Project 4: Motor Control

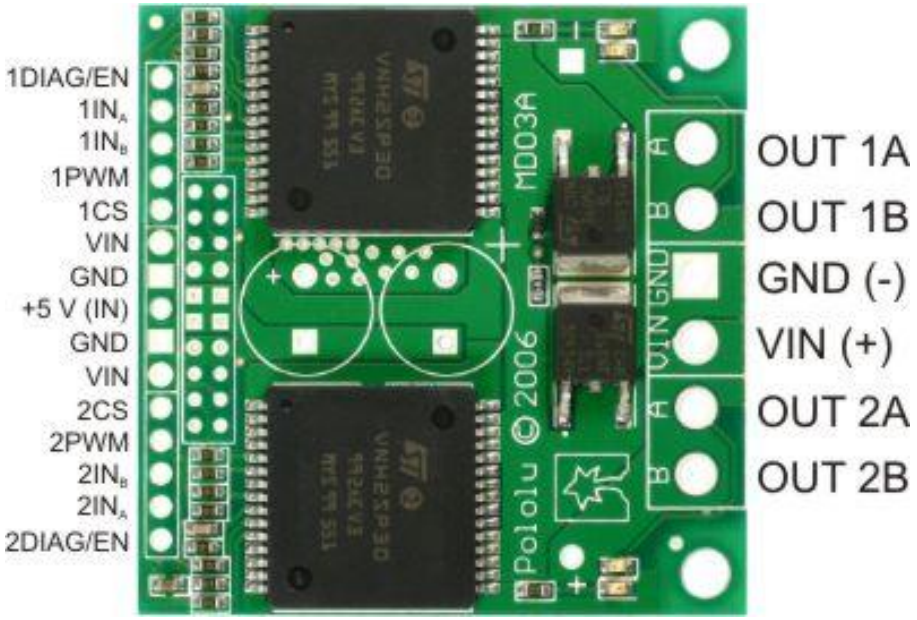
Project 4: Motor Driver Control

Eventually: four ducted fans for our hovercrafts:

- Three lateral fans:
  - Brushed motors
  - Bidirectional control
  - H-Bridges
- One lift fan:
  - Brushless motor
  - Unidirectional control
  - Electronic Speed Control (ESC) unit

Component 1: Circuit

- Right side:
  - H-bridge to battery power
  - H-bridge to fans
- Left side: H-bridge to Teensy
  - Teensy power (+5V) and ground
  - For each fan: PWM magnitude and 2 direction control signals
    - Lift fan: hard-wire direction to push air into the lower chamber



Be careful with direct battery power!

Component 2: Supporting Types/Implementation

Loop:

```
void loop()
{
        Static PeriodicAction fsm_task(50, fsm_step);

        // Check to see if it is time to execute the fsm_task
        fsm_task.step();
}
```

Component 3: Interface Functions

```
float bound(float value, float min_value,
            float max_value)
```

```
void set_motor(float val)
```

- The value is in the range -64 … 64
- The magnitude of the value determines the PWM duty cycle
- The sign of the value determines the state of INa/INb

Setting PWM Duty Cycle

analogWrite(pin, duty);

- pin = Arduino pin (not Analog pin!!!)
- duty in [0 … 255] (0% to 100%)
  - This is an int! Make sure that you convert your float to an int before calling this function

- Note: negative duty cycles do not make sense & will likely lead to strange behavior

Component 4: Finite State Machine

fsm_step() will implement the following behavior:

When switch is pressed:

- Lateral fans:
  - Ramp motor up to 25% duty cycle,
  - Ramp motor down to -25% duty cycle,
  - Ramp motor up to 0% duty cycle

Coding

- fsm_step():
  - Called once every 50ms
  - Do not include for, while or sleep. Instead, rely on the fact that the function will be called regularly
- Make sure that each function that you implement does exactly what the specification says & no more
- Stick to the documentation specification