Small Engine Dynamometer

Overview
Penn State’s Mechanical and Nuclear Engineering department tasked the team with constructing a dynamometer workstation. The workstation needed to measure torque, rotational speed, and power output of small-sized engines, specifically the engine of the customer: the Eco-marathon Urban Concept group.

Objectives
- Construct dynamometer capable of testing engine outputting 4.4hp and torque of 7.4 ft-lb
- Ensure users safety during testing, including incorporation of 1.5 factor of safety where applicable
- Keep spending within allowable budget

Approach
- Scope and objectives were determined via discussion with customers, sponsor, and instructor.
- Existing workstation with DC motor, provided by MNE department, was inspected for salvageable components.
- Research on dynamometers and weighing customer needs led to design selection.
- Second motor was purchased along with components to allow for parallel operation. Additional purchases include proximity sensor and data acquisition system.
- SolidWorks models, created by team members or found online, allowed team to find precise geometries of hardware for construction.
- Team machined components, including drilling holes in two steel channels, boring out larger diameter in shaft coupling, and creating a safeguard.
- Measurement instruments—torque transducer and proximity—and DAQ were calibrated and tested.

Outcomes
- Incorporation of existing DC motor with new allows for sufficient power absorption, efficient energy management, and low manufacturing cost.
- The workstation’s sensors give highly accurate readings that are easily transferred to a user’s computer.
- Selected apparatuses are able to test full power range of customer’s engine, according to initial metrics.
- A mobile workstation permits easy transportation for testing in multiple locations on campus.
- The workstation’s design allows for easy modification for future projects related to engine testing.