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Abstract: Thrust vector control (TVC) is often employed to guide rockets in the desired flight trajectory. For instance, the J2-X has two orthogonal actuators that are used to gimbal the engine nozzle and in turn vector the thrust, keeping the rocket on the flight path. Our project was to build and design a learning center that would demonstrate TVC of Ares I, as well as TVC in general. We began with a dual-axis inverted pendulum mechanical set-up that was developed by a group of interns last year. The set-up was composed of two linear voice-coil actuators attached to a rod which acted as a lever arm through which we applied force to the model rocket in order to balance it. The first step in our project was to develop a mathematical model to characterize the dual-axis inverted pendulum system using Lagrangian mechanics. The model then fed into a linear quadratic regulator controller. From this model we determined the measurements necessary to control the system, which were obtained via two tri-axial rate gyroscopes, two potentiometers, and two linear encoders. The measurements taken from these instruments were incorporated into a LabVIEW VI which calculated the necessary force to be sent to our actuators to control the system. Using this closed-loop feedback system ensured the system was being controlled appropriately.