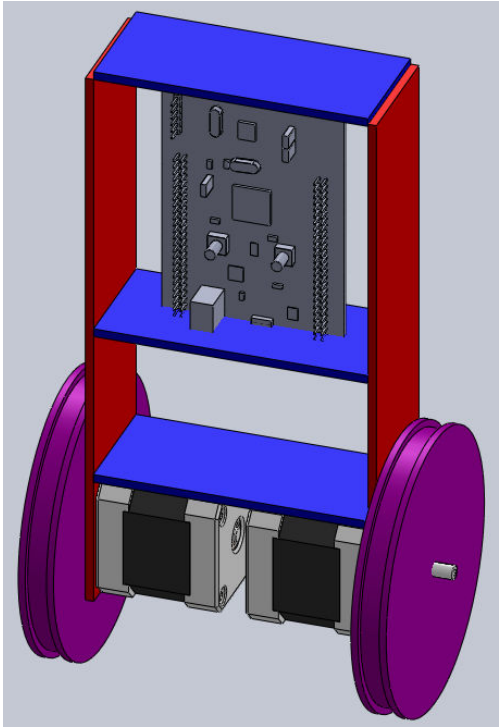
Hardware Implementation

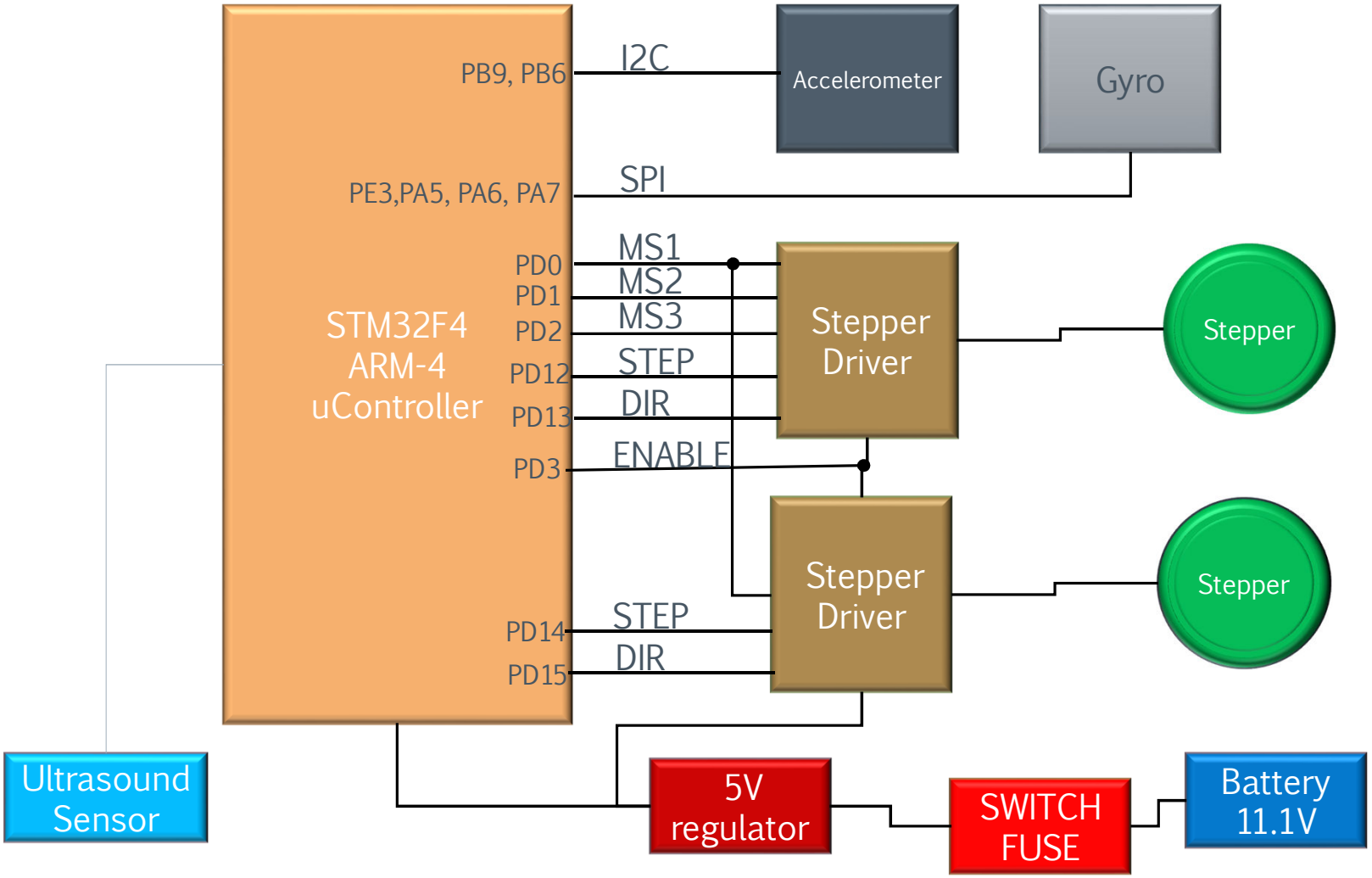
Self Balancing Robot

Design Objective

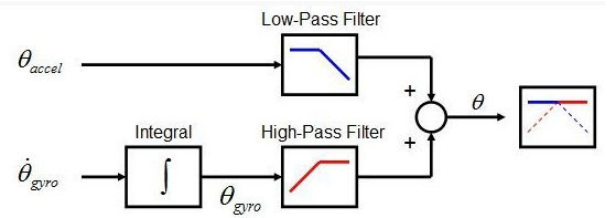
- Implement base to develop code
- Define pins to use for code
- Use material discussed
- Balance Robot using
  - Gyroscope
  - Accelerometers
  - PID loops
  - Kalman Filter



System Block Diagram

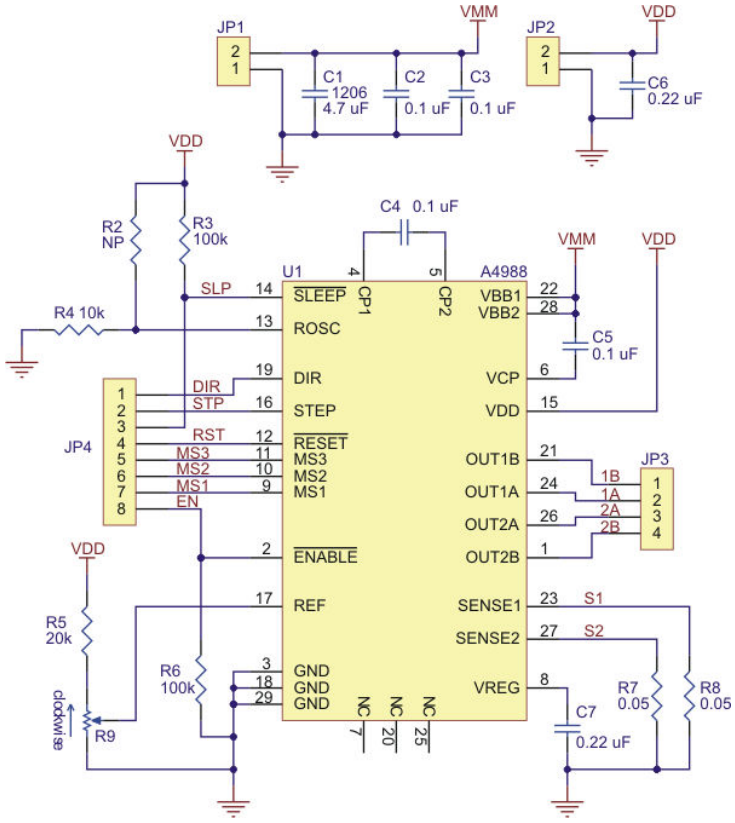


How Self balancing Works



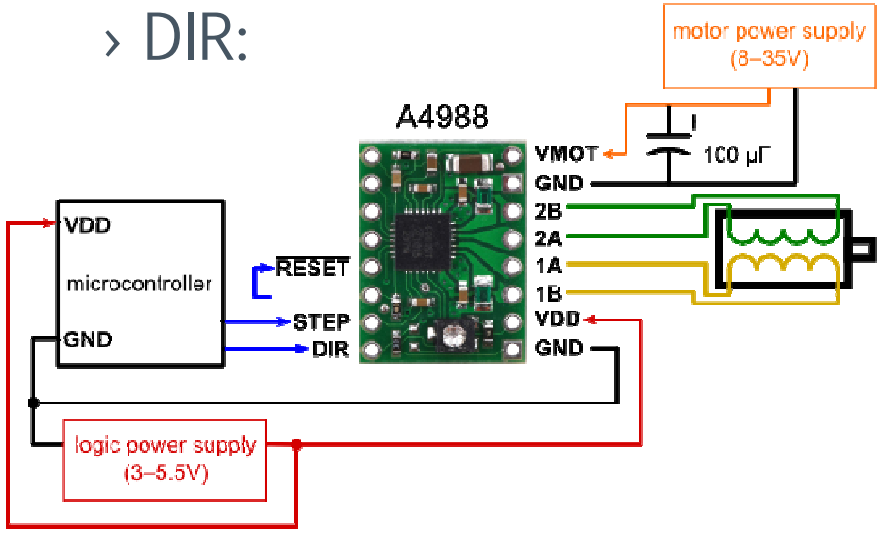
- Inverted Pendulum
  Acceleration = (gravity/length) * sin(Angle from equilibrium)
- PID Control (Proportional, Integral Derivative)
- Gyro = Angular Velocity (degrees/sec)
  - Integrating the Gyro = pivoting angle
  - Integration also adds error to angle
- Accelerometer = change in velocity (including gravity)
  - Calculate the Inclination
    - At rest measurement = 9.81 m/s^2
    - Falling downwards measurement = 0 m/s^2

Stepper Motor Detail Connections



Source: https://www.pololu.com/product/1182

- MS1-3: Steps resolution
- RESET: Disable Motor
- STEP:
- DIR:



What do we need from the Gyro?

What do we need from the Accelerometer

Ideas to add on

- Wheel hub with set screw, with brass going into hub
- Oversized perf board to hold controller and add mounting holes