Sensors Tutorial

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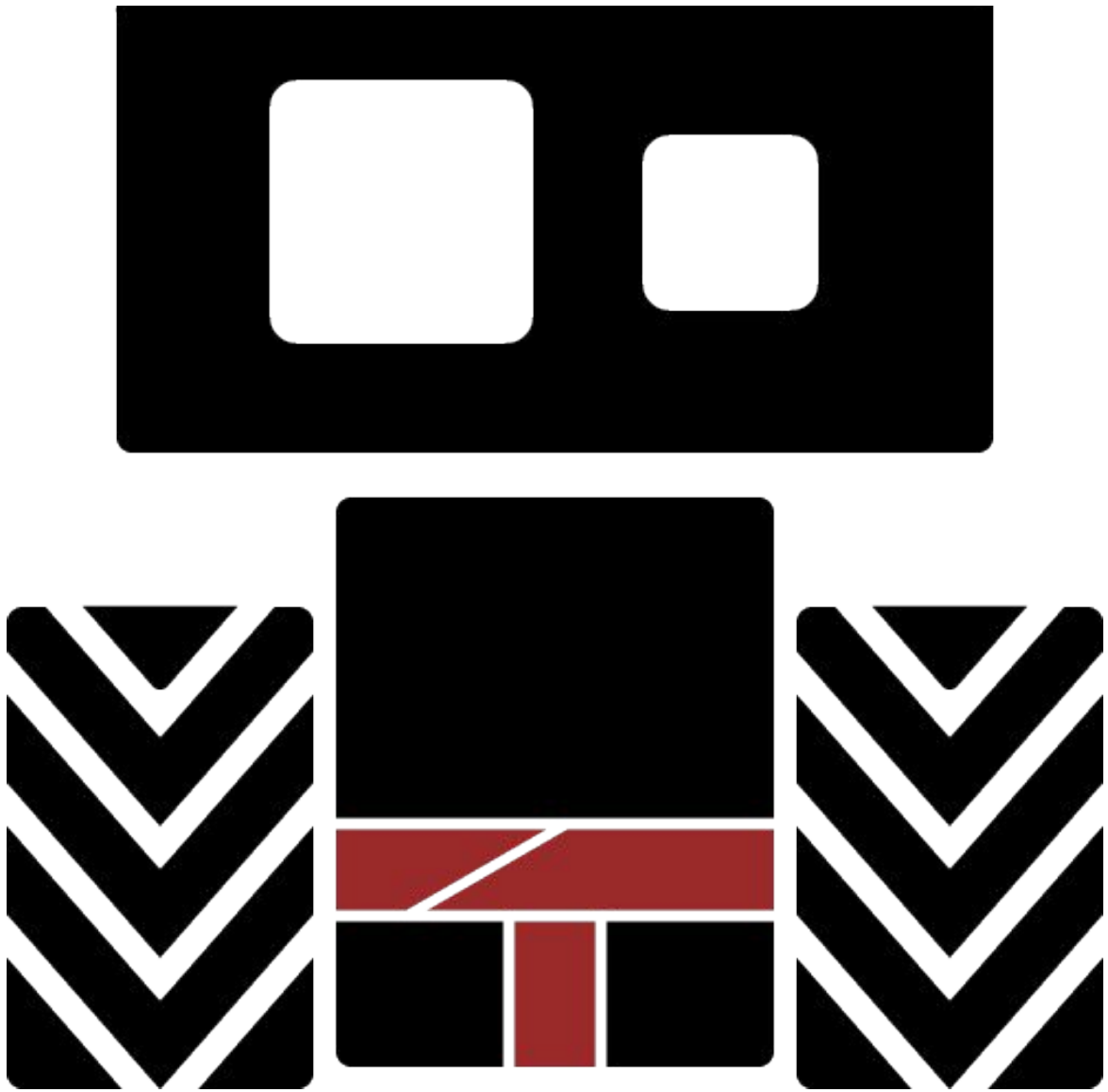
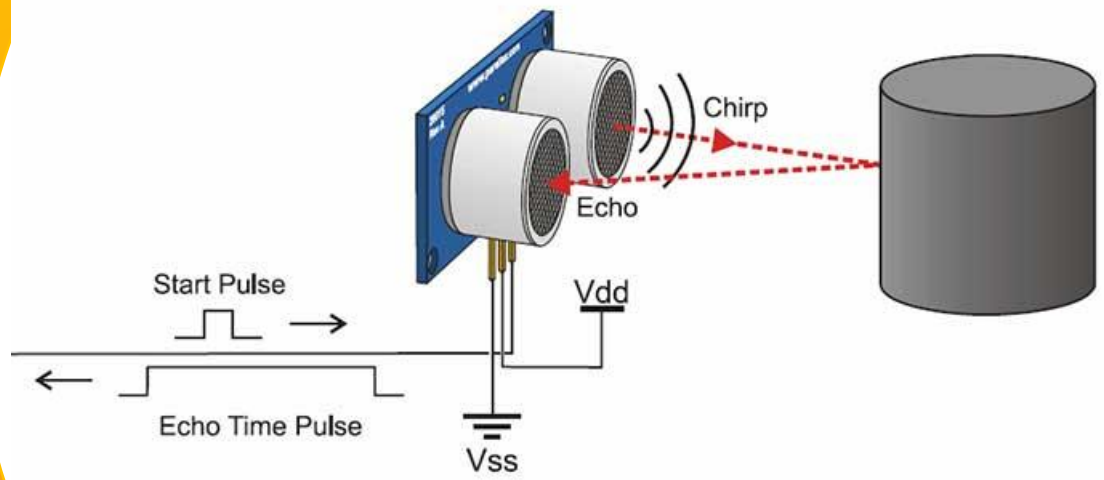


Parts Included

- Arduino Nano or Arduino Uno
- Ultrasonic Sensor
- N20 Motor + Wheels
- Line Follower (QRD 1114)
- Motor Driver
- Resistors
- Breadboard
- Jumper Wires

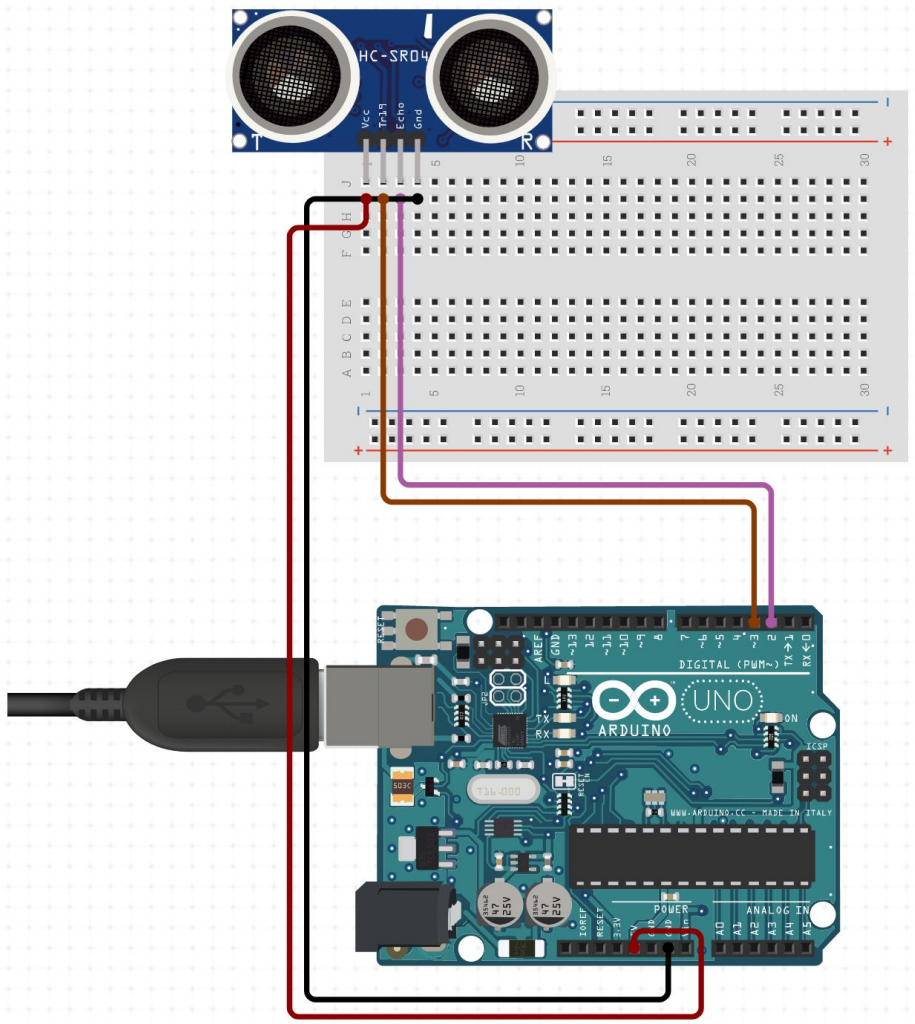
Ultrasonic Sensor

- Ultrasonic sensor uses a “time-of-flight” method to determine the distance
- Emits sound wave at a high frequency, the sound wave is then bounced back by the object, then the receiver side of ultrasonic sensor calculates the distance
- Distance = speed of sound * time of duration /2



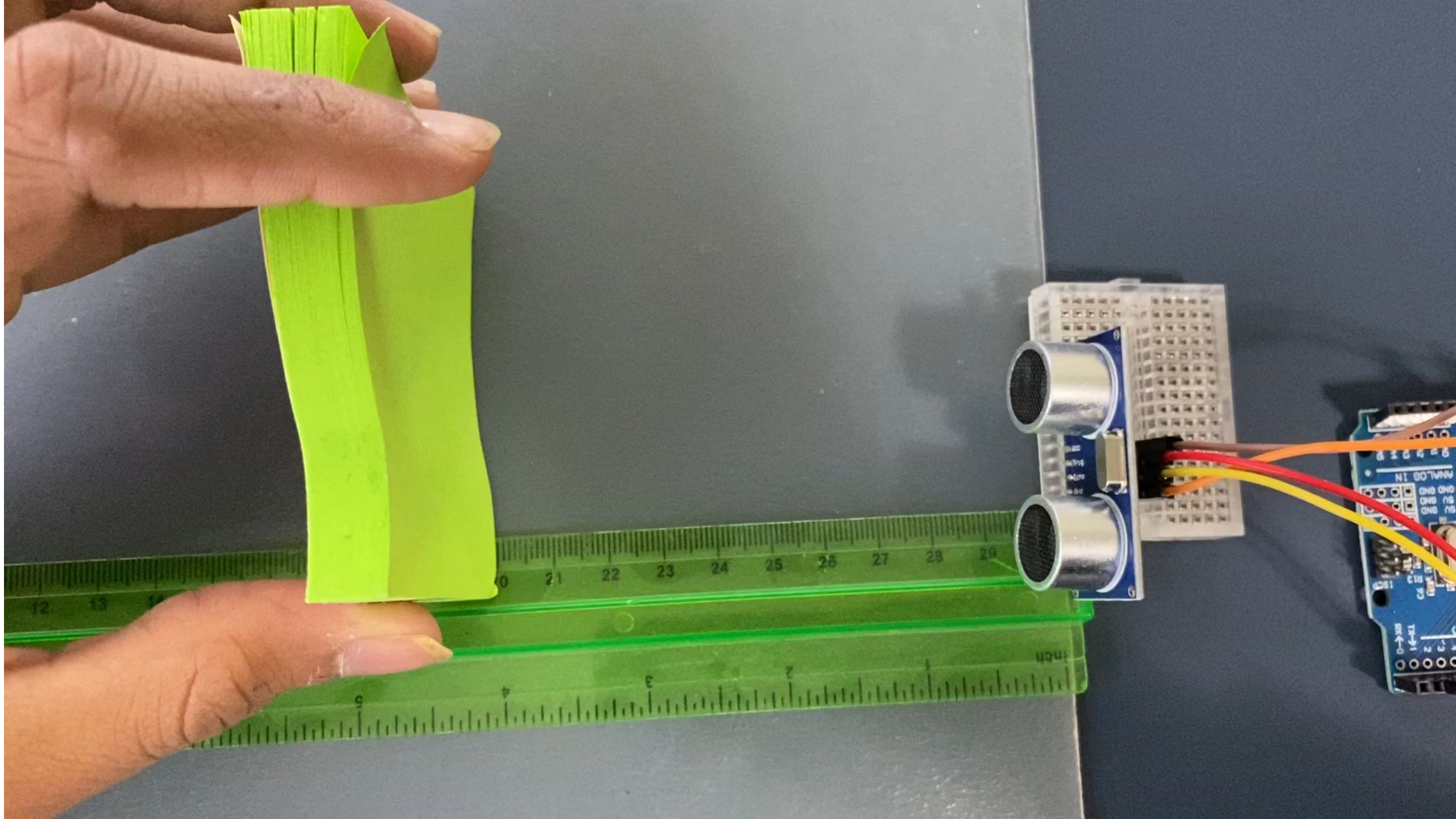
Circuit – Arduino + Ultrasonic

- Trig pin -> D3;
- Echo pin -> D2;
- Vcc -> 5V;
- Gnd -> Gnd;



Code for Ultrasonic Sensor

Code

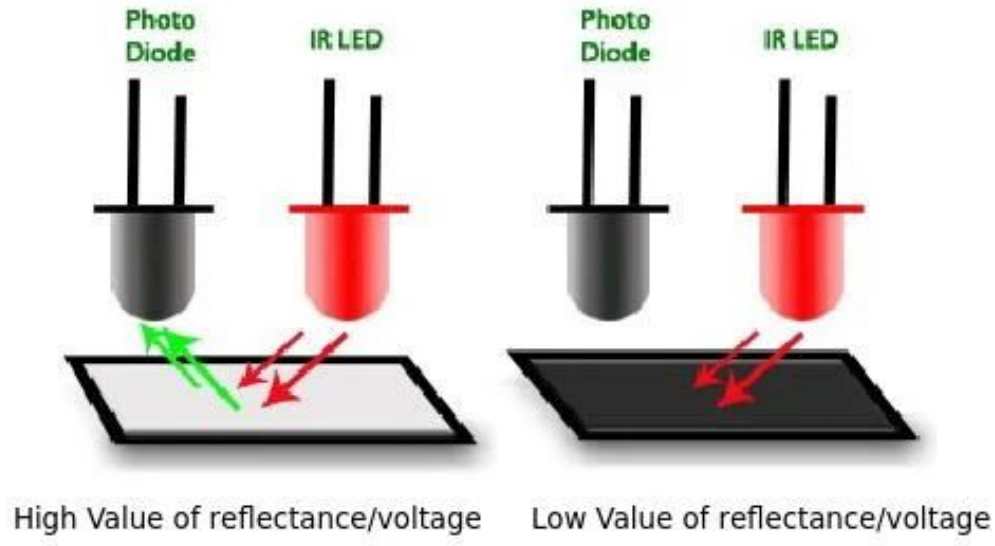


Resources

- Arduino - Ultrasonic Sensor
- Ultrasonic Sensor HC-SR04 and Arduino Tutorial
- Ultrasonic Ranging Module HC - SR04

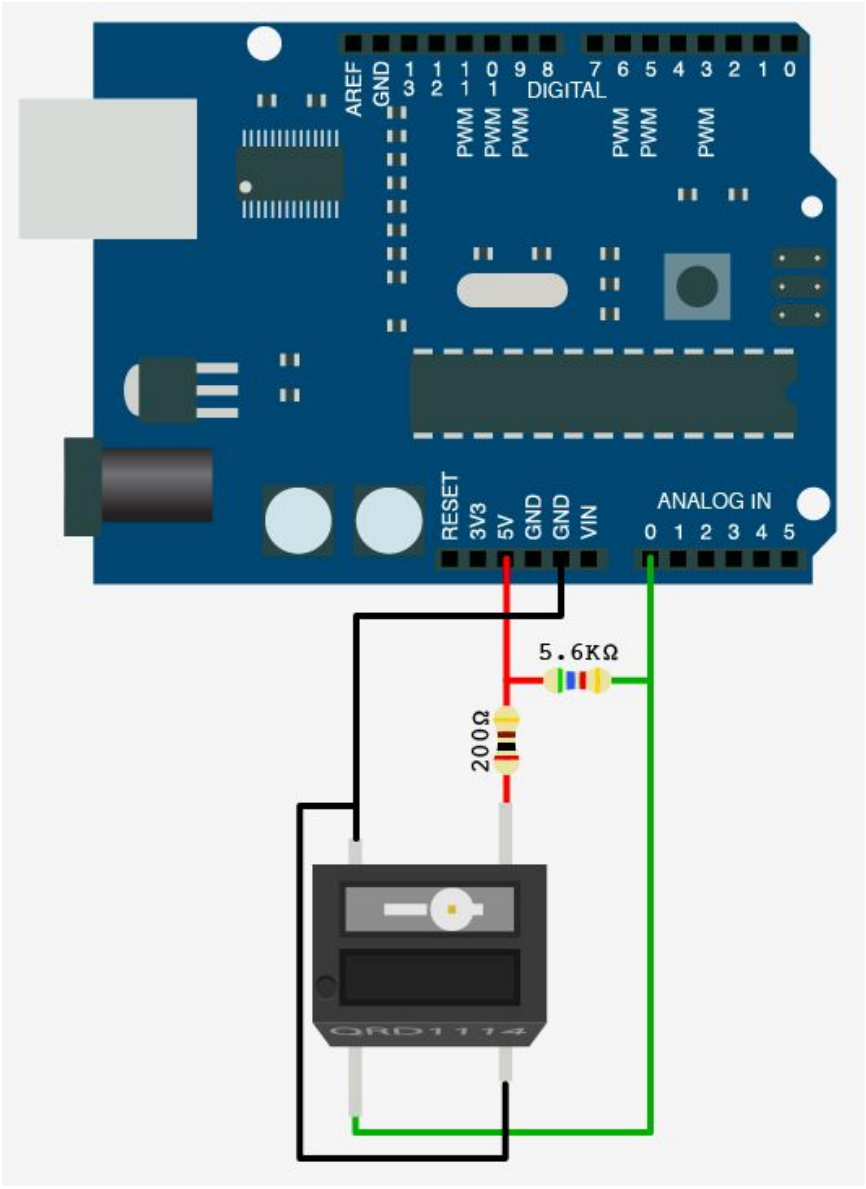
Line Follower – QRD 1114

- Sensor type: QRD1114
- a half-LED, half-phototransistor, all infrared reflective optical detector
- It can be used to sense objects in close proximity or even detect the difference between black and white surfaces.
- Optimal for projects like line-following robots, close-proximity detection in smart phones.
- The sensor outputs an analog signal -- read by Arduino’s analog-to-digital converter pin



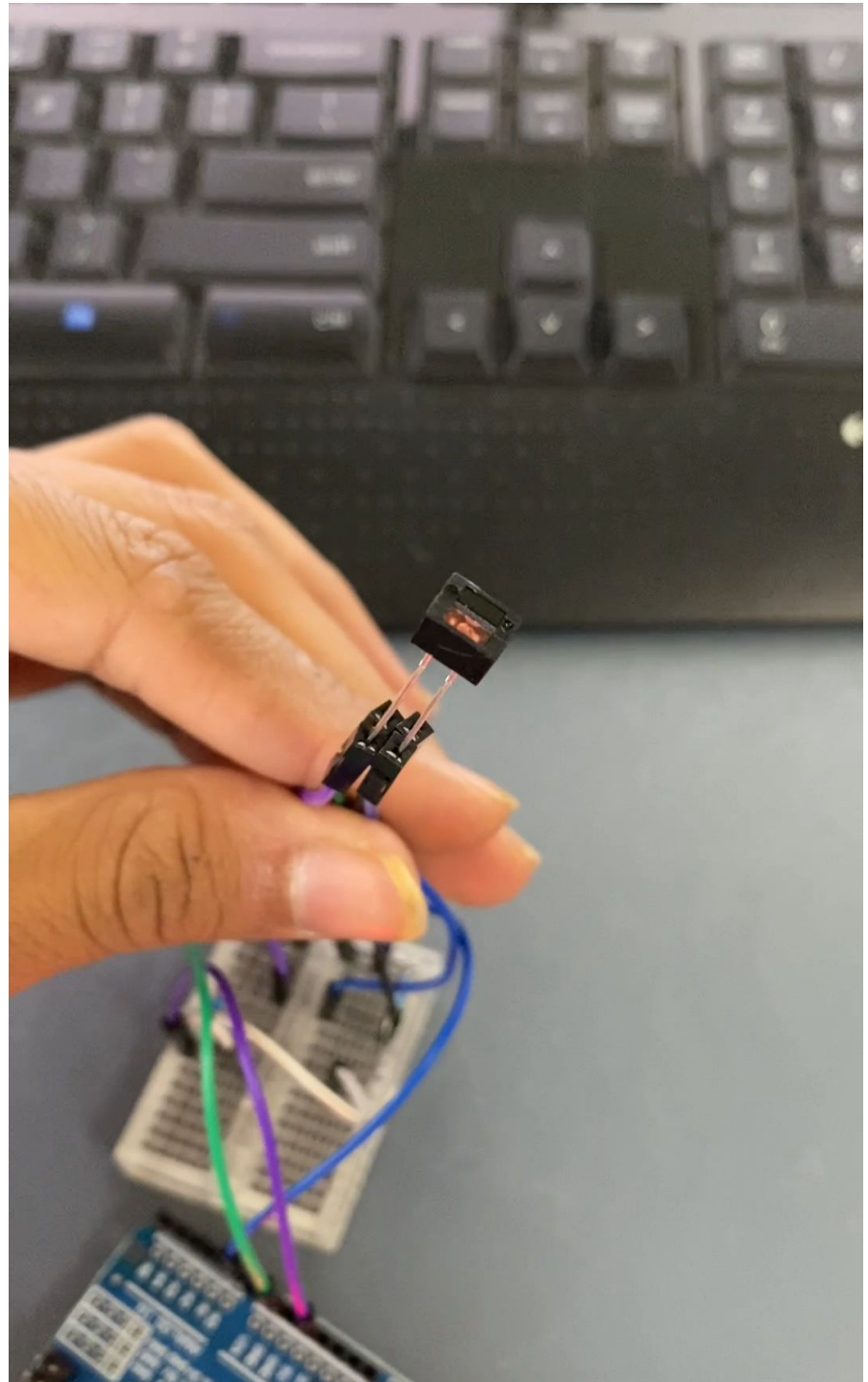
Circuit – Arduino + Ultrasonic + QRD 1114

- U1 -> A0 (Analog !)
- Input -> 5V
- Gnd -> Gnd



Code for QRD 1114

Code

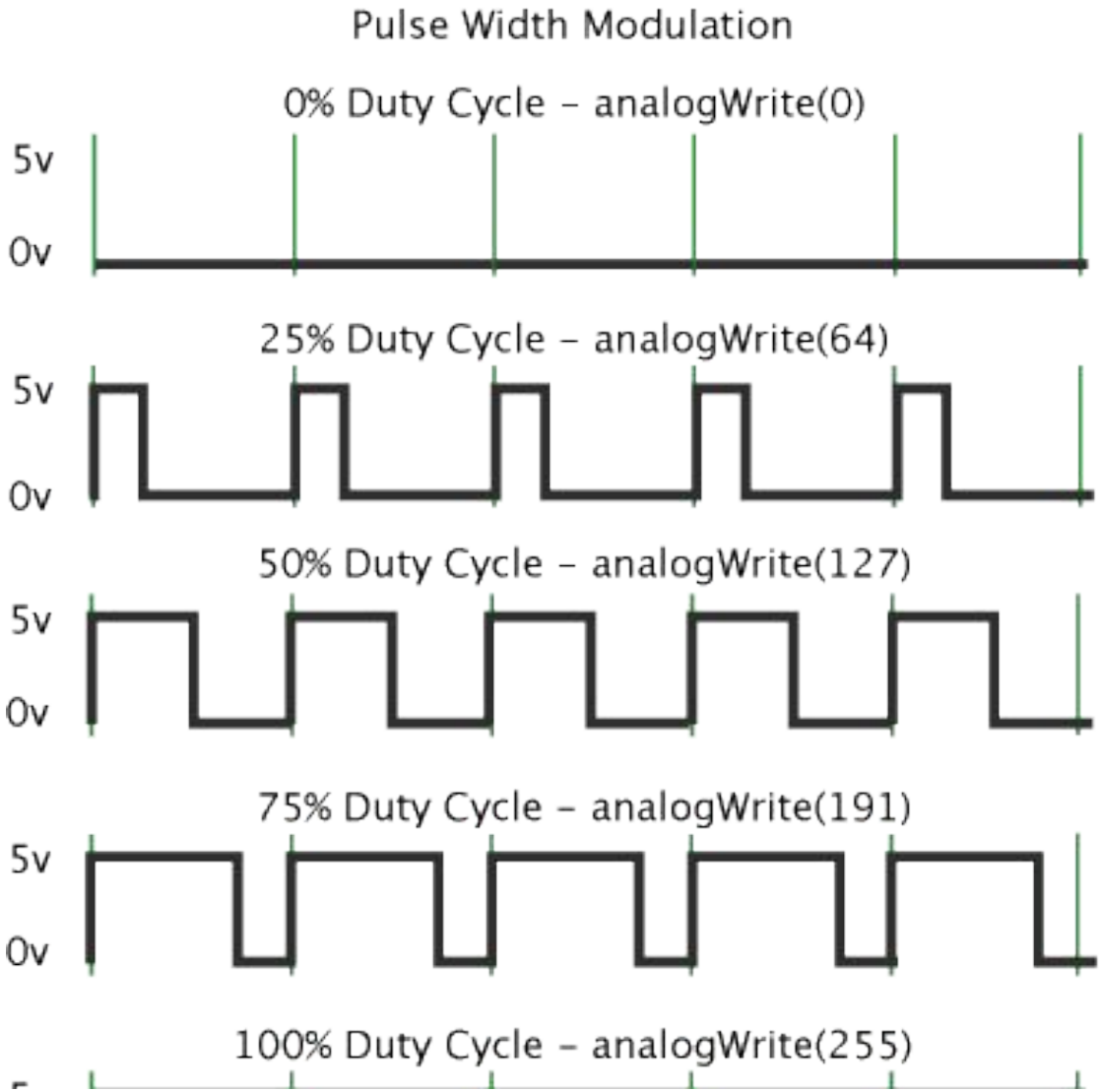


Resources

- QRD1114 Optical Detector Hookup Guide
- QRD1114 Circuit How-to Tutorial

What is PWM?

- Digital signals have two positions: on or off, interpreted in shorthand as 1 or 0. Analog signals, on the other hand, can be on, off, half-way, two-thirds the way to on, and an infinite number of positions between 0 and 1.
- PWM is a way to control analog devices with a digital output. Another way to put it is that you can output a modulating signal from a digital device such as an MCU to drive an analog device.
- It's one of the primary means by which MCUs drive analog devices like variable-speed motors, dimmable lights, actuators, and speakers.
- PWM is not true analog output, however. PWM "fakes" an analog-like result by applying power in pulses, or short bursts of regulated voltage.

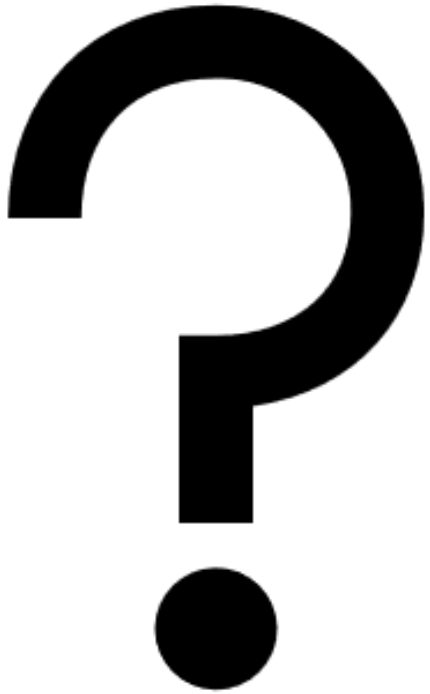


Why use PWM?

- We aren't able to adjust the voltage going into the motor like we would using a DC adjustable power bench power supply. Adjusting DC voltage involves some complicated modules/devices which we don't have.

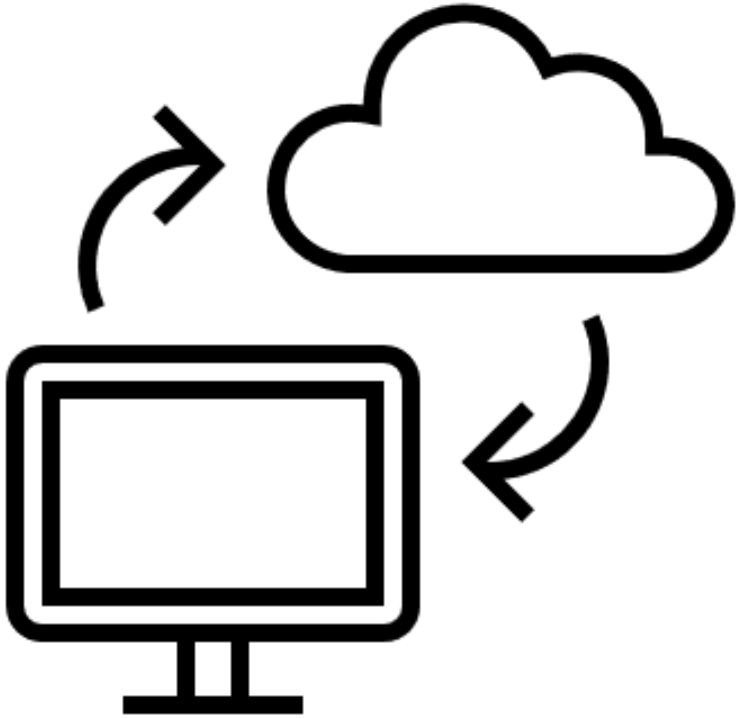
- So how instead do we vary the voltage (therefore the speed) of the motor? We use PWM. Luckily for us, the motor treats rapidly changing voltage as somewhat of a constant. That means having a high frequency signal on half of the time and off half of the time would equal to half the input voltage when powering the motor. Example: 12v power source switching on and off at rapid speeds. The 12v is in the on state for 50% of the time and in the off state for 50% of the time. To the motor, this signal is similar to a smooth 6v

- If instead, the 12v power was on for 75% of the time and off for only 25% of the time, the equivalent voltage to the motor would be 9v



Other Resources

Link to bot drive if code link doesn't work



Thank You For Attending Sensors Tutorial