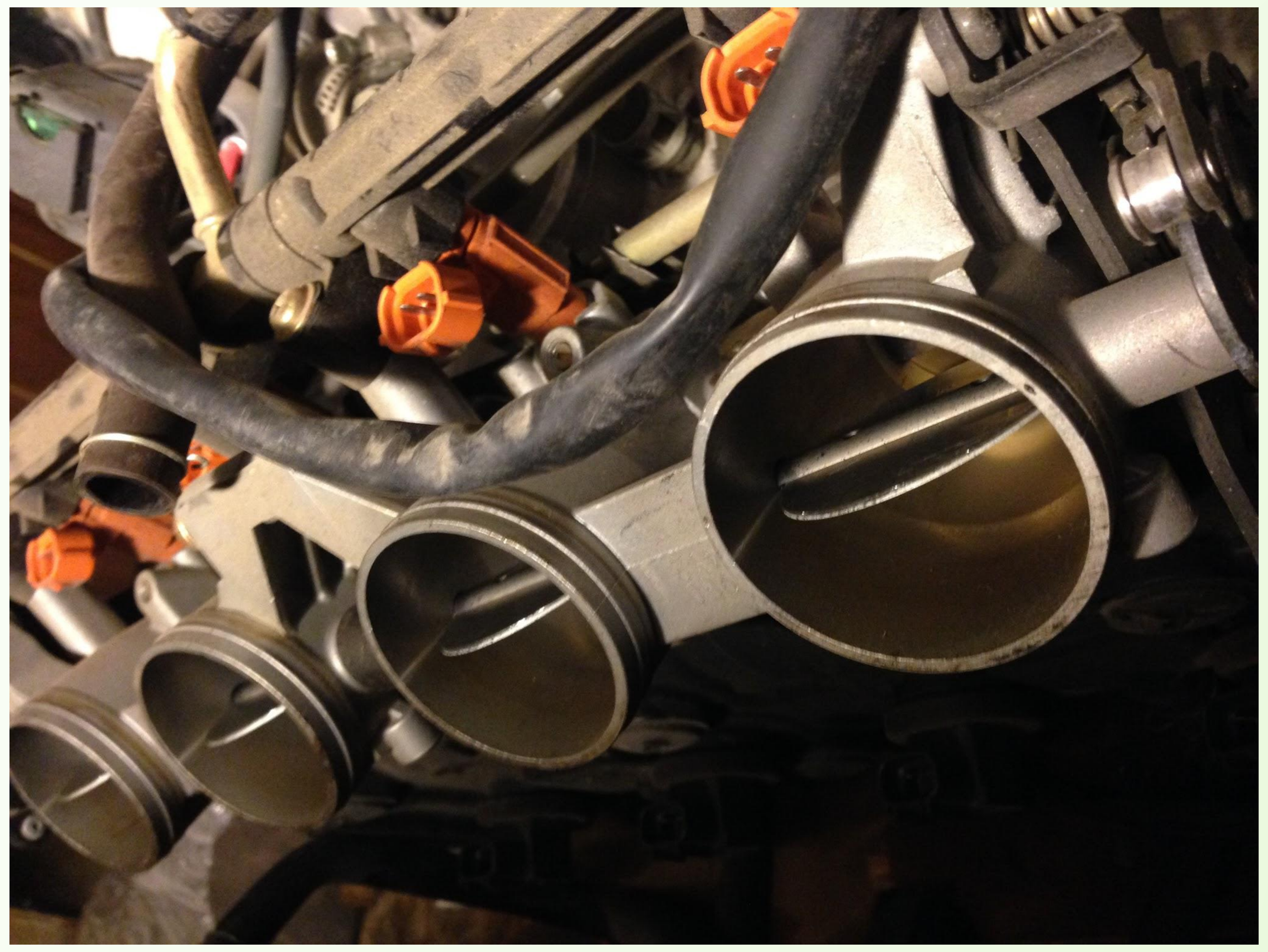
Washkewicz College of Engineering

Engine Control

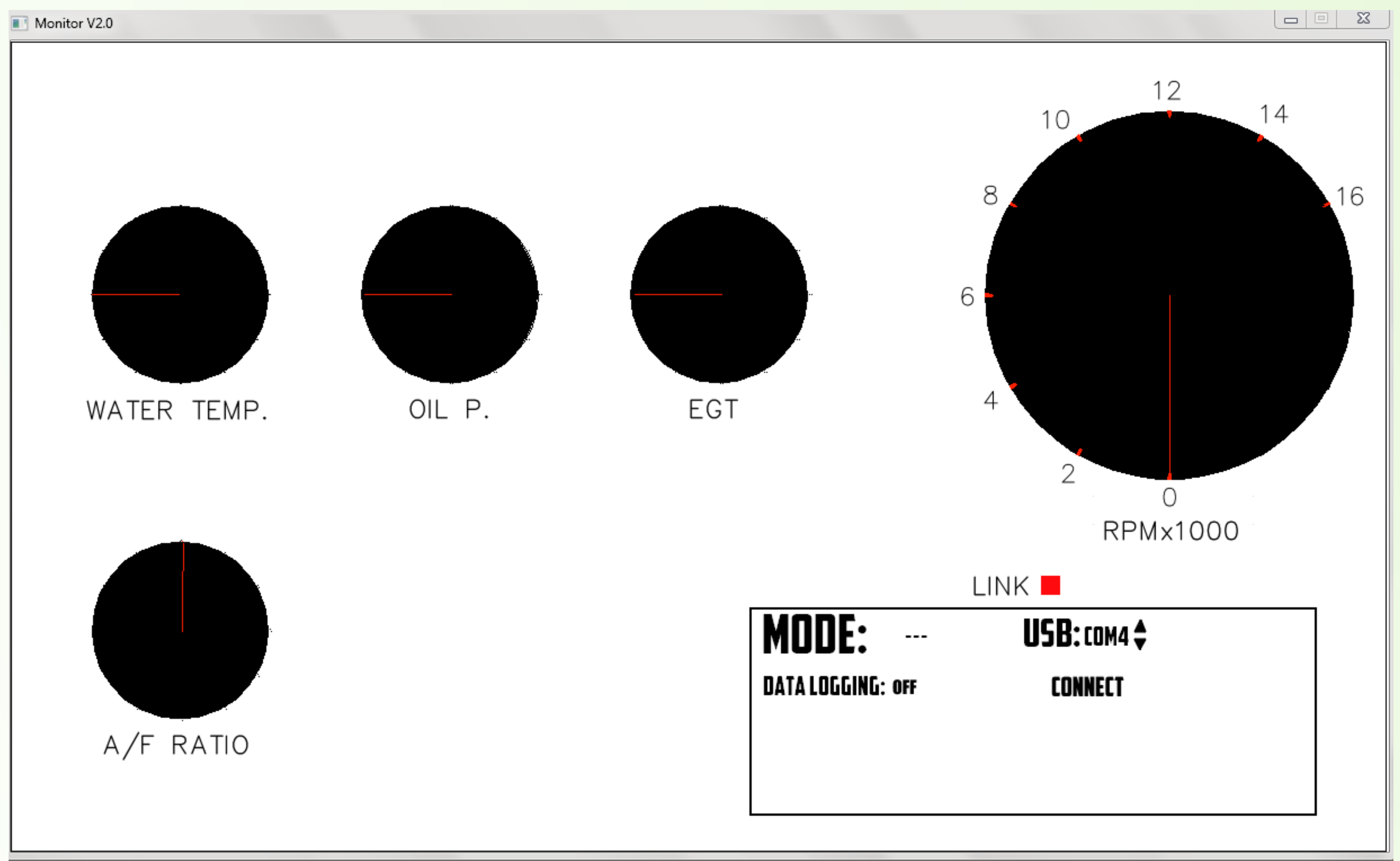
Andrew Moragne, Ahmad Alabdulwahab, Hamdan Alruwaili, Sattam Alotaibi; Instructor: Dr. Zhiqiang Gao

Washkewicz College of Engineering, Department of Electrical and Computer Engineering

Cleveland State University



Suzuki GSX-R 600	
Engine 4 CYLINDER	16 VALVE DOHC
Displacement	599 cc
Maximum Revolutions	15,000 rpm



Digital Dashboard (GUI)

Our microcontroller is connected to a computer via usb cable and sends engine data to our digital dashboard pictured above.

Our senior design group researched existing engine control methods present in industry today, and designed a controller for a 600 cc motorcycle engine. This engine is similar to engines used for formula SAE competitions. The timeline for the project was the fall 2014 and spring 2015 semesters with the main focus of project activities being in the spring.

An engine's fuel efficiency is highly dependent upon parameters such as air fuel ratio (air mass flow) and spark timing. Fuel efficiency today is also a balance between achieving low fuel consumption and low emissions.

Lean **Rich**

Running an engine "lean" would seem to be a good way to conserve fuel, but if the engine gets too lean, it produces nitrous oxides (NO_x) an air polluting greenhouse gas.

One way to reduce these gases is the use of a catalytic converter. The catalytic converter is a reduction/oxidation (redox) device that reduces nitrous oxides (NO_x) into nitrogen and oxygen, and oxidizes carbon monoxide to carbon dioxide.

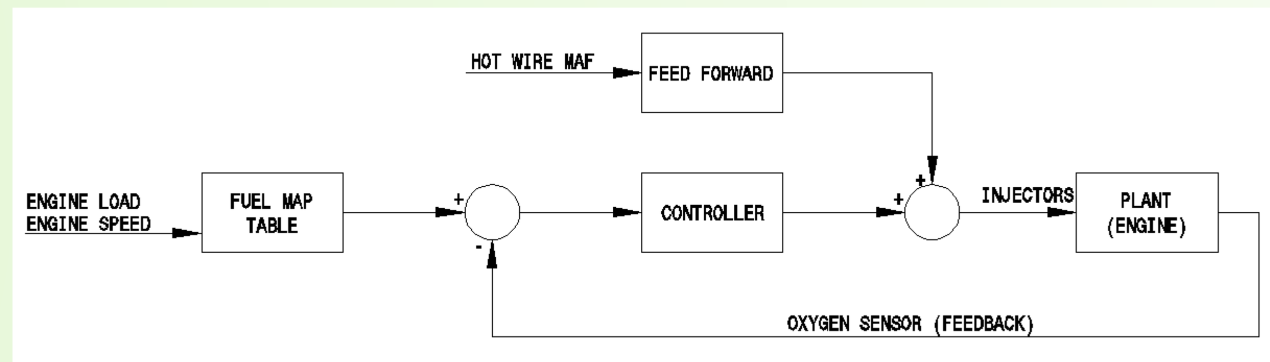
The fuel delivery controller must prevent the NO_x reduction catalyst from becoming fully oxidized, yet replenish the oxygen storage material to maintain its function as an oxidation catalyst. Under rich conditions, the excess fuel consumes all of the available oxygen prior to the catalyst, thus only stored oxygen is available for the oxidation function. To reduce fuel consumption, keeping the air fuel ratio closer to stoichiometric is the key. varying slightly above and below rich ensures a low emission burn.

Objectives:

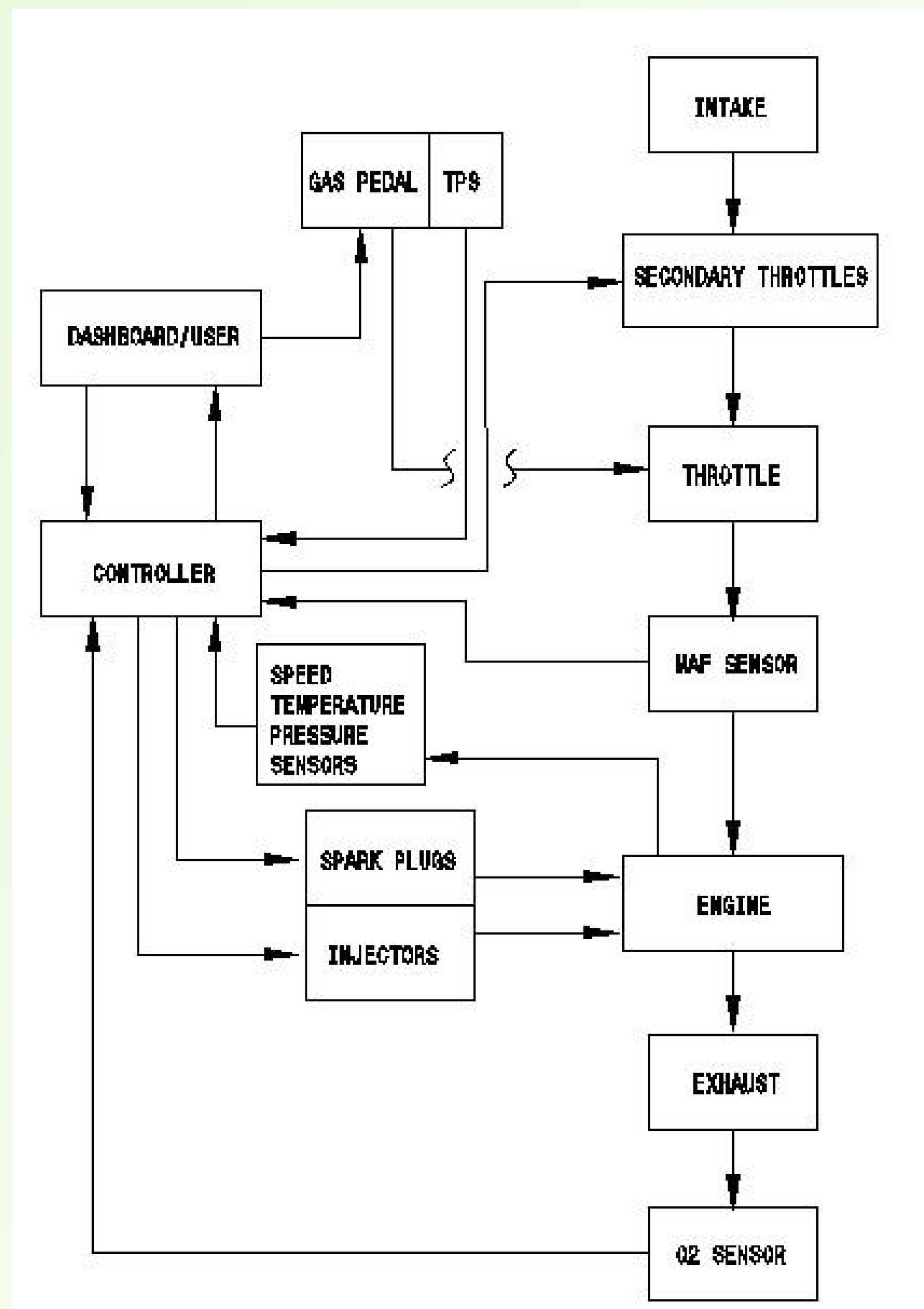
- Jump-start an engine study infrastructure
- Research and design different engine control methods
- Attain an engine (within size limitations for Formula SAE competitions)

We researched engine model equations for mass air flow and torque production. We simulated a fuel controller with the mass airflow model, and simulated torque control from a model based on data pulled from a ford V8.

Shown below is our block diagram for our fuel controller and our overall control system diagram



Fuel Control Loop - Block Diagram



Overall System Diagram