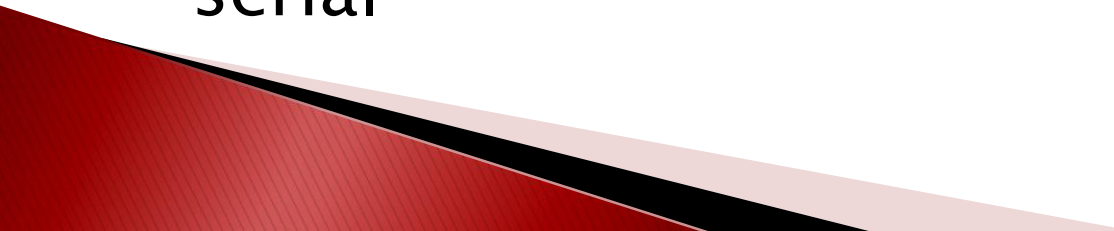


Robot Mobility

OU Robotics Club
September 25, 2014

Tonight's Goals

- ▶ Learn about different types of drive systems
 - ▶ Learn about motor control with PWM and H-bridges
 - ▶ Implement automated control of a 2-wheeled robot
 - ▶ Implement control of a 2-wheeled robot over serial
- 

Drive Systems

Drive Systems: Car Steering

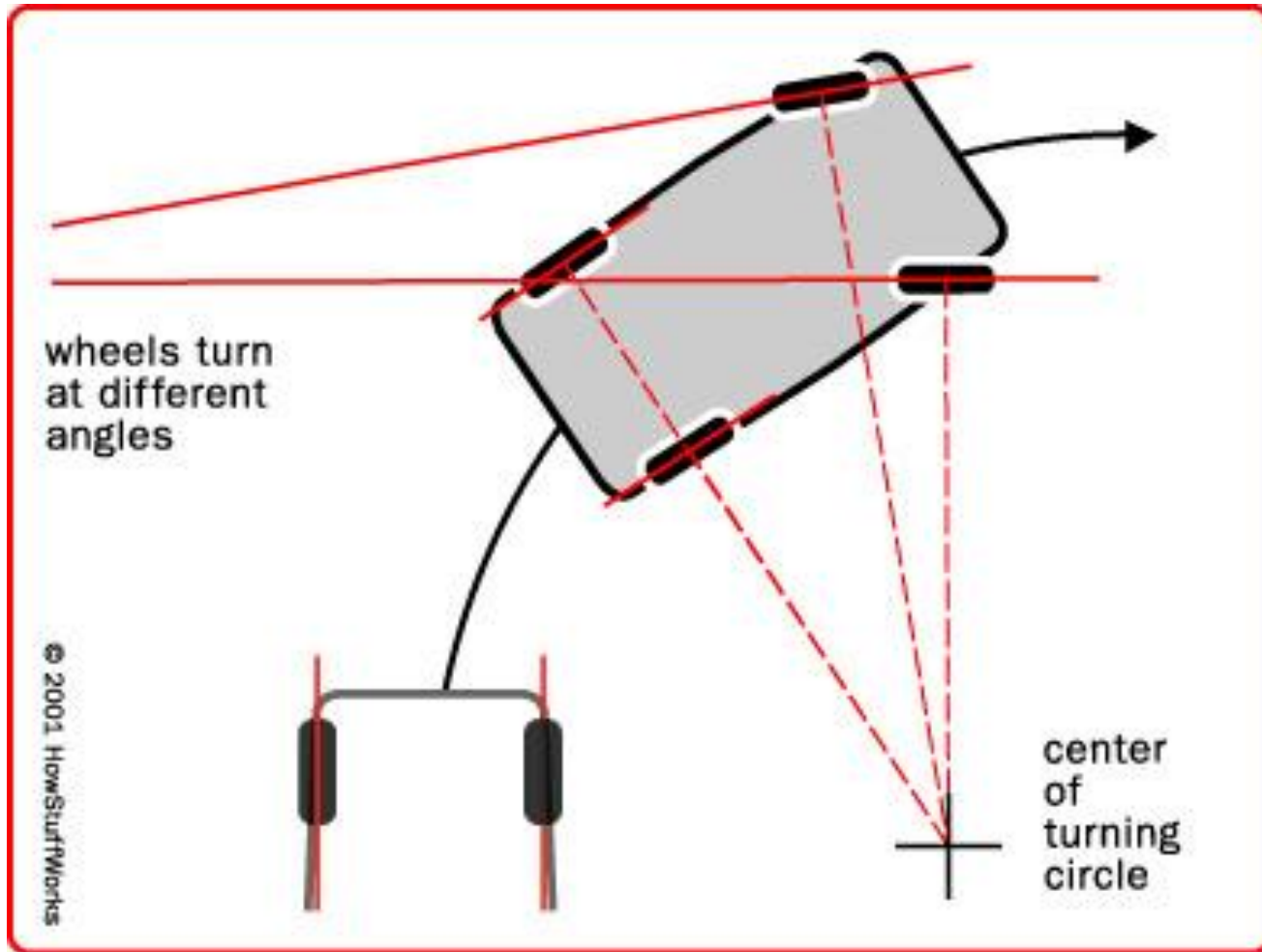


Image credit: HowStuffWorks.com

Car Steering Pros and Cons

Pros:

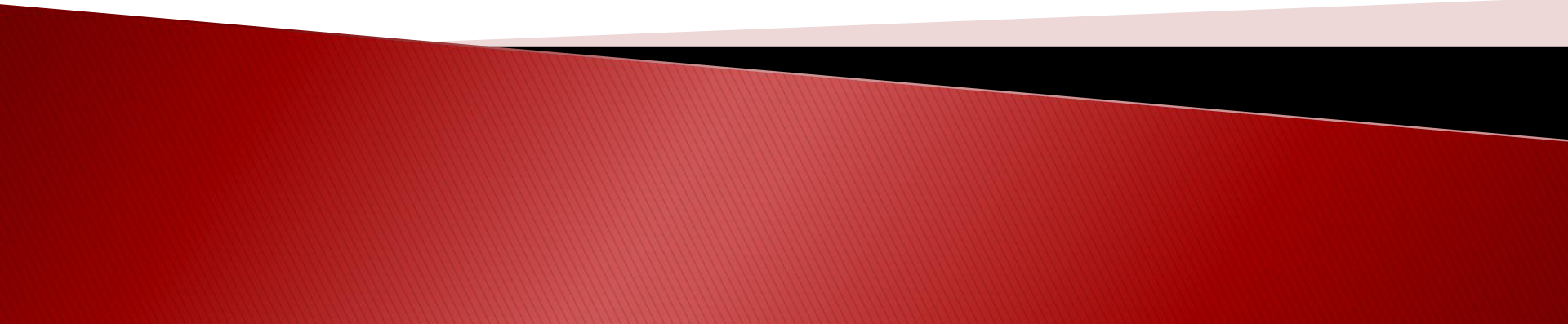
- ▶ Only needs one motor
- ▶ Good at going straight

Cons:

- ▶ Bad at turning
- ▶ Mechanically complicated

Today's Word of the Day:

Holonomic



Drive Systems: Omniwheels

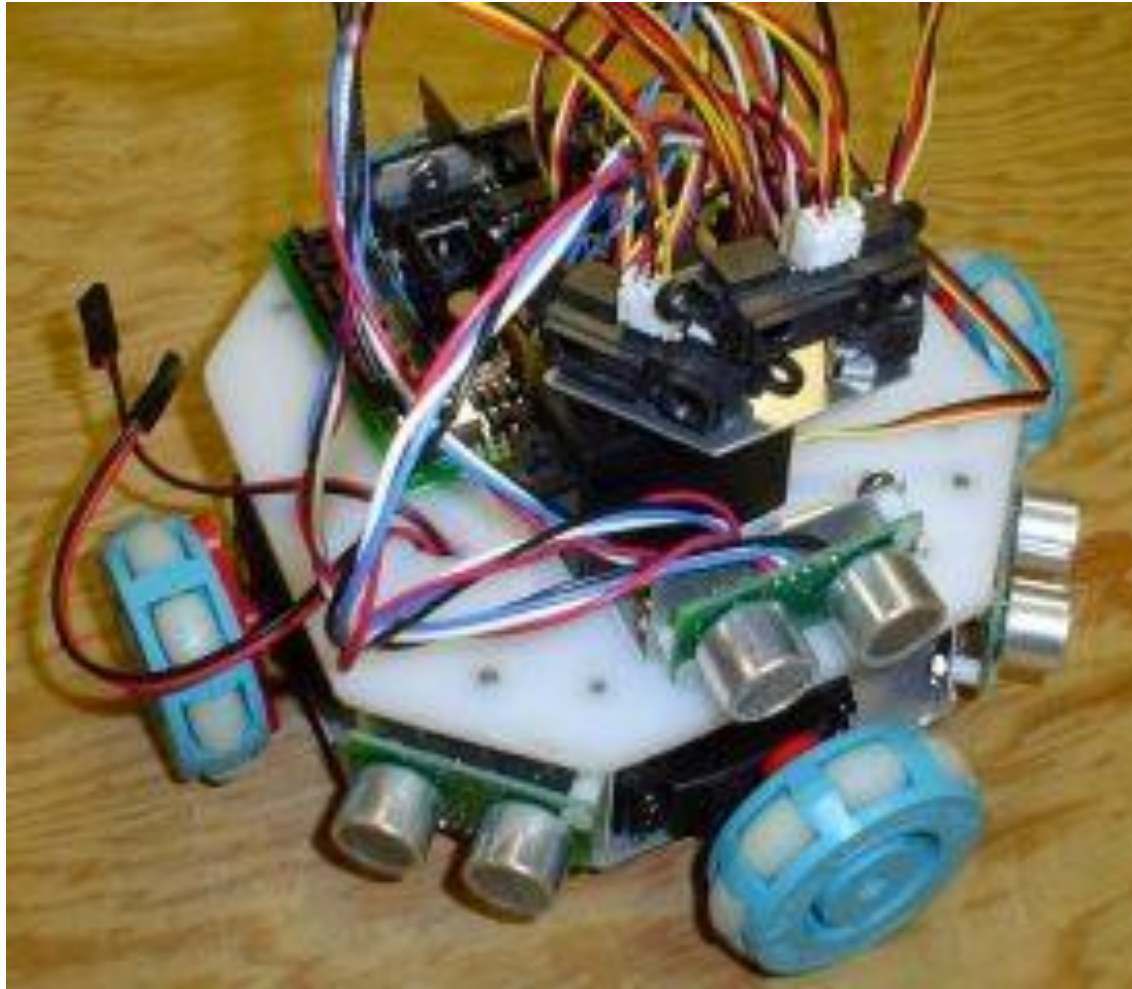


Image credit: SocietyOfRobots.com

Omni-wheel Pros and Cons

Pros:

- ▶ Can translate in any direction without turning
- ▶ Can turn without translating

Cons:

- ▶ Takes at least 3 motors
- ▶ Control slightly complicated
- ▶ Performs poorly on uneven surfaces

Drive Systems: Mecanum Wheels



Image credit: Wikipedia

Mecanum Wheels Pros and Cons

Pros:

- ▶ Can translate in any direction without turning
- ▶ Can turn without translating

Cons:

- ▶ Takes at least 4 motors
- ▶ Control quite complicated
- ▶ Performs poorly on uneven surfaces (but better than omni-wheels)

Drive Systems: 2-Wheel Differential

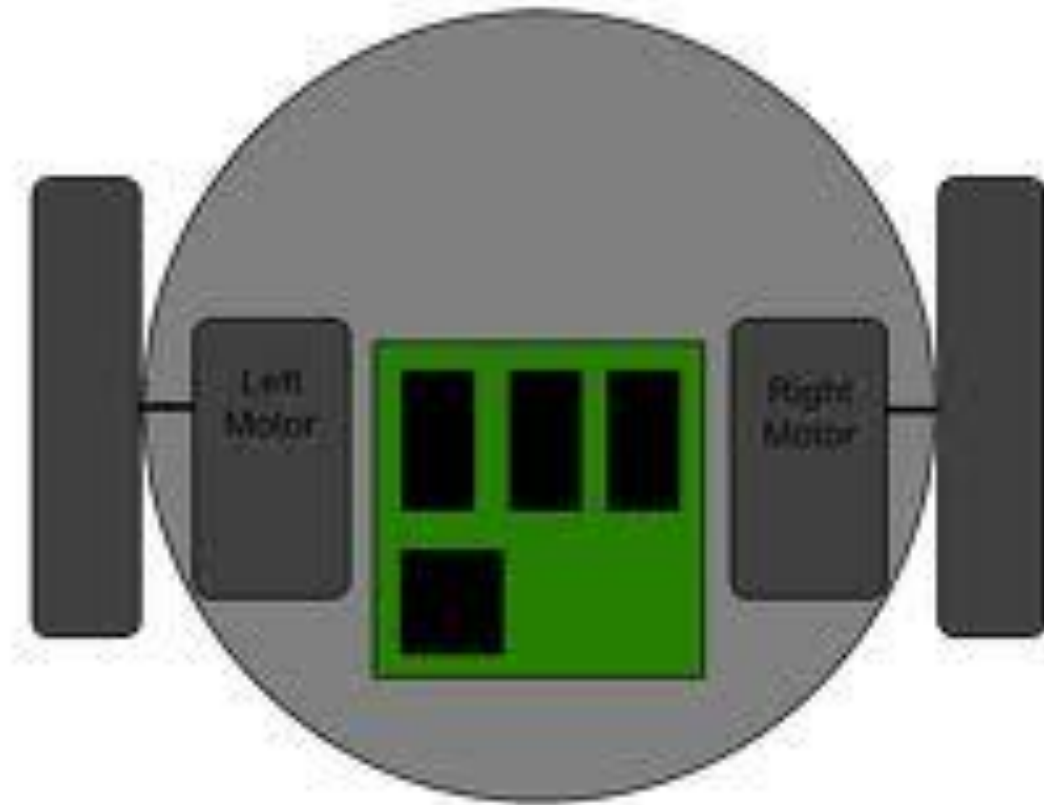


Image credit: Robotix.in

2-Wheel Differential Pros and Cons

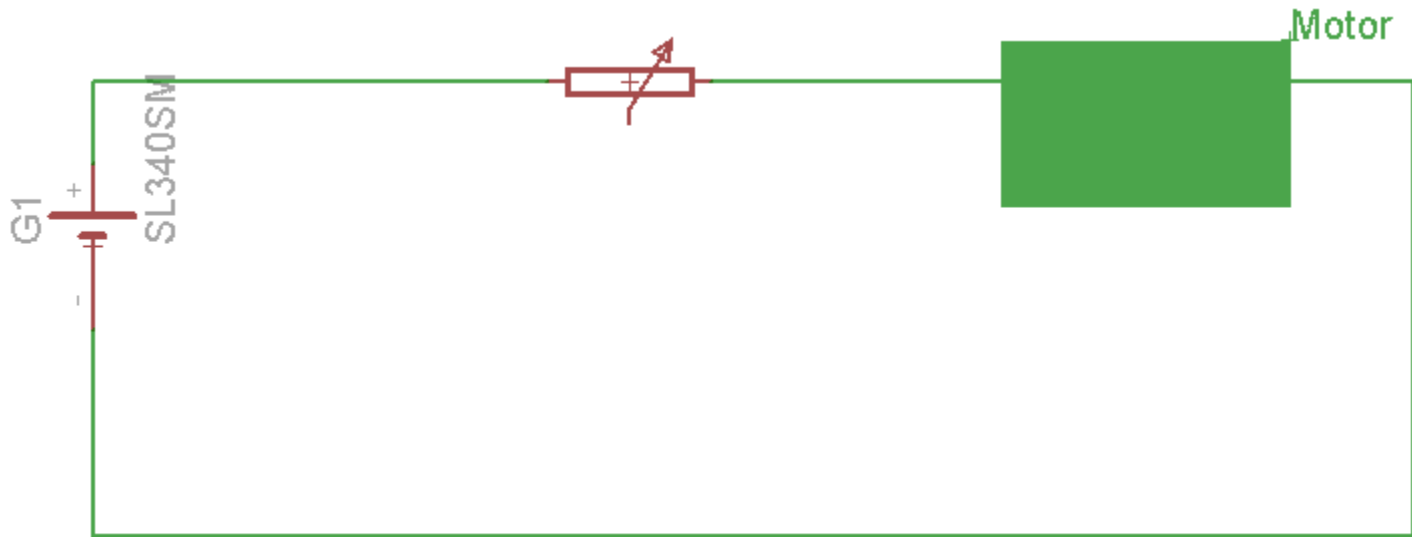
Pros:

Cons:

- ▶ Can execute zero-point turn
- ▶ Control is very simple
- ▶ Mechanically very simple

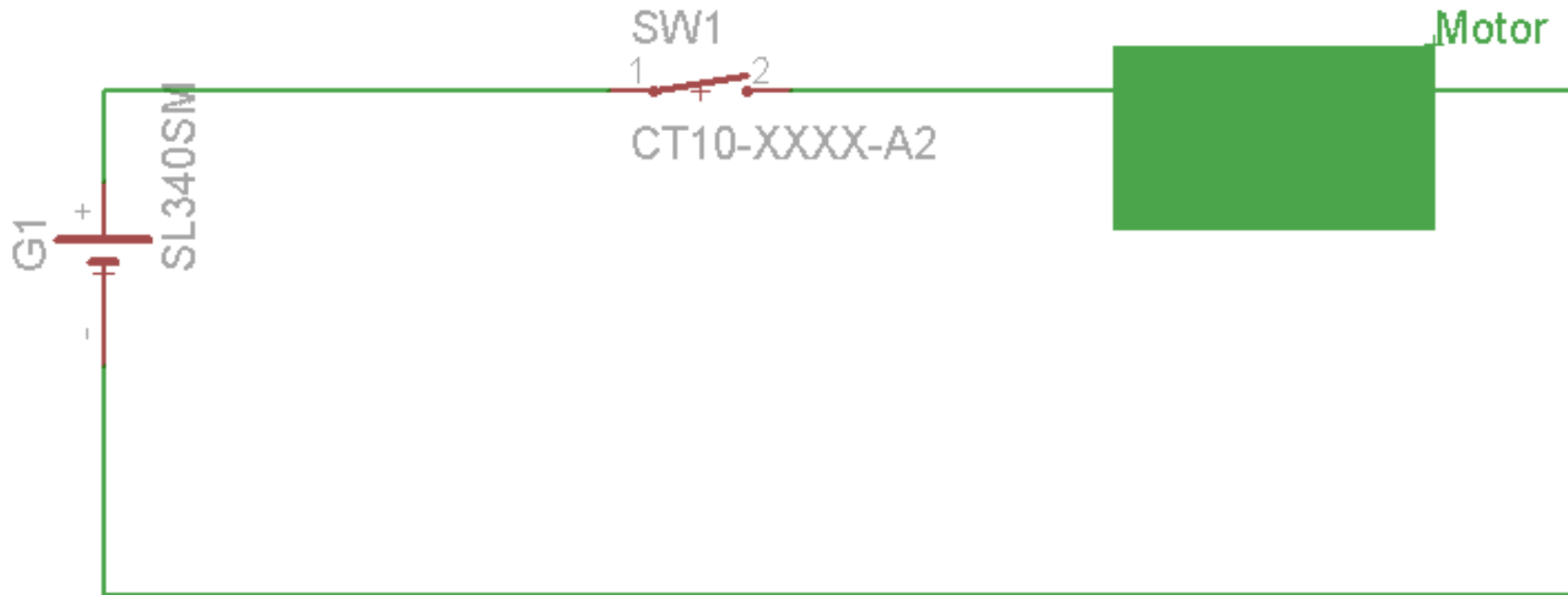
Motor Speed Control

A basic approach



What's wrong with this?

A better approach



A great approach

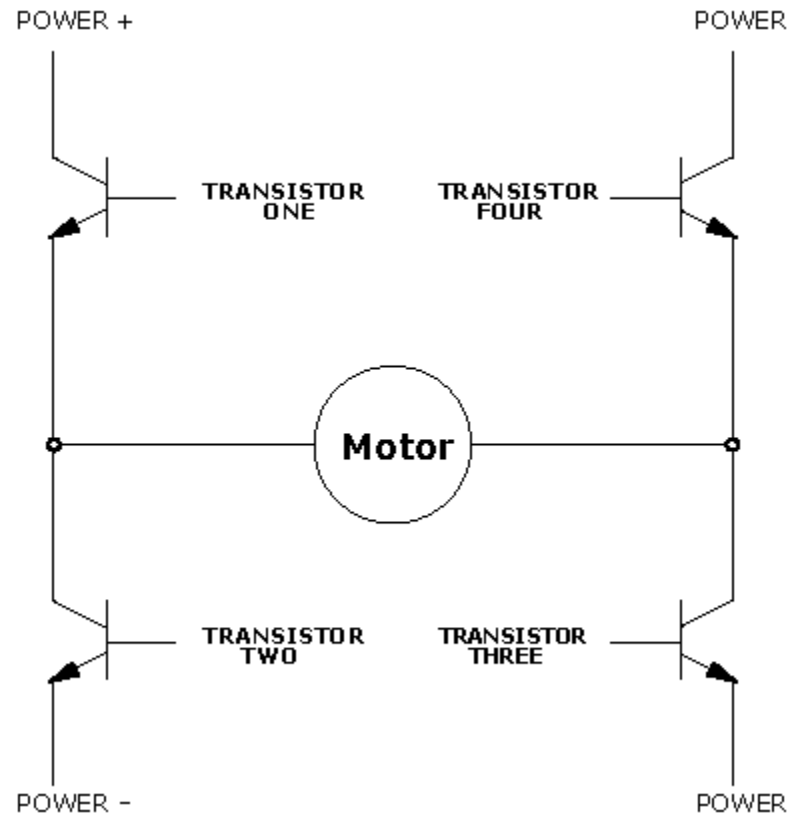


Image Credit: clear.rice.edu

A great approach

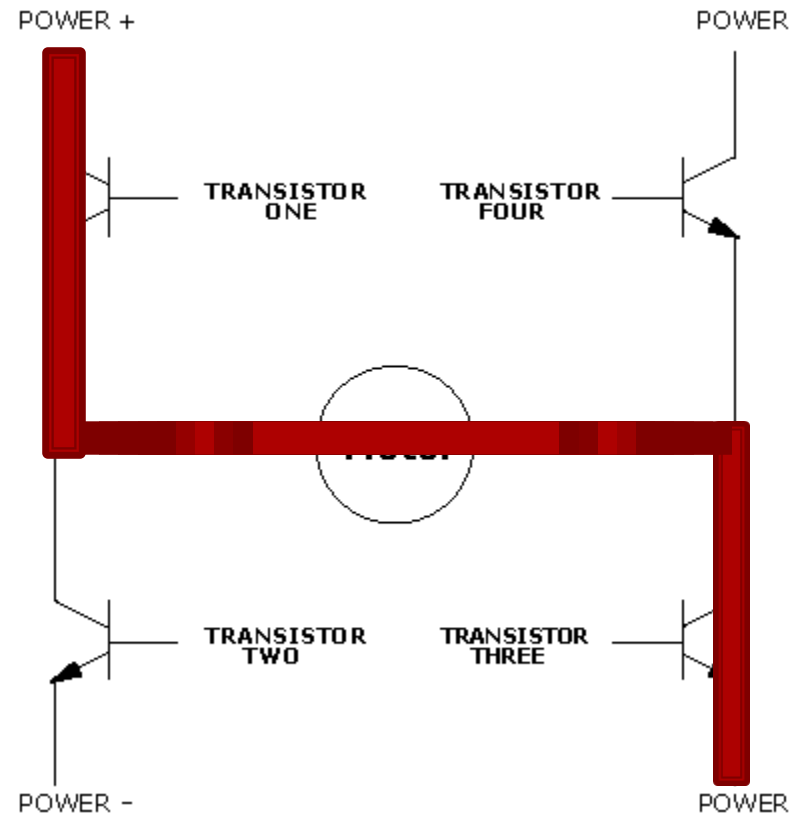


Image Credit: clear.rice.edu

A great approach

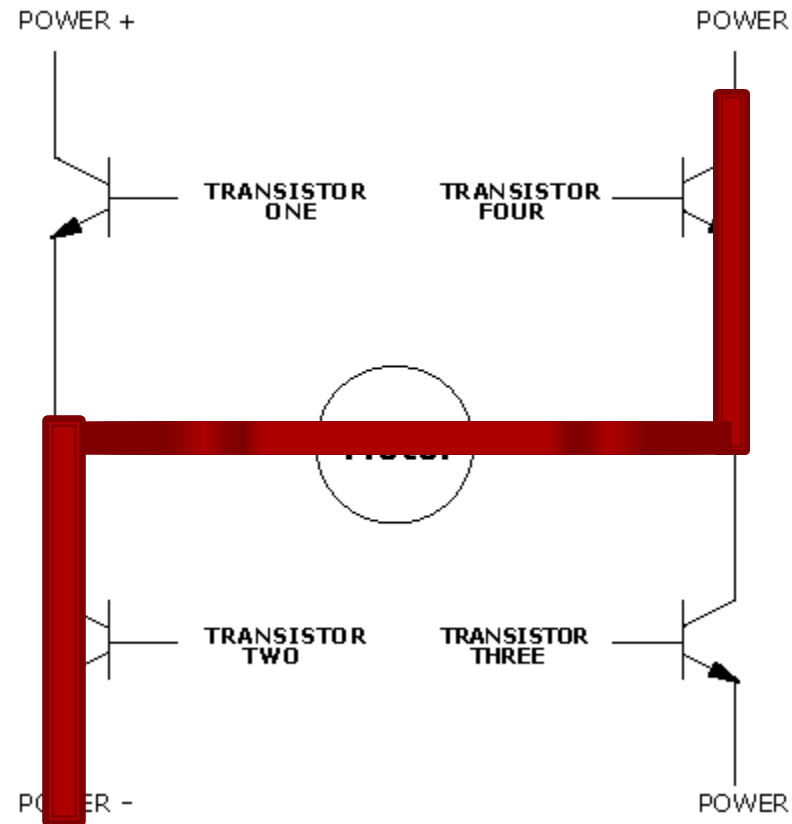


Image Credit: clear.rice.edu

PWM: Pulse Width Modulation

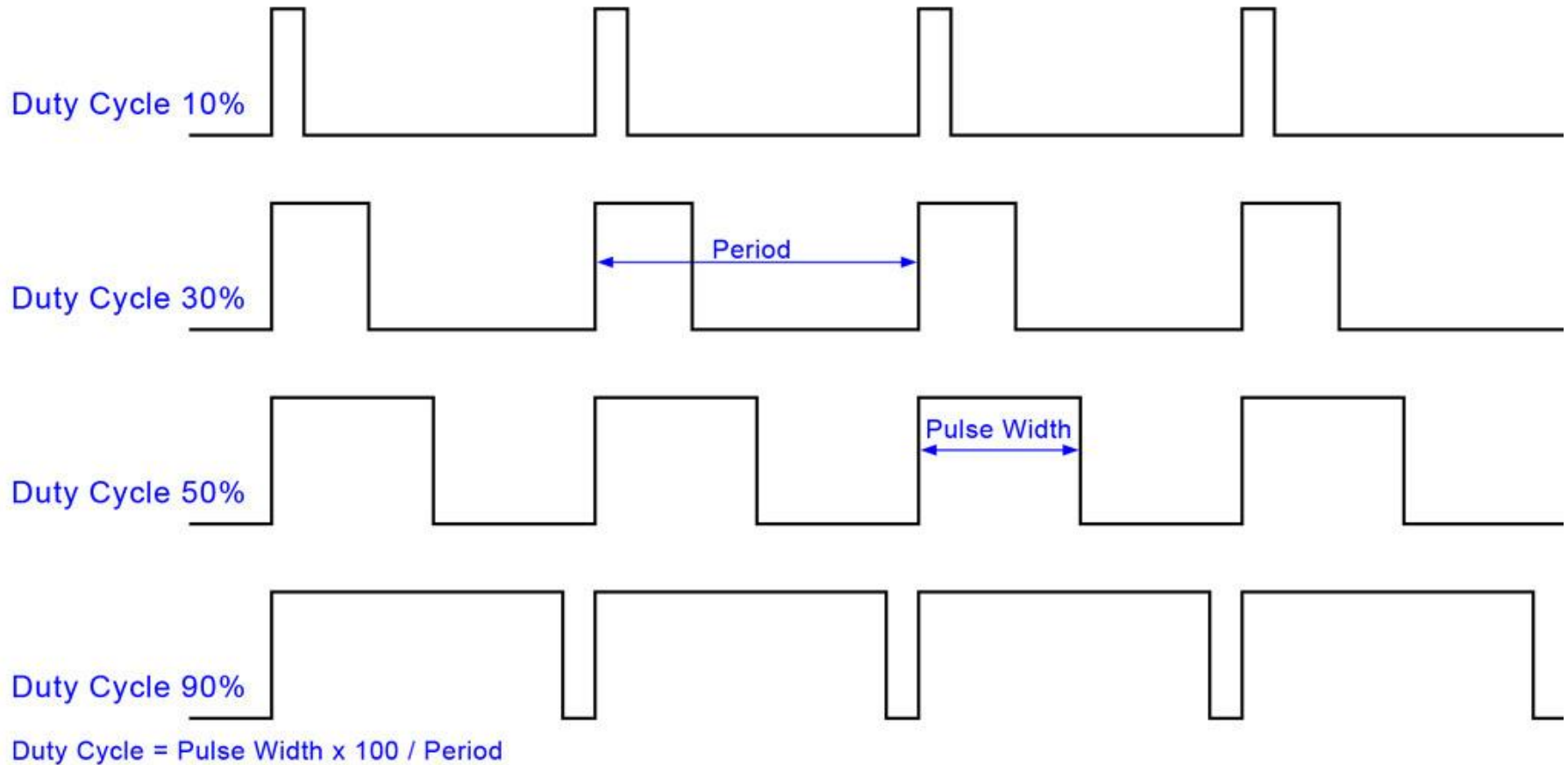


Image credit: protostack.com

Making Today's Robot

Wiring the H-Bridge

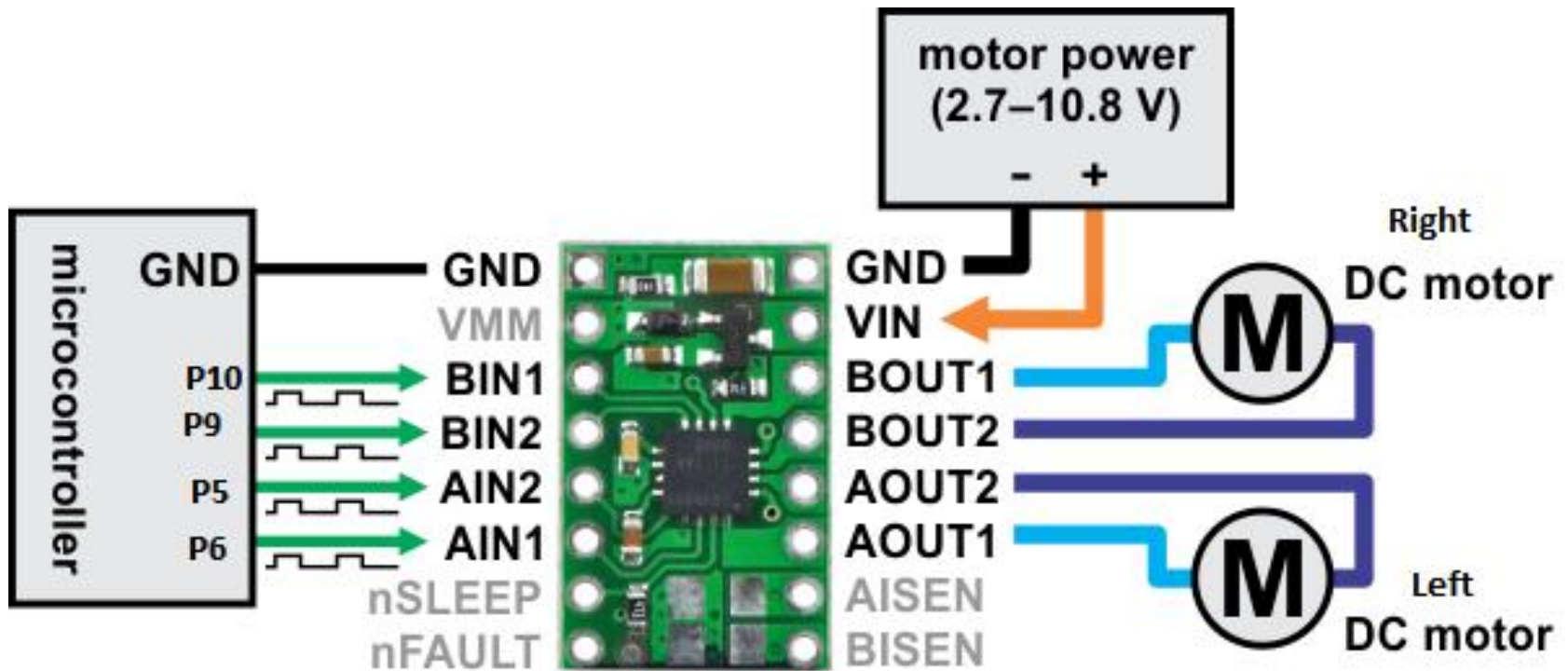
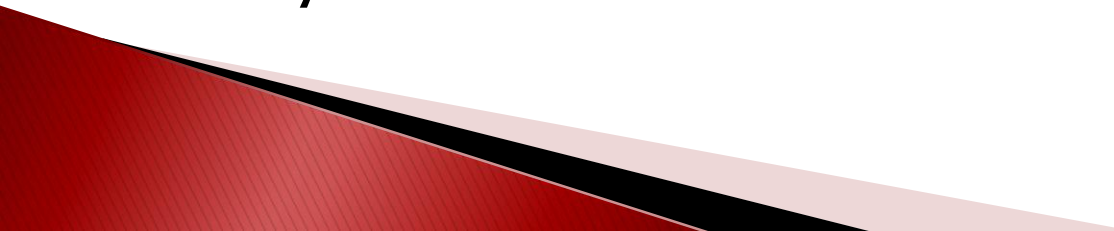


Image credit: Pololu.com, then modified

The Code

- ▶ Get the `setupMotors` and `setMotors` functions from <http://pastebin.com/NE3P9NGV> and include those methods in your file.
 - ▶ Write your own “setup” and “loop” functions
 - ▶ Be sure to call the `setupMotors()` function once during the setup function. Call `setMotors(leftSpeed, rightSpeed)` as often as you like.
- 

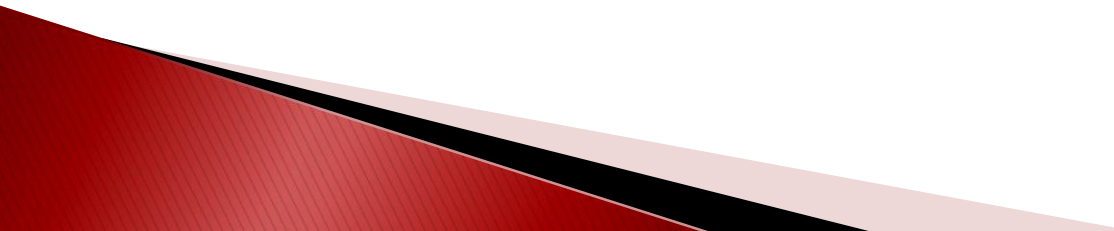
The Task

- ▶ Program the robot to drive in a pattern (e.g. a square) by issuing movement and delay commands

My solution

```
void setup() {  
    setupMotors();  
}
```

```
void loop() {  
    setMotors(255, 255);  
    delay(2000); //times may vary  
    setMotors(255, -255);  
    delay(1500); //times may vary  
}
```



The Challenge

- ▶ Program the robot to take serial data so that you can remote control it with the keyboard.
- ▶ Include Forward, backward, left, right, speed up, and slow down.

```
void setup() {  
    setupMotors();  
    Serial.begin(9600);  
}
```

```
void loop() {  
    while(!Serial.available());  
    char c = Serial.read();  
    switch(c) {  
        //handle the characters  
    }  
}
```

My solution

- ▶ See my solution at <http://pastebin.com/ZTkRPTDu>