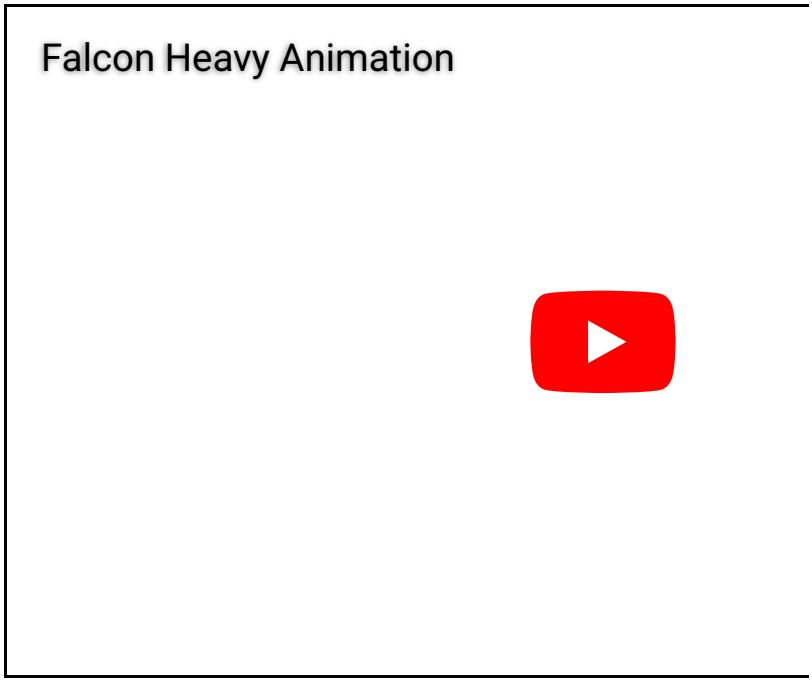
In [6]:
```
from IPython.display import HTML
```

In [7]:
```
HTML("""
<iframe width="560" height="315" src
="https://www.youtube.com/embed/Tk33
8VXcb24" frameborder="0" allow="auto
play; encrypted-media" allowfullscre
en></iframe>
""")
```

Out[7]:



Topics

- H-bridge
- Servo Motor
- Bluetooth
- UltraSound
- Homework

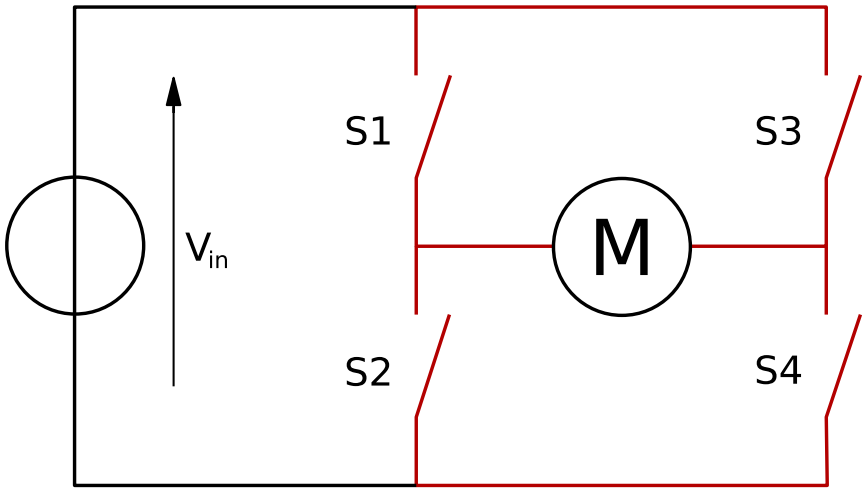
H-Bridge L298N

Datasheet found here (https://www.sparkfun.com/datasheets/Robotics/L298_H_Bri

Workings

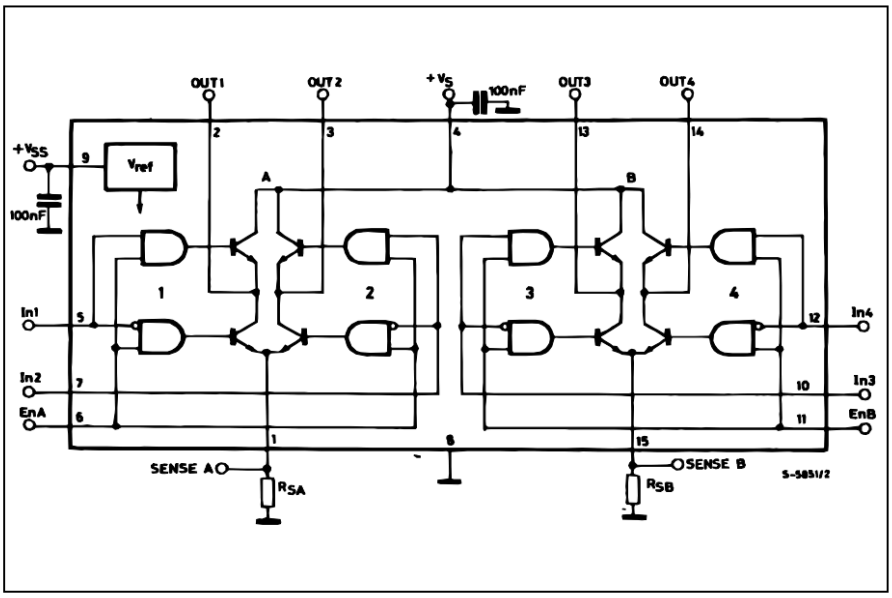
H bridges are available as integrated circuits, or can be built from discrete components.[1]

The term H bridge is derived from the typical graphical representation of such a circuit. An H bridge is built with four switches (solid-state or mechanical). When the switches S1 and S4 (according to the first figure) are closed (and S2 and S3 are open) a positive voltage will be applied across the motor. By opening S1 and S4 switches and closing S2 and S3 switches, this voltage is reversed, allowing reverse operation of the motor.



Internals

BLOCK DIAGRAM



Servo Motor - SG90

SERVO MOTOR SG-90

Servo Motor

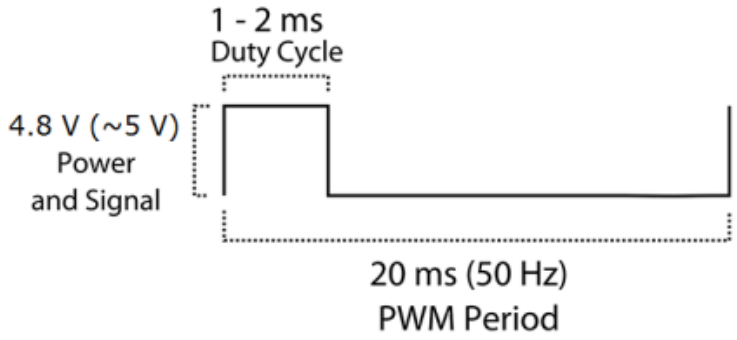
Servo Motor Pinout (Wires)

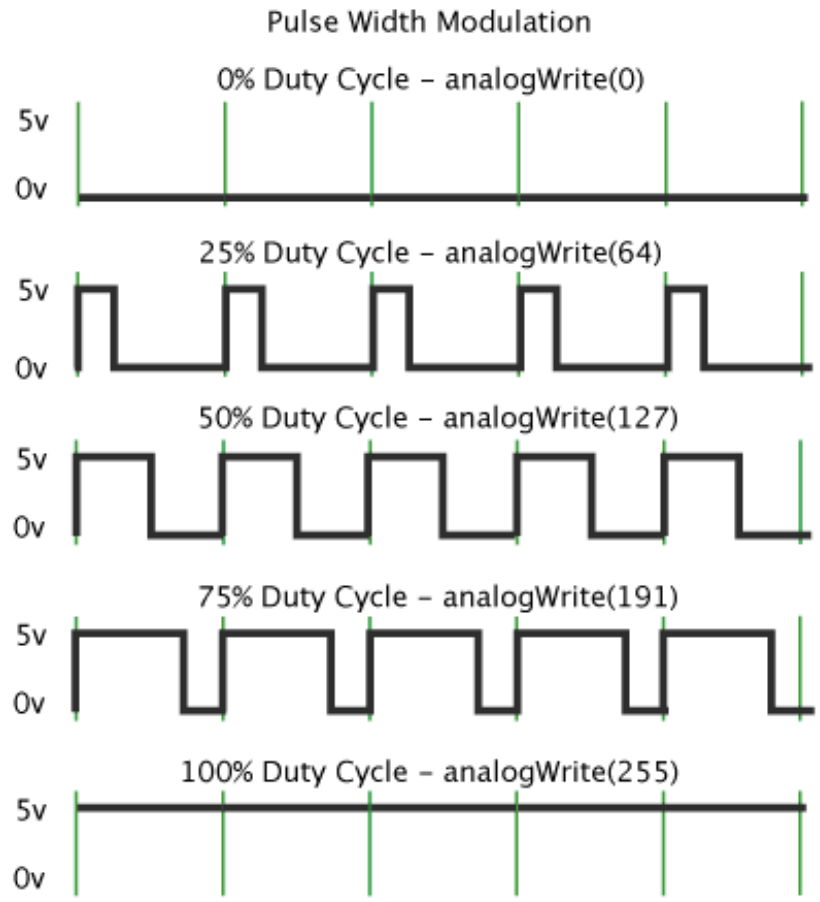
Wire Configuration

Wire Number	Wire Colour	Description
1	Brown	Ground wire connected to the ground of system
2	Red	Powers the motor typically +5V is used
3	Orange	PWM signal is given in through this wire to drive the motor

What is PWM

Pulse Width Modulation, or PWM, is a technique for getting analog results with digital means. Digital control is used to create a square wave, a signal switched between on and off. This on-off pattern can simulate voltages in between full on (5 Volts) and off (0 Volts) by changing the portion of the time the signal spends on versus the time that the signal spends off. The duration of "on time" is called the pulse width. To get varying analog values, you change, or modulate, that pulse width. If you repeat this on-off pattern fast enough with an LED for example, the result is as if the signal is a steady voltage between 0 and 5v controlling the brightness of the LED.





Can't do PWM on all pins, on our UNO

analogWrite(pin,value);

analogWrite() is used to write analog value of 0 to 255 for PWM ports. What you need to note is that, analogWrite() is only used to digital pins with function of PWM. Pins with function of PWM in UNO are only digital pins of 3，5，6，9，10，11.

Features

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Gear Type: Plastic
- Rotation : 0°-180°
- Weight of motor : 9gm

Usage

It would be something to note here. The servo motor has three leads, with one more than a DC motor. Each lead has a color code. So you have to connect the brown wire from the micro servo to the GND pin on the Arduino. Connect the red wire from the servo to the +5V on the Arduino. And finally, connect the orange wire from the SG90 servo to a digital pin (pin 9) on the Arduino.

Code to address the servo

```
#include servo.h  //add '<' and '>' be
fore and after servo.h
int servoPin = 9;

Servo servo;
int servoAngle = 0;   // servo positio
n in degrees

void setup()
{
  Serial.begin(9600);
  servo.attach(servoPin);
}
void loop()
{
//control the servo's direction and th
e position of the motor
   servo.write(45);      // Turn SG90
servo Left to 45 degrees
   delay(1000);          // Wait 1 sec
ond
   servo.write(90);      // Turn SG90
servo back to 90 degrees (center posit
ion)
   delay(1000);          // Wait 1 sec
ond
   servo.write(135);     // Turn SG90
```

```
servo Right to 135 degrees
   delay(1000);          // Wait 1 sec
ond
   servo.write(90);      // Turn SG90
servo back to 90 degrees (center posit
ion)
   delay(1000);
//end control the servo's direction an
d the position of the motor

//control the servo's speed
//if you change the delay value (from
example change 50 to 10), the speed of
the servo changes
  for(servoAngle = 0; servoAngle < 180
; servoAngle++)  //move the micro serv
o from 0 degrees to 180 degrees
  {
    servo.write(servoAngle);
    delay(50);
  }

  for(servoAngle = 180; servoAngle > 0
; servoAngle--)  //now move back the m
icro servo from 0 degrees to 180 degre
es
  {
    servo.write(servoAngle);
    delay(10);
  }
  //end control the servo's speed
}
```

Bluetooth

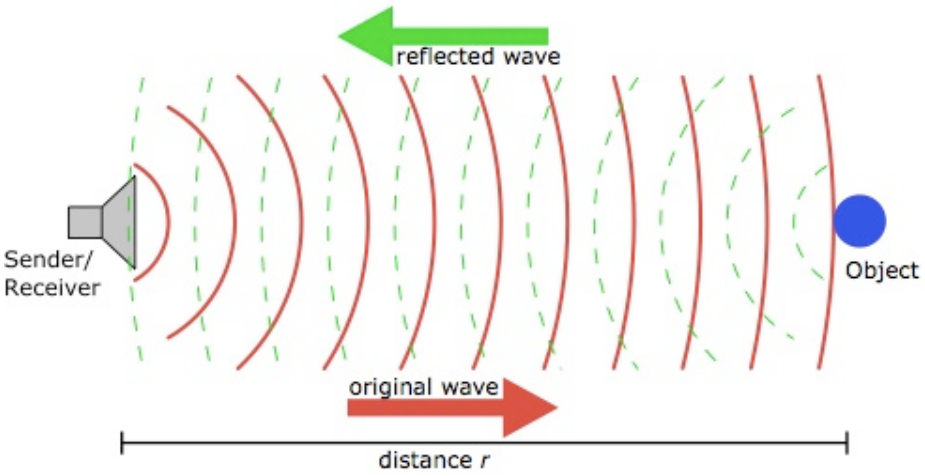
Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz)

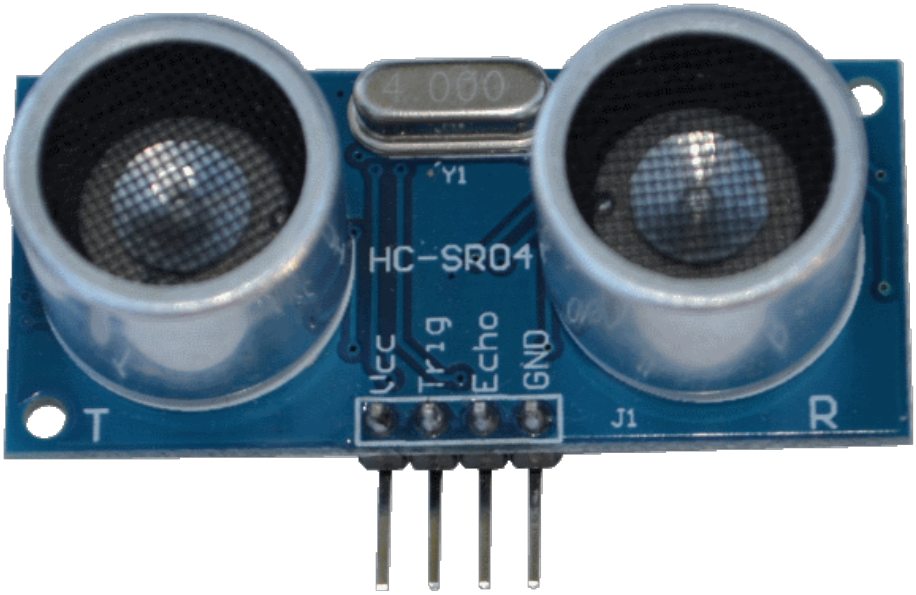
A master BR/EDR Bluetooth device can communicate with a maximum of **seven** devices in a **piconet** (an ad-hoc computer network using Bluetooth technology), though not all devices reach this maximum. The devices can **switch roles**, by agreement, and the **slave** can become the **master** (for example, a headset initiating a connection to a phone necessarily begins as master—as initiator of the connection—but may subsequently operate as slave).

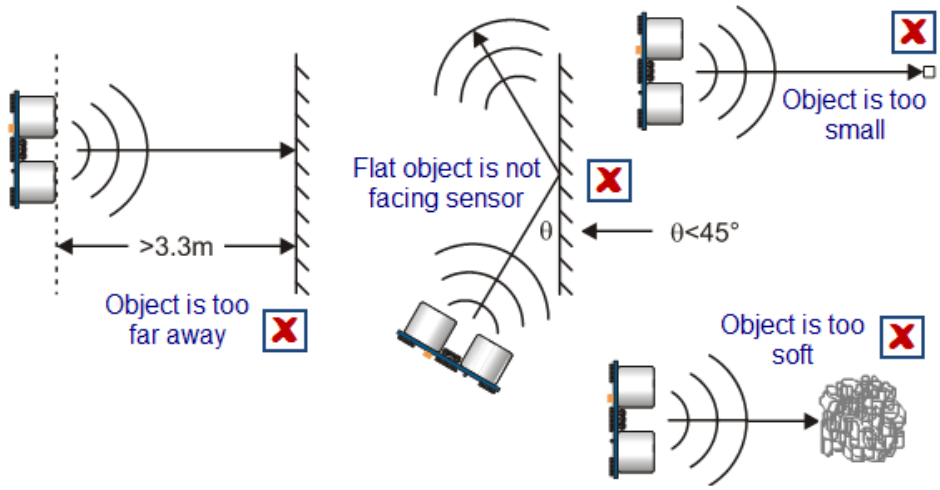
The Bluetooth Core Specification provides for the connection of two or more piconets to form a **scatternet**, in which certain devices simultaneously play the master role in one piconet and the slave role in another.

Bluetooth version	Maximum speed	Maximum range
3.0	25 Mbit/s	10 meters (33 ft)
4.0	25 Mbit/s	60 meters (200 ft)
5	50 Mbit/s	240 meters (800 ft)

Ultrasound


reflected wave
Sender/
Receiver
Object
original wave
distance r


Y1
HC-SR04
Vcc
Trig
Echo
GND
J1
T
R



Distance = Speed * Time/2

Speed of sound at sea level = 343 m/s = $\frac{m}{s}$

Symbol	Name	Function
	Start/end	An oval represents a start or end point
	Arrows	A line is a connector that shows relationships between the representative shapes
	Input/Output	A parallelogram represents input or output
	Process	A rectangle represents a process
	Decision	A diamond indicates a decision

Homework

- Draw a flow diagram of the logic needed to avoid obstacles
- if we measure a pulse coming back after 0.01 seconds, how far is the object?
- if an object is 1 kilometer away, how long will you have to wait for the pulse to come back?