Coursera Specialization on Embedding Sensors and Motors

University of Colorado **Boulder**

Common Types of Sensors

- Process: flow, level, temperature, pressure, vacuum
- Position: GPS, potentiometer, radar, sonar, altimeter
- Motion: gyroscopes, LVDT, accelerometer, speedometer,
- Ergonomic: touch, optical, acoustic
- Chemical: mass spectrometer, pH, conductivity, smoke, O_2, H_2, NO_2, CO
- Electrical: voltmeter, ammeter, metal detector, Hall effect

Sensors Used in Your Smart Phone

- Process: temperature (auto-shutdown)
- Position: GPS, proximity
- Motion: gyroscopes (angular position), accelerometer (gesture control)
- Ergonomic: capacitive touch screen, touch ID, light
- Electrical: battery life

[1]

Sensors Used in Your Smart Phone

[2]

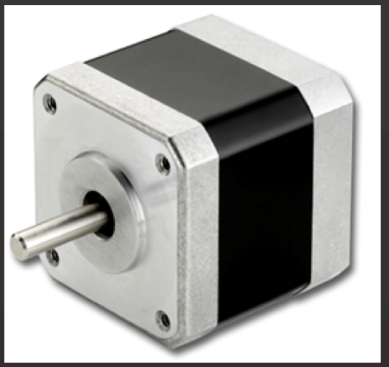
- Process: temperature (engine/cabin/coolant), pressure (oil/tire), and air intake
- Position: GPS, throttle, crankshaft, camshaft, radar
- Motion: accelerometer (airbag), speedometer
- Ergonomic: dash board touch screen
- Chemical: O2, H2
- Electrical: low battery

Common Types of Actuators

- Hydraulic: pressure from compressed oil powers a cylinder. Used in cranes, and excavators. Slow speed of response
- Pneumatic: similar to hydraulic, but uses air instead of oil. Used in assembly equipment, and vehicles. Fast speed of response, but prone to leakage
- Electrical: motors convert electrical energy to rotary motion. Easy to interface to embedded circuits
- Mechanical: Gears, belts, pulleys, chains, and lead screws increase torque or convert rotary to linear motion

Types of Electrical Motors

- Stepper: Multiple coils organized in phases cause the motor to rotate in very precise steps



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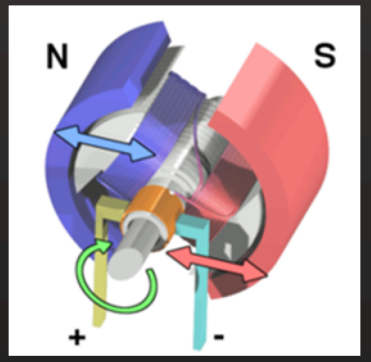
- Brushed DC: A coil generates a magnetic field around an armature. One side of the armature is repelled by a north pole magnet and the other side attracted to the south pole, causing rotation.



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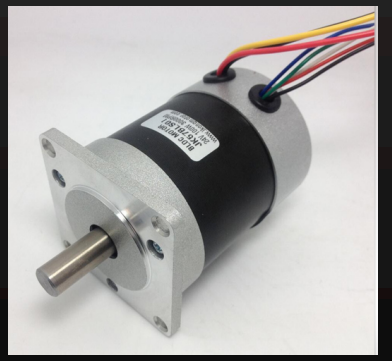
- Brushless DC: permanent magnets generate the magnetic field around the rotating armature



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Citations

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