19OE204- IoT System Architecture

Sensors and Actuators

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Sensor and Actuators

What is a sensor?
In simple words, a sensor is a device that "listens" to the physical environment and tells you what happens . Each sensor is able to listen to a specific input, that can be light, heat, motion, moisture, pressure, or any one of a great vairety of other environmental phenomena.

What is a actuator?
Actuator is a device that converts energy in movement. It could be a valvle or a motor.
Example a display, a led, a loudspeaker.

Sensors

•Humidity sensor (DHT22)
•Temperature sensor (LM35)
•Water detector sensor (Simple Water
Trigger)
•PIR SENSOR
•ULTRASONIC SENSOR

Humidity Sensors

Humidity Sensor (DHT22)

The DHT-22 (also named as AM2302) is a digital-output, relative humidity, and temperature sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and sends a digital signal on the data pin.
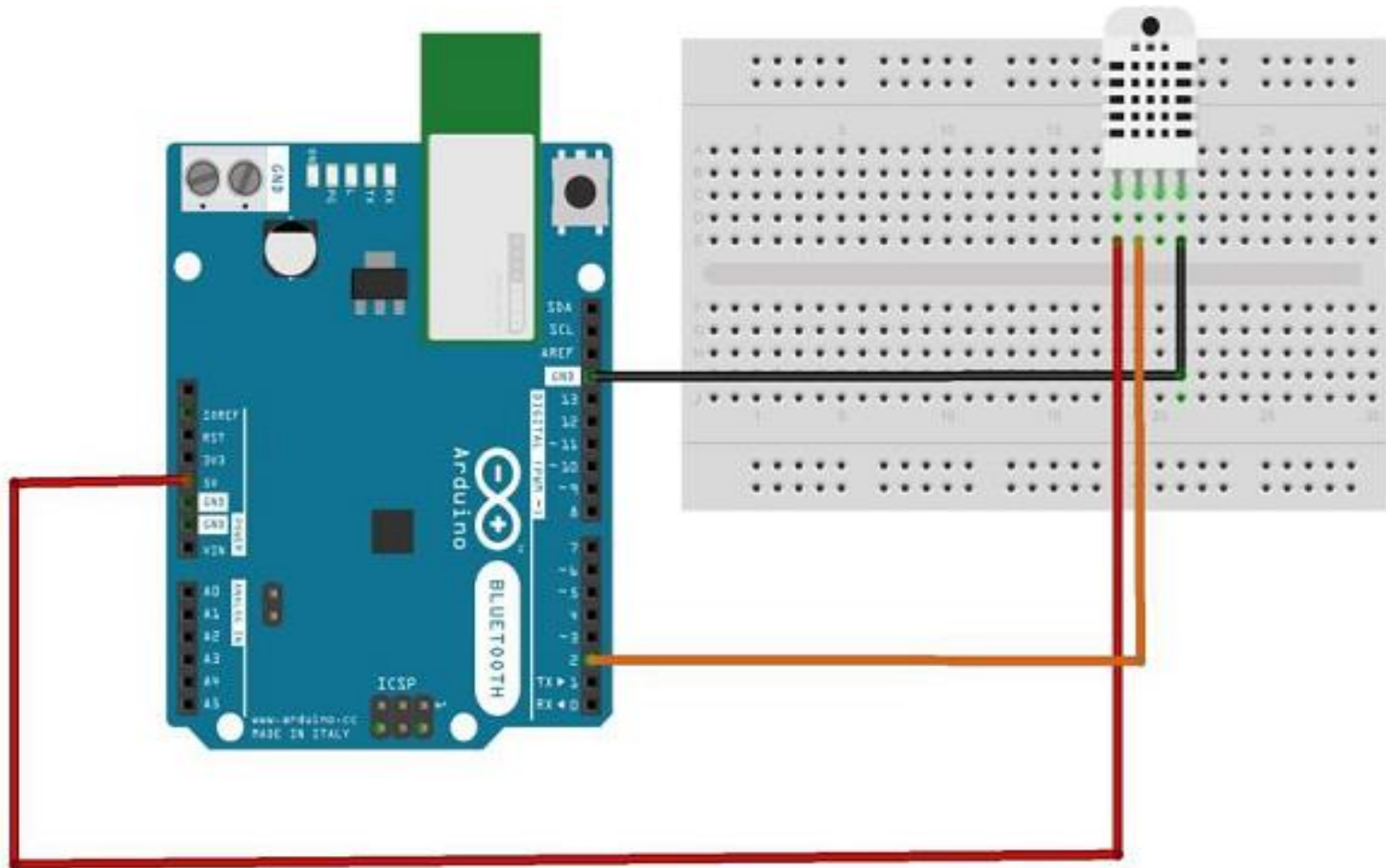
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DHT22 pins	
1	VCC
2	DATA
3	NC
4	GND

Technical Details
•**Power** − 3-5V
•**Max Current** − 2.5mA
•**Humidity** − 0-100%, 2-5% accuracy
•**Temperature** − 40 to 80°C, ±0.5°C accuracy

# Humidity Sensors

Temperature Sensors

The Temperature Sensor LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature.

The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range.
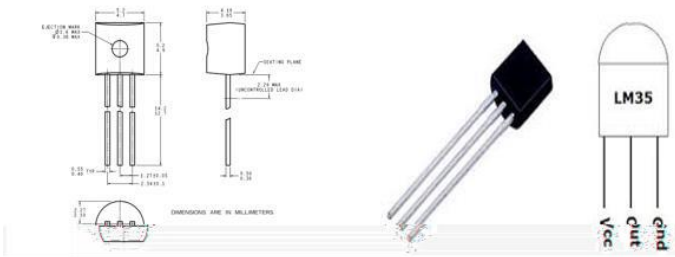
Technical Details
Calibrated directly in Celsius (Centigrade)
Linear + 10-mV/°C scale factor
0.5°C ensured accuracy (at 25°C)
Rated for full −55°C to 150°C range
Suitable for remote applications

Temperature Sensors
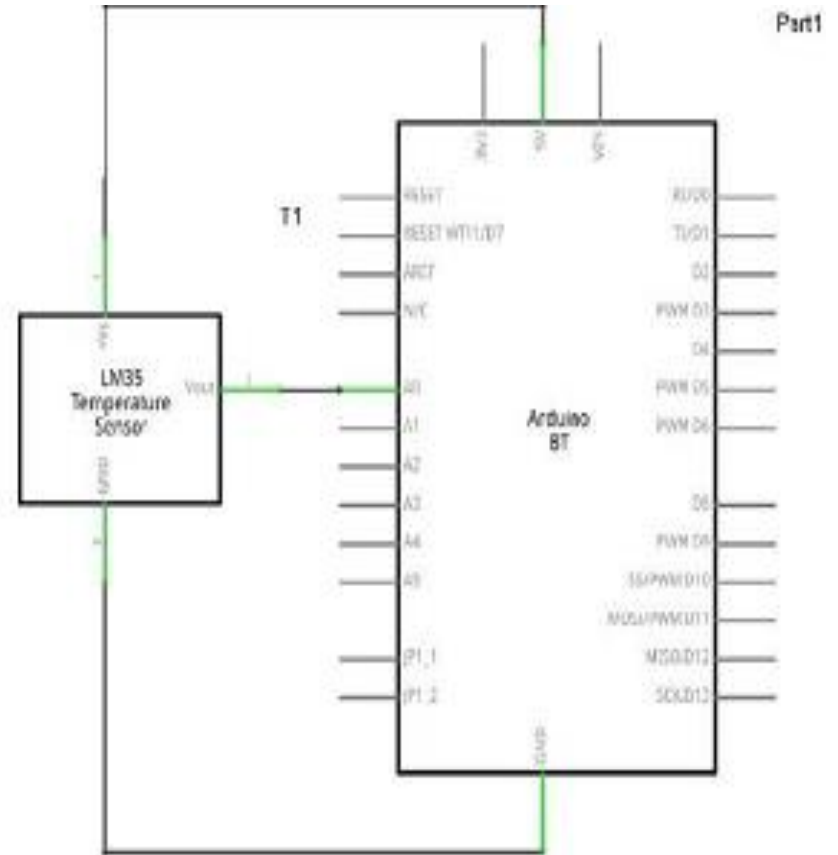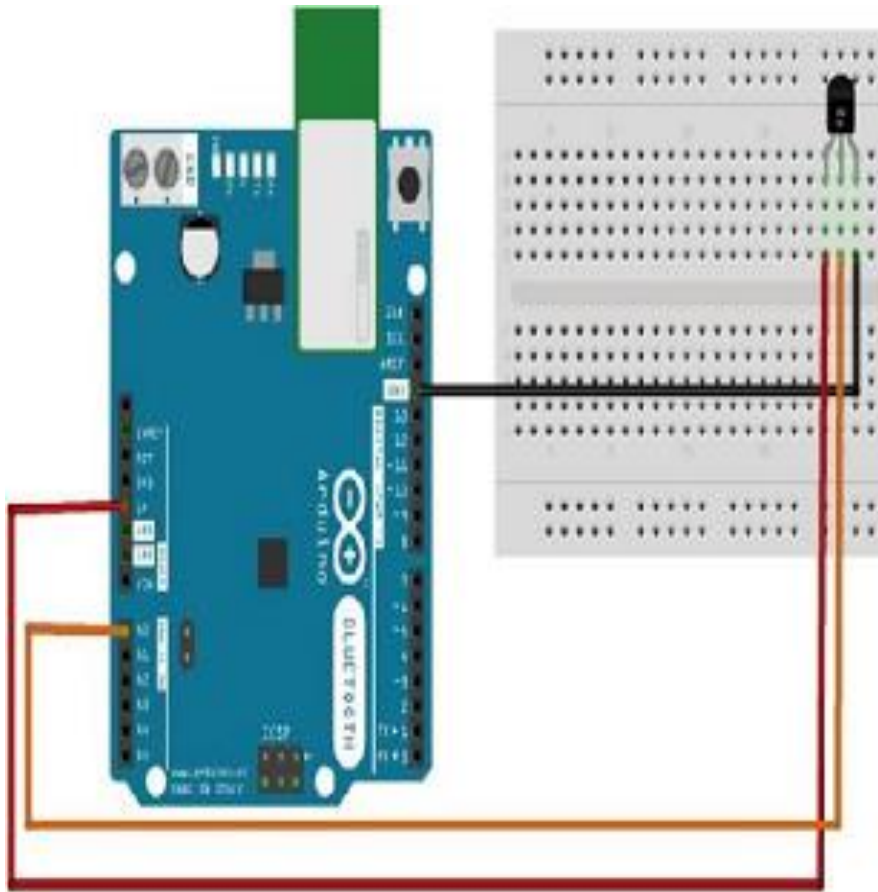
Water Sensors

Water sensor brick is designed for water detection, which can be widely used in sensing rainfall, water level, and even liquid leakage.

Connecting a water sensor to an Arduino is a great way to detect a leak, spill, flood, rain, etc. It can be used to detect the presence, the level, the volume and/or the absence of water.

While this could be used to remind you to water your plants, there is a better Grove sensor for that.
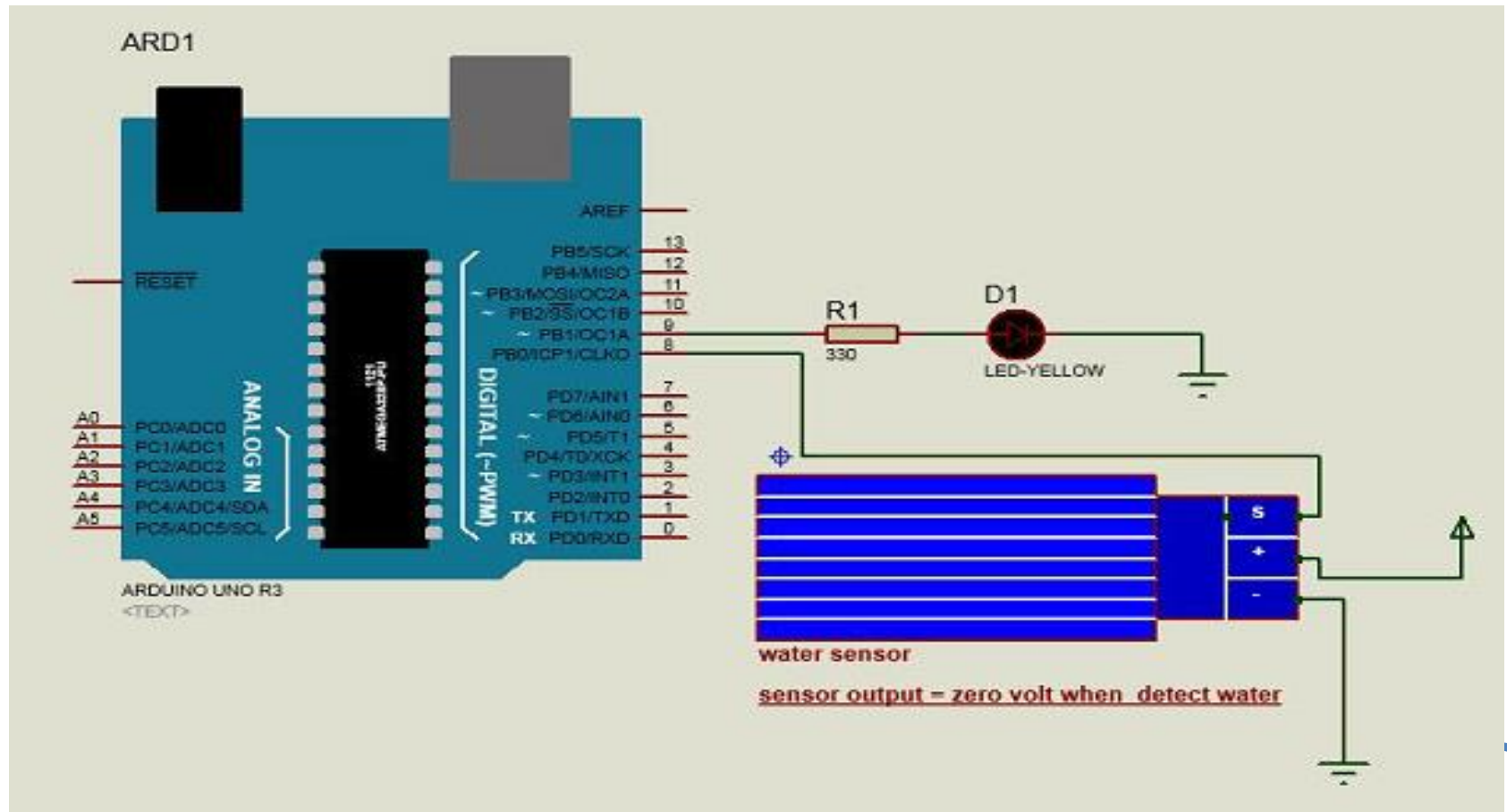
Technical Details
- **Power** − 3-5V
- **Max Current** − 2.5mA
- **Humidity** − 0-100%, 2-5% accuracy
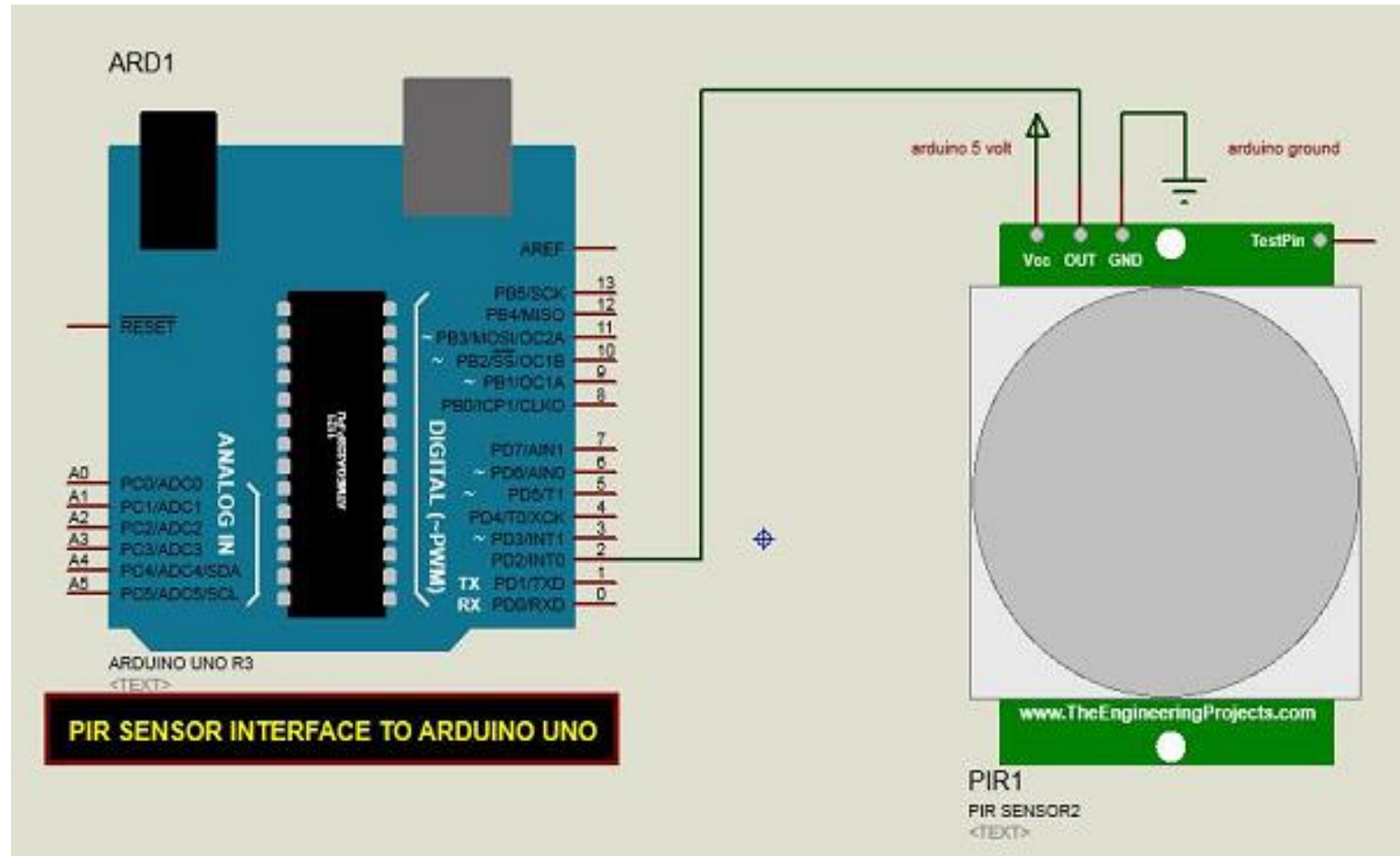- **Temperature** − 40 to 80°C, ±0.5°C accuracy

Water Sensors

PIR Sensors

PIR sensors allow you to sense motion. They are used to detect whether a human has moved in or out of the sensor's range. They are commonly found in appliances and gadgets used at home or for businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

PIR Sensors

Ultrasonic Sensors

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do.
It offers excellent non-contact range detection with high accuracy and stable readings.
The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect.
It comes complete with ultrasonic transmitter and receiver module.

Technical Details
Power Supply − +5V DC
Quiescent Current − <2mA
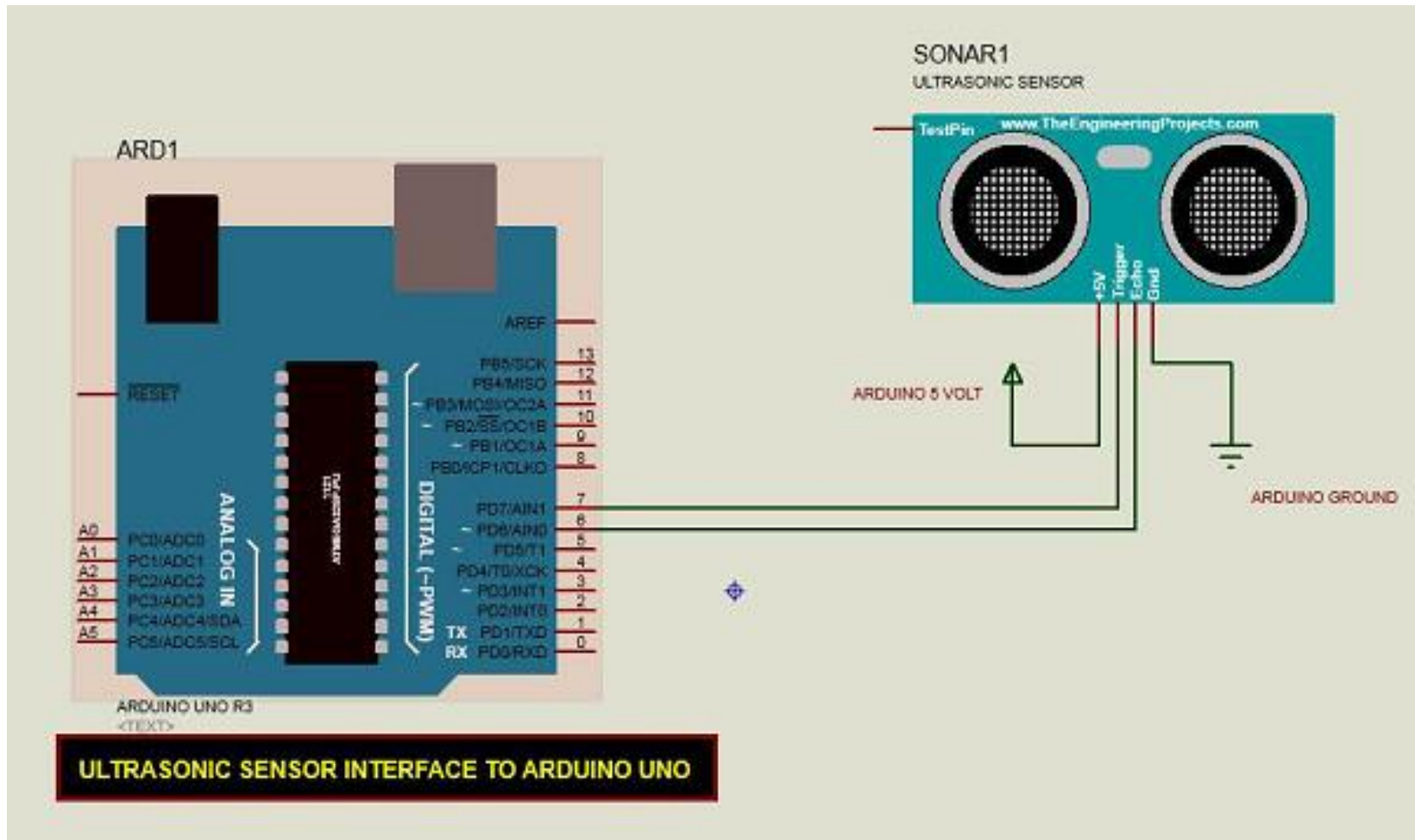Working Current − 15mA
Effectual Angle − <15°
Ranging Distance − 2cm – 400 cm/1″ – 13ft
Resolution − 0.3 cm
Measuring Angle − 30 degree

Ultrasonic Sensors

Motors

There are three different type of motors can be connected with Arduino:
DC motor
Servo motor
Stepper motor

1. DC Motor
A DC motor (Direct Current motor) is the most common type of motor. DC motors normally have just two leads, one positive and one negative. If you connect these two leads directly to a battery, the motor will rotate. If you switch the leads, the motor will rotate in the opposite direction.
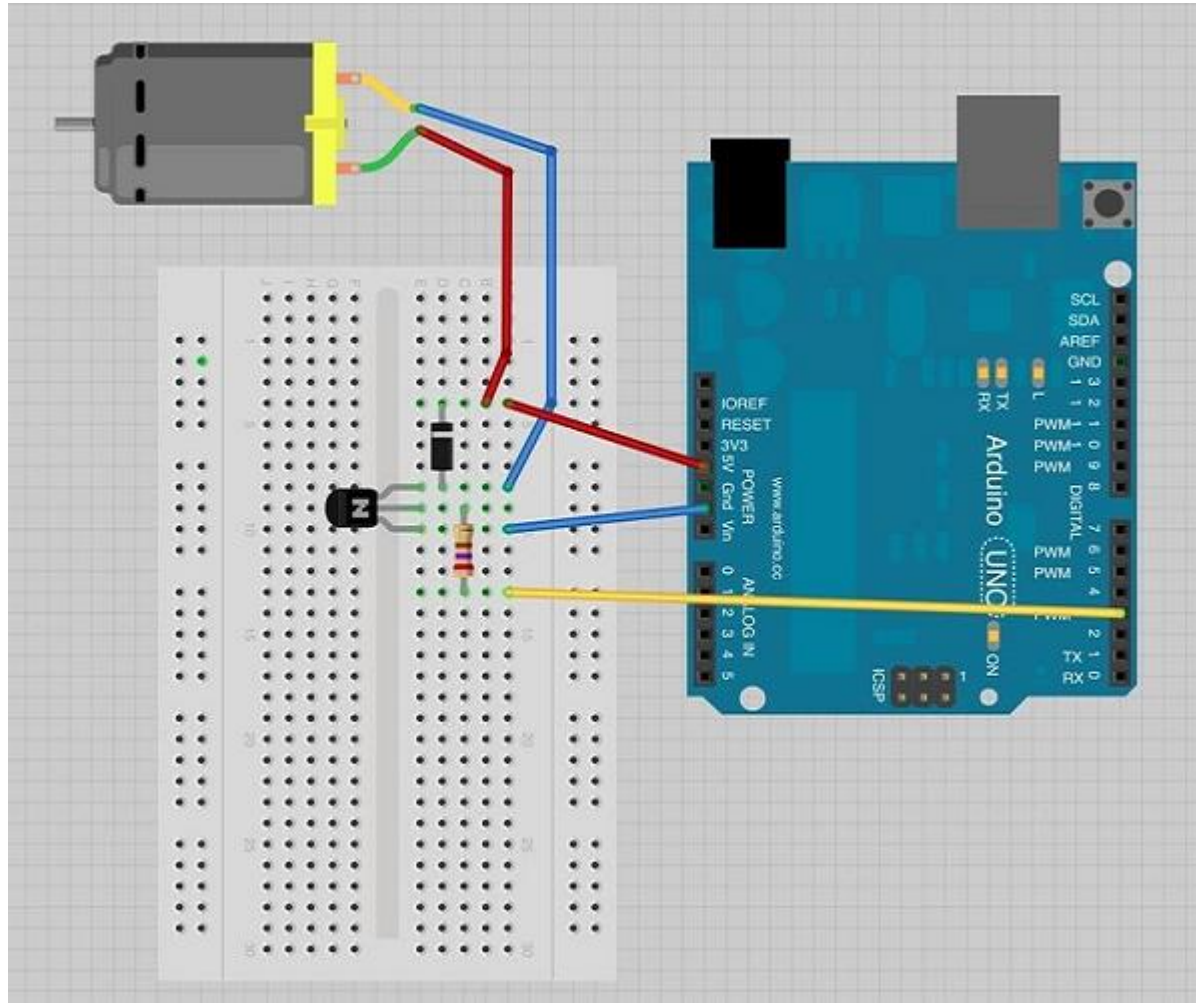
Components Required
You will need the following components −
•1x Arduino UNO board
•1x PN2222 Transistor
•1x Small 6V DC Motor
•1x 1N4001 diode
•1x 270 Ω Resistor

Connection of Arduino with DC Motor

Servo Motor

A Servo Motor is a small device that has an output shaft. This shaft can be positioned to specific angular positions by sending the servo a coded signal. As long as the coded signal exists on the input line, the servo will maintain the angular position of the shaft. If the coded signal changes, the angular position of the shaft changes.

 In practice, servos are used in radio-controlled airplanes to position control surfaces like the elevators and rudders. They are also used in radio-controlled cars, puppets, and robots.

Servos are extremely useful in robotics. The motors are small, have built-in control circuitry, and are extremely powerful for their size.

How Do You Communicate the Angle at Which the Servo Should Turn?
The control wire is used to communicate the angle. The angle is determined by the duration of a pulse that is applied to the control wire. This is called **Pulse Coded Modulation**.

Working of Servo Motor

The servo motor has some control circuits and a potentiometer (a variable resistor, aka pot) connected to the output This pot allows the control circuitry to monitor the current angle of the servo motor.

If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle is not correct, it will turn the motor until it is at a desired angle. The output shaft of the servo is capable of traveling somewhere around 180 degrees. Usually, it is somewhere in the 210-degree range, however, it varies depending on the manufacturer. A normal servo is used to control an angular motion of 0 to 180 degrees. It is mechanically not capable of turning any farther due to a mechanical stop built on to the main output gear.

The power applied to the motor is proportional to the distance it needs to travel. So, if the shaft needs to turn a large distance, the motor will run at full speed. If it needs to turn only a small amount, the motor will run at a slower speed. This is called **proportional control**

Stepper Motor

A Stepper Motor or a step motor is a brushless, synchronous motor, which divides a full rotation into a number of steps. Unlike a brushless DC motor, which rotates continuously when a fixed DC voltage is applied to it, a step motor rotates in discrete step angles.
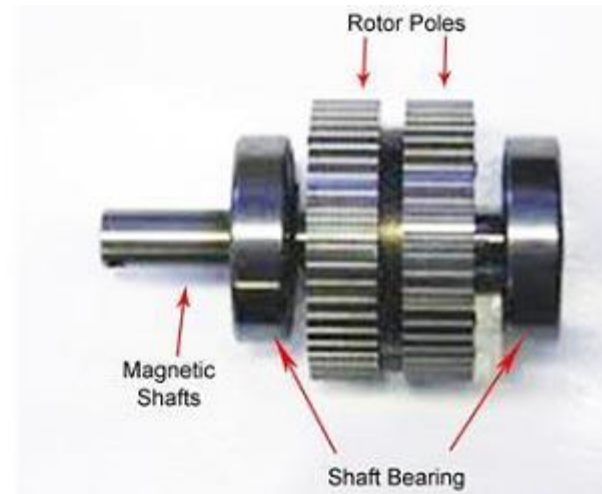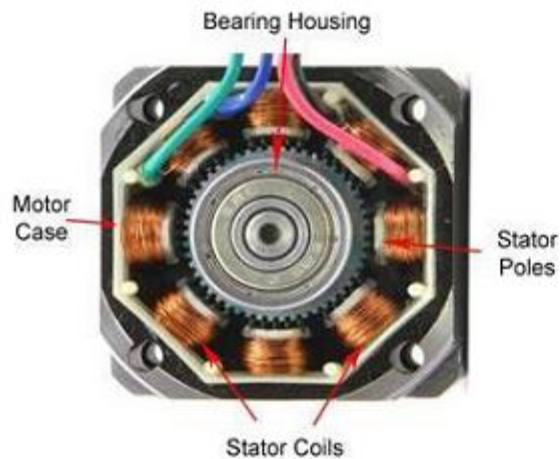
The Stepper Motors therefore are manufactured with steps per revolution of 12, 24, 72, 144, 180, and 200, resulting in stepping angles of 30, 15, 5, 2.5, 2, and 1.8 degrees per step. The stepper motor can be controlled with or without feedback.

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How a stepper Motor Works?

A regular DC motor spins in only direction whereas a Stepper motor can spin in precise increments.
Stepper motors can turn an exact amount of degrees (or steps) as desired. This gives you total control over the motor, allowing you to move it to an exact location and hold that position. It does so by powering the coils inside the motor for very short periods of time. The disadvantage is that you have to power the motor all the time to keep it in the position that you desire.

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