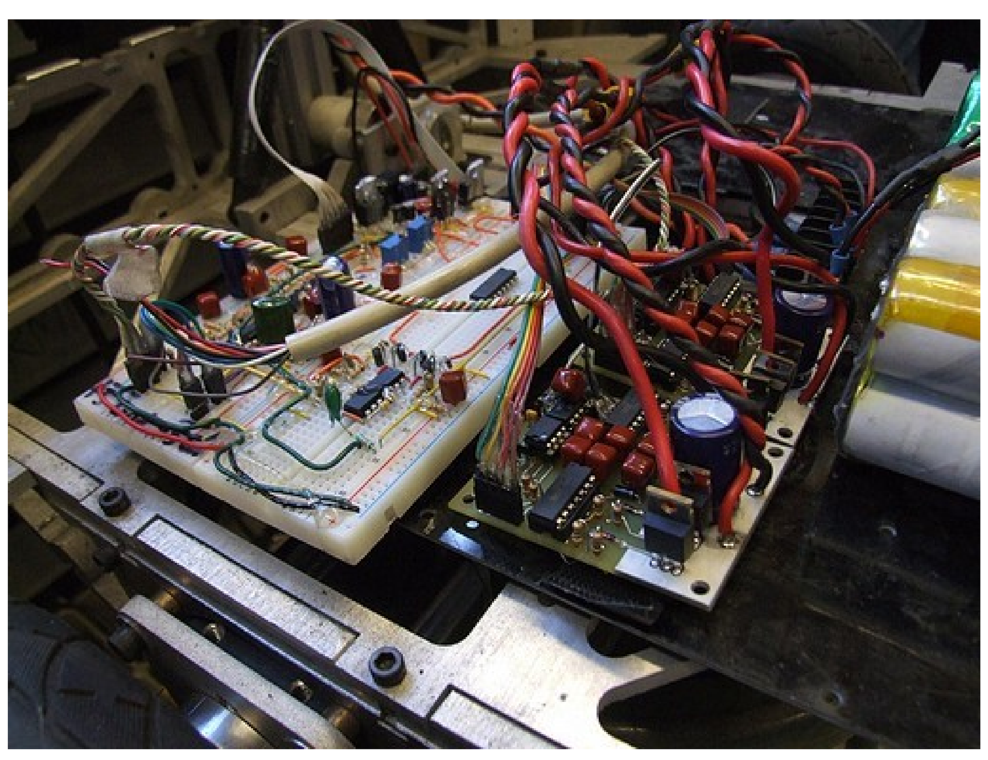


A custom spur-gear differential was designed and built purely as a machining exercise, but proved useful on the vehicle because of the extra maneuverability it provided. The spur differential was machined from aluminum billet and the gears fabricated from lengths of “pinion stock”, pre-formed steel gear tooth sections.

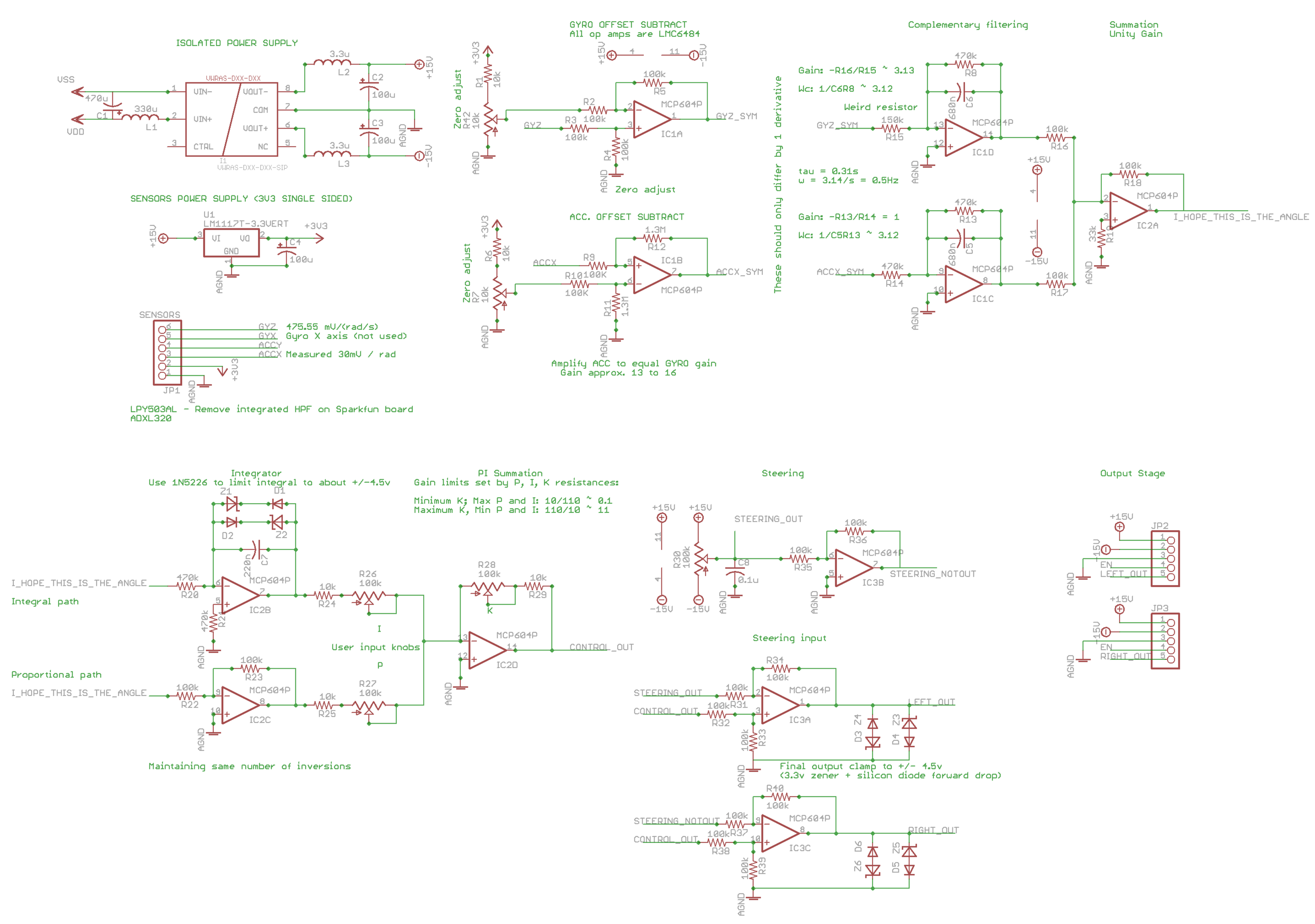
With its 48 volt electrical system and 8 horsepower (6 kW) main drive motor, it was also a challenge to control. A custom 100 volt, 200 ampere (20 kW) bidirectional DC motor controller was developed over multiple iterations to serve as the speed governor for LOLrioKart. The controller can perform regenerative braking. Development of the controller provided much needed and useful insight on power electronic systems, and the result was an achievement much more educational than using a commercial controller.

Segfault is a custom two-wheeled self-balancing vehicle similar to the *Segway* Personal Transporter. However, it is unique from other custom Segway-like vehicles because it uses no digital logic in its balancing controller. While the Segway and other amateur replicas use digital microcontrollers to read and process the sensors, in Segfault, all of the signal processing is represented by analog voltages.

The balance controller in Segfault combines the signal from an accelerometer and a gyroscope, which measure respectively the long-term angular deviation from vertical and the short term rate of angular change. The signals are *complementary filtered* such that each sensor is only used in the regime it can reliably measure, and the measurement combined to recover the original tilt angle.



The output of the balance controller is a voltage, which is used as the input to command 2 custom bidirectional DC motor drivers. The gains of the controller are adjustable using knobs located on the upper control panel, allowing user experiments to find stable gains.



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