

Collision warning / motion activated light switch







Introduction:

An ultrasonic sensor is something that can constantly measure the distance of itself to any other object in its way. It is useful in many different applications. Many cars have these sensors in their bumpers to warn the driver of possible collision with an obstacle. Same sensor can be used to detect if someone crosses the threshold of a room so that lights can be switched on. You're going to implement both of these circuits separately, and if you are able to do that well within time, there's a challenge for you as well at the end.

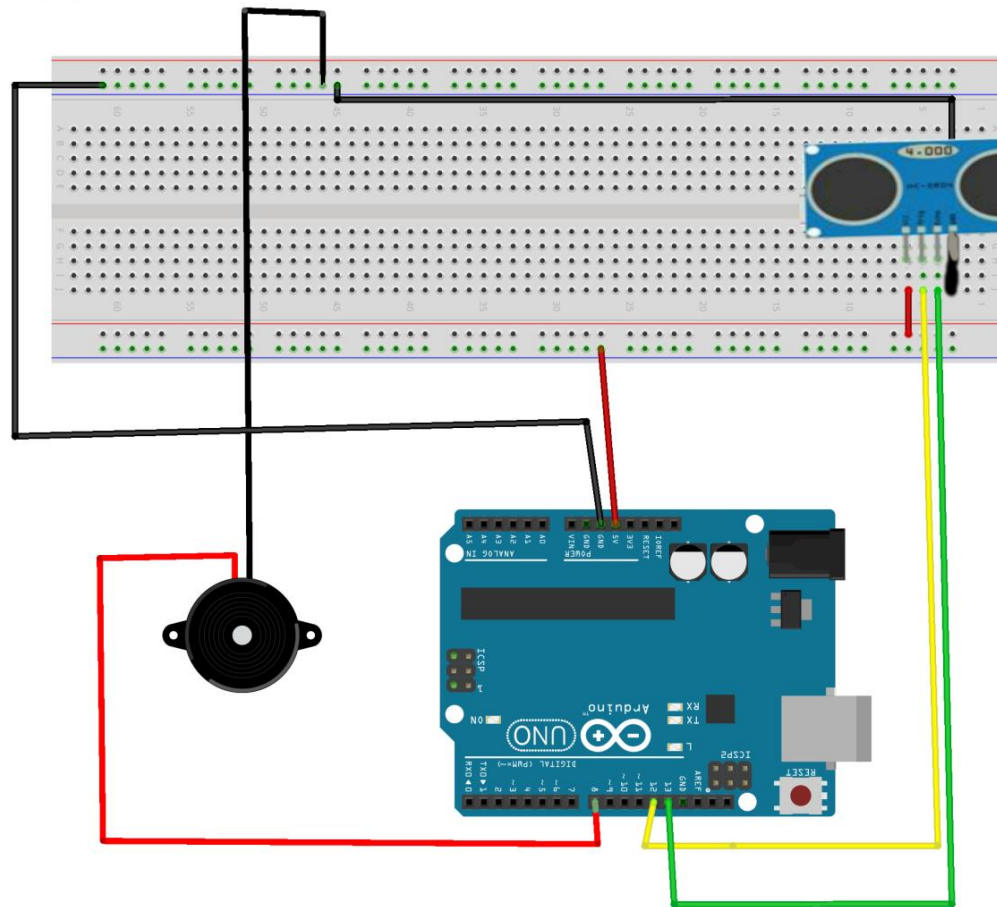
Circuit 1: Collision Warning

In this implementation, whenever the sensor will detect an object, the buzzer will start ringing. Following is a list of components that you are provided with. Your facilitators can help you identify which ones are which.

COMPONENTS:

-  Ultrasonic Sensor HC-SR04
-  Arduino UNO
-  Breadboard
-  Buzzer
-  Male to male jumper wires
-  Male to female jumper wires

Here is the schematic diagram of the project that you need to recreate.



Steps to follow:

- Make sure you have Arduino IDE installed
- Connect Arduino to your laptop, verify and upload example code of blink to see if your arduino uno is working. (refer to intro to arduino and electronics.pdf in dropbox folder for help).
- Use the above schematic to make the circuit on breadboard. In the schematic above:
 - Red wires are connected to 5V; black wires to the ground
 - Yellow one is connected between trigger pin on sensor and arduino digital pin 12
 - Green one is connected between sensor's echo pin and arduino's digital pin number 13.

- Run the code provided and see if the buzzer creates sound if an object is brought closer to the sensor.

The Code:

You are provided code in the same dropbox folder where you found this manual. Here is what is happening in the code.

- The trigPin is a pin on sensor that requires signal from arduino to send an ultrasonic wave, so it is an output pin on arduino code.
- echoPin is a pin on sensor that generates a response to be detected by the external device, in this case it is an arduino.
- Condition statement i.e. `if (distance >= 80 || distance <= 0)` is checking the distance of the object from ultrasonic sensor. Distance is measured in cm.

Task:

Once you're able to patch the circuit as drawn above and run the code on Arduino, make changes in the code to:

- ✓ Change the sound of the buzzer by changing the frequency value in the code.
- ✓ Change Ultrasonic sensor value to differentiate objects at different distances.

Circuit 2: Motion activated light switch

Introduction:

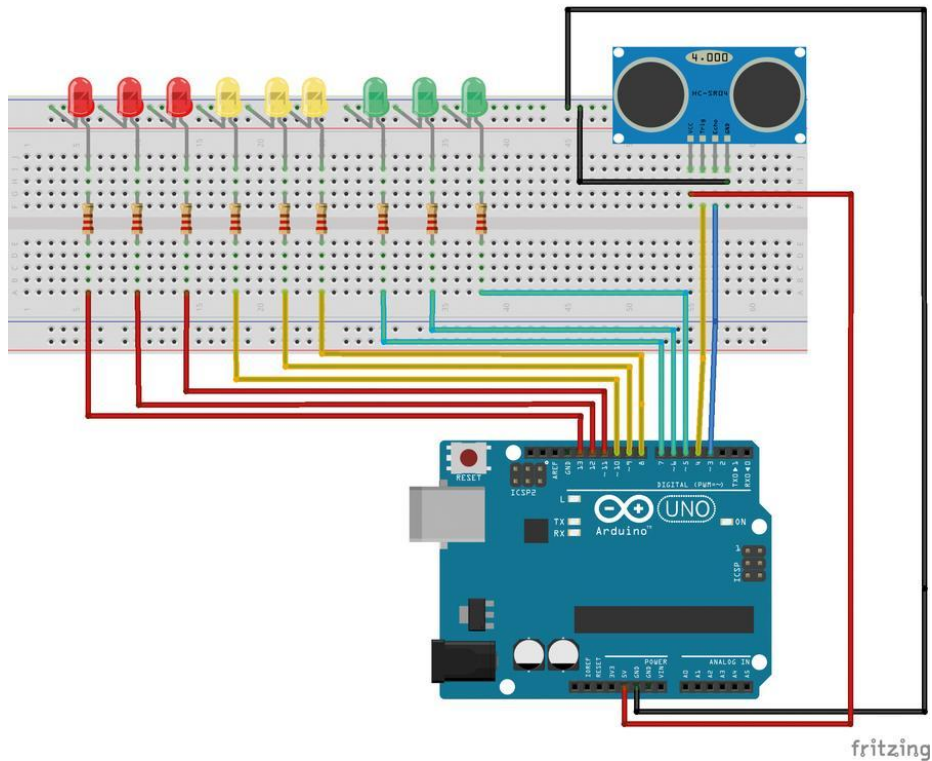
Now you need to turn on LEDs on a breadboard using the same sensor. The idea is to turn LEDs of different colors on depending upon the distance of the obstacle from the sensor in the following order.

- Turn red LEDs on from distance $< 10\text{cm}$
- Yellow LEDs on for distance range between 10cm and 30cm
- Green LEDs on for distance longer than 30cm

Following is the list of components that you need for making this circuit.

Components:

- ✓ Arduino UNO
- ✓ Ultrasonic Sensor HC-SR04
- ✓ 3 Red LEDs
- ✓ 3 Yellow LEDs
- ✓ 3 Green LEDs
- ✓ 9 x 470 ohm resistors
- ✓ Breadboard
- ✓ Male to Male jumper wires



Steps to follow:

- Use the schematic above to make the circuit on breadboard. In the schematic:
 - One of the Red wires is connected to 5V; black wires are connected to the ground,
 - Yellow one is connected between trigger pin on sensor and arduino digital pin 4.
 - Dark blue one is connected between sensor's echo pin and arduino's digital pin number 3.
 - Resistors are added in the circuit to limit the current, so that LED's don't get burned.
 - There are 3 cyan; 3 yellow; and 3 red wires connecting the LED's through resistors to arduino's digital pins.

- Run the code provided
 - See if the LED's are able to indicate the distance of the sensor to an obstacle in front of it.

The Code:

You are provided code in the same dropbox folder where you found this manual. Here is what is happening in the code.

- The trigPin is a pin on sensor that requires signal from arduino to send an ultrasonic wave, so it is an output pin on arduino code.
- echoPin is a pin on sensor that generates a response to be detected by the external device, in this case it is an arduino.
- Condition statements check the distance of the object from ultrasonic sensor and lights up LEDs depending on the condition block that becomes true.

Task:

- ✓ Change the distance in conditional statements to see how it affects the circuit.

CHALLENGE:

Now try to make a new circuit by combining the above two circuits and make one that lights up the LEDs and also turn on the buzzer sound.

You can change and combine the two sketches to build a new one. You should also try to figure out the application of such a circuit.

Hint:

