SENSORS

The data collecting tools

Sensors are devices (usually electro-mechanical) which help us measure a physical parameter (such as temperature, pressure, force, acceleration etc.) by providing a signal that either quantitatively measures (level) that physical parameter or provides a simple binary signal that indicates a yes/no signal that tells us if something occurred or not (such as a touch sensor). Most sensors require power to be provided to a sensing element and an electrical signal is then generated after the measurement.

ULTRASONIC SENSORS

Ultrasonic sensors measure distance by using ultrasonic waves.The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. An optical sensor has a transmitter and receiver, whereas an ultrasonic sensor uses a single ultrasonic element for both emission and reception. In a reflective model ultrasonic sensor, a single oscillator emits and receives ultrasonic waves alternately. This enables miniaturization of the sensor head.This module has 4 pins- Vcc (5V), Trig, Echo, GND. Trig (trigger) is used to send out an ultrasonic high level pulse for at least 10μs and the Echo pin then automatically detects the returning pulse.The distance can be calculated with the following formula:

Distance L = 1/2 × T × CT is the time between the emission and reception, and C is the sonic speed.

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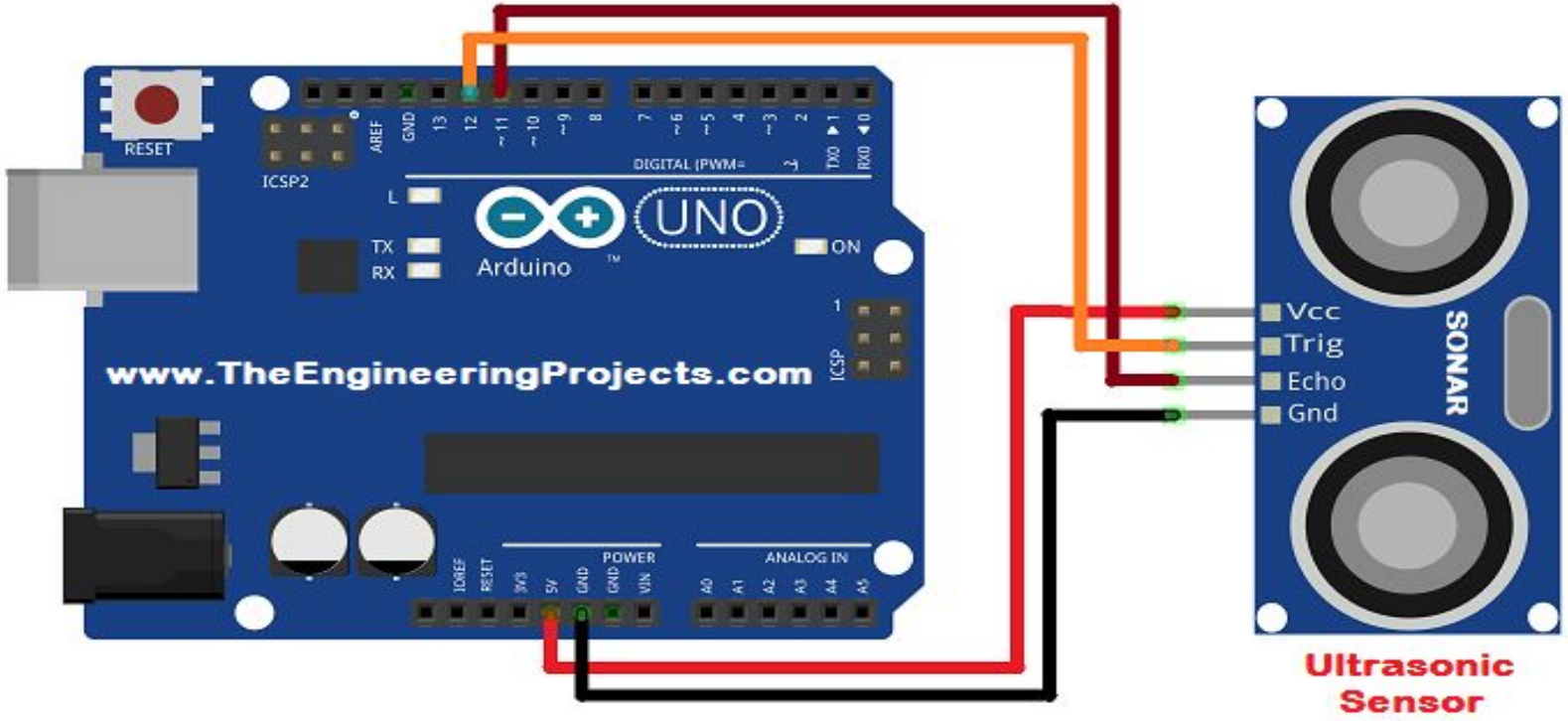
ULTRASONIC SENSOR

Ultrasonic Sensor Arduino Interfacing



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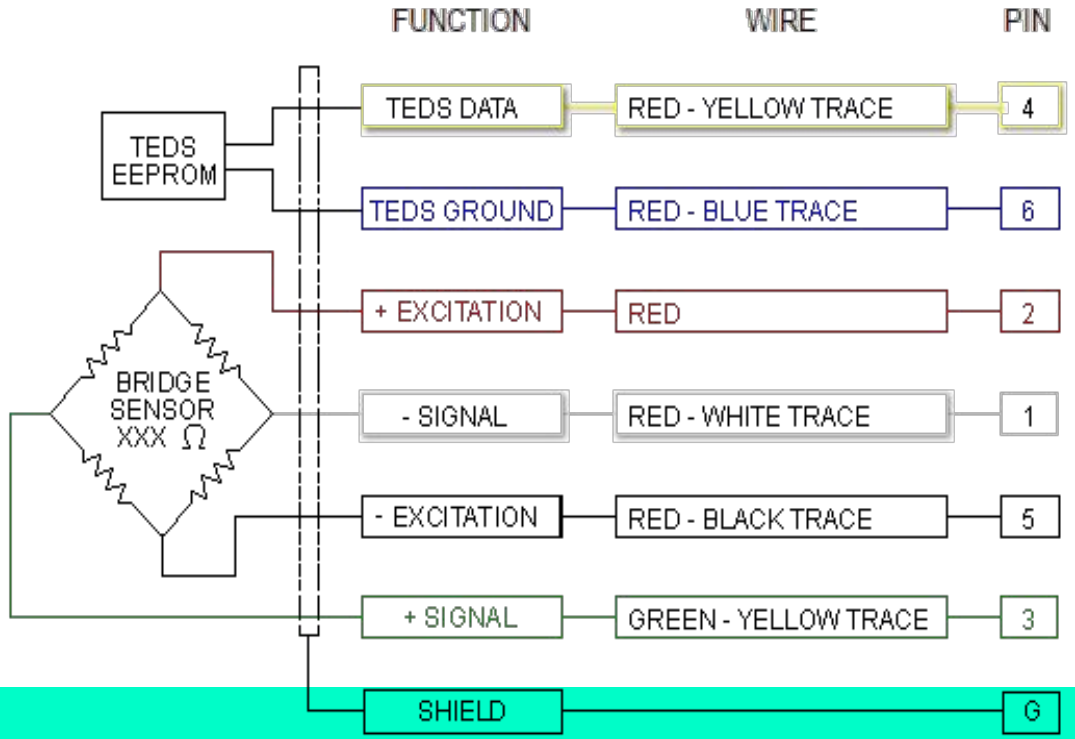
LOAD CELL

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The various load cell types include hydraulic, pneumatic, and strain gauge.

Strain gauge load cells work on the principle that the strain gauge (a planar resistor) deforms when the material of the load cells deforms appropriately. Deformation of the strain gauge changes its electrical resistance, by an amount that is proportional to the strain.

To ensure that a load cell works on site the way it actually should, it is usually not only adjusted but also calibrated. If a kilo is resting on the load cell or weigher, then depending on the accuracy class, the indicated weight should also be one kilo, not 857 grams, for example.

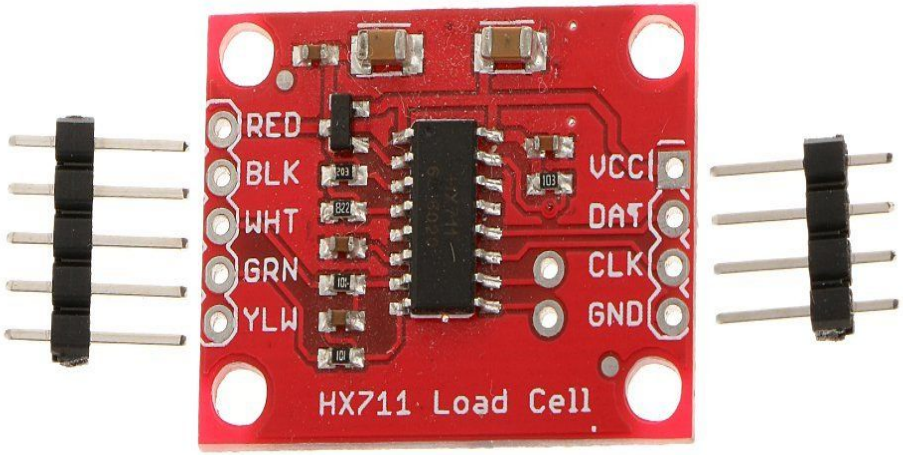


Load cells use a four or five wire wheatstone bridge to connect to the HX711. These are commonly coloured Red, Black, White, Green and Yellow. Each color corresponds to the conventional color coding of load cells:

- Red (Excitation+ or VCC)
- Black (Excitation- or GND)
- White (Amplifier+, Signal+, or Output+)
- Green (A-, S-, or O-)
- Yellow (Present in some of the load cells,by default put it to ground.)

LOAD CELL

This Load Cell Amplifier is a small breakout board for the HX711 IC that allows you to easily read load cells to measure weight. By connecting the amplifier to your microcontroller you will be able to read the changes in the resistance of the load cell and with some calibration you'll be able to get very accurate weight measurements.



LOAD CELL AMPLIFIER HX711

HUMIDITY SENSORS

A humidity sensor (or hygrometer) senses, measures and reports the relative humidity in the air. It therefore measures both moisture and air temperature. Relative humidity is the ratio of actual moisture in the air to the highest amount of moisture that can be held at that air temperature.

Humidity Sensors can also be classified based on the parameter used for measuring Humidity i.e. Capacitive Humidity Sensors, Electrical Conductivity (or Resistive) Humidity Sensors and Thermal Conductivity Humidity Sensors.

- DATA pin to Arduino
- Vcc pin to 5 volt of Arduino board
- GND pin to the ground of Arduino board
- We need to connect 10k ohm resistor (pull up resistor) between the DATA and the Vcc pin

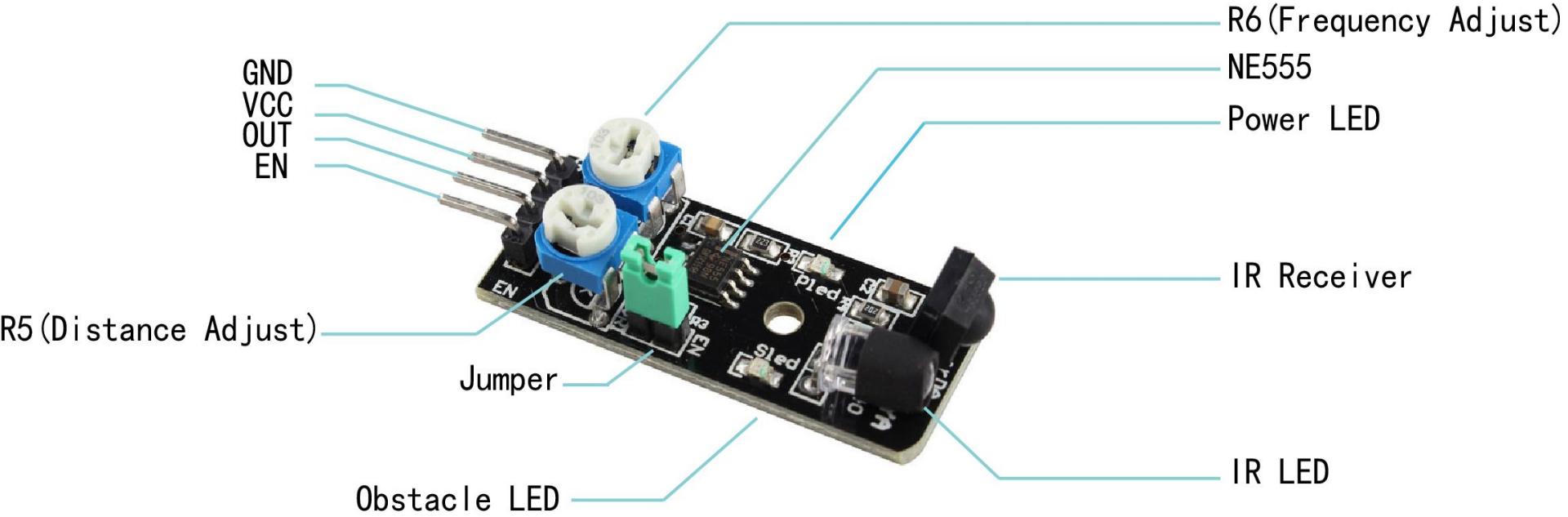
HUMIDITY SENSOR

INFRARED SENSOR

- An infrared sensor is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. They are also capable of measuring the heat being emitted by an object and detecting motion.Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave regions. The infrared waves typically have wavelengths between 0.75 and 1000μm.
- Televisions use an infrared detector to interpret the signals sent from a remote control. The key benefits of infrared sensors include their low power requirements, their simple circuitry and their portable features.
- All objects which have a temperature greater than absolute zero (0 Kelvin) posses thermal energy and are sources of infrared radiation as a result.
- Infrared sensors are broadly classified into two main types:Thermal infrared sensors ,Quantum infrared sensors

A transmission medium is required for infrared transmission, which can be comprised of either a vacuum, the atmosphere or an optical fiber.Optical components, such as optical lenses made from quartz, CaF2, Ge and Si, polyethylene Fresnel lenses and Al or Au mirrors, are used to converge or focus the infrared radiation. In order to limit spectral response, band-pass filters can be used.Next, infrared detectors are used in order to detect the radiation which has been focused. The output from the detector is usually very small and hence pre-amplifiers coupled with circuitry are required to further process the received signals.

The Key Applications of Infrared Technology : Water analysis ,Petroleum exploration ,Rail safety ,Infrared Astronomy ,Art History and Restoration ,Infrared Tracking

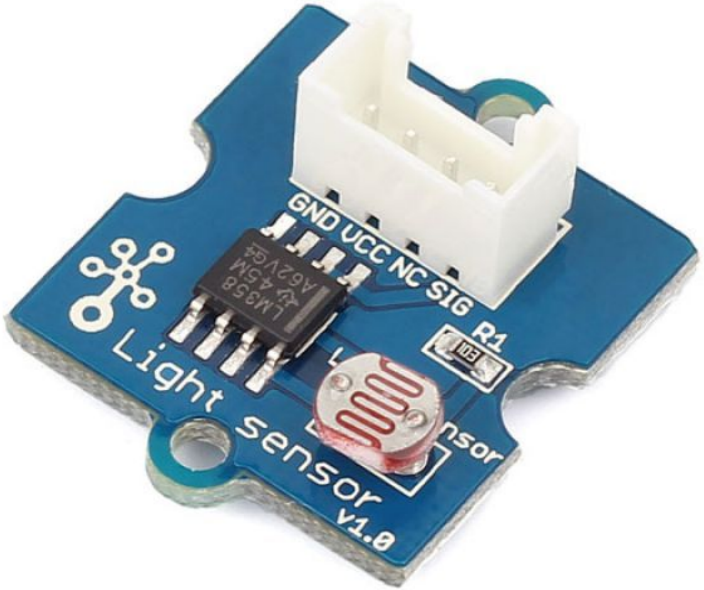


INFRARED SENSOR

LIGHT SENSOR

A light sensor is an electronic device used to detect light. There are several types of light sensors. A photocell or photo resistor is a small sensor which changes its resistance when light shines on it. A CCD (charged coupled device) transports electrically charged signals and can be found in digital cameras and night-vision devices. Photomultipliers detect light and multiply it.

The light sensor circuit can be used to design various practical embedded systems based sensor based projects such as security alarm system by photo electric sensor, Arduino managed high sensitive LDR based power saver for street light control system, a solar highway lighting system with auto turn off in daytime, sunset to sunrise lighting switch, and so on.



LIGHT SENSOR