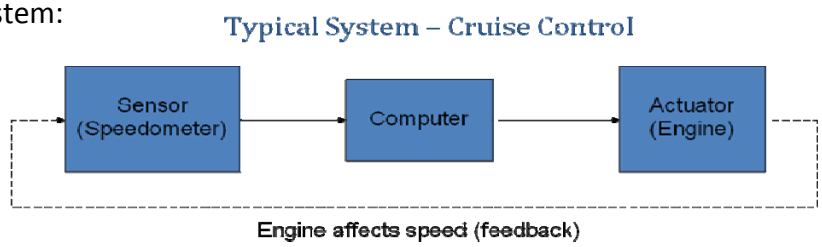
# ES405 Applied Sensors and Actuators

**Summary:** A course which provides hands-on experience with these two components of a typical system:




In the above example of a car's cruise control, the sensor (speedometer) measures a physical quantity of interest (speed). If that quantity is not at the intended value, the actuator (engine) changes the value of the physical quantity to the desired value. A computer of some sort makes the decision on how to use the actuator to change the physical quantity. In this course students are introduced to a variety of common sensors and actuators and the theory behind their operation. They build on their previous experience with computers to program a microcontroller to accept sensor data and issue actuator commands. Additional circuitry such as sensor conditioning circuits and actuator drivers, which provide computer interface, are also covered. The course provides familiarity with hardware and programming to support the capstone project.

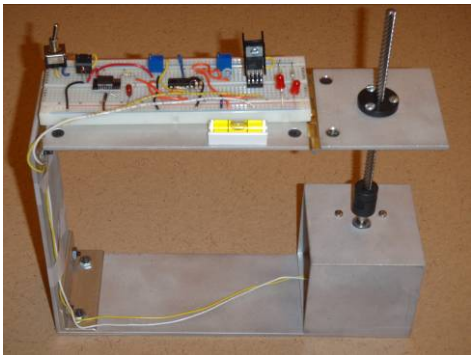
**Credits**: 2-2-3 Prerequisites: **(ES304 or ES304H), ES308, SM316**

**Topics**

- C programming refresher, computer I/O and libraries, serial communications
- Sensor fundamentals, conditioning circuits, and noise analysis
- Electrical actuators: DC motors, servos, stepper motors, brushless DC motors
- Motor drivers

**Laboratory Hardware:**

- Microcontroller
- Various sensors: range, light, temperature, acceleration
- Various motors



**Sample Lab Exercises**

- Electronic thermometer
- Range-sensitive stick-wielding servo

**Projects:**

- Design / build an intrusion detection system using the sensor of student's choice.
- As a final project students start with an accelerometer and DC motor to build a self-leveling platform system.