

## Sensing Your Surroundings Worksheet **Answer Key**

### Exploration and Data Collection

1. Build the robot design as described in the *Sensing Your Surroundings Building Instructions*.
2. Explore the sensors, referring to the chart below. Fill out the chart as you go.  
 → Teachers: As necessary, fill out the first row (Detect Color) with the students.

Program	Sensor Used	External Stimulus	Response
<b>Detect Color</b>	light	reflected light	Command executed: Robot says color name.
<b>Detect Distance</b>	ultrasonic	transmitted waves	Calculates distance based on the velocity equation; robot says “Watch out” if you are within 10 inches of an object.
<b>Detect Sound</b>	sound	sound level	If within a certain low range of decibel level, robot says “You’re good”; as the volume (decibel level) increases, it says “Attention”
<b>Detect Touch</b>	touch	pressed button	If robot touches a target, it changes direction

3. Brainstorm with your team: For what real-world purposes might these sensors be used?

**To detect color:** Answers will vary.

**To detect distance:** Answers will vary.

**To detect sound:** Answers will vary.

**To detect touch:** Answers will vary.

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

### Creative Thinking

1. For each sensor used, analyze its external stimuli. To what human sense is each robot sensor similar? Is each robot sensor similar to a human sense?

The touch, sound and light sensors are similar to human touch, hearing and vision senses.

Humans do not have an equivalent to the ultrasonic sensor.

2. Do any animals have senses similar to the ultrasonic sensor? Name them.

The ultrasonic sensor is similar to the echolocation sense used by bats and dolphins.

Note about ultrasonic sensors: We know that  $\text{velocity} = \text{distance}/\text{time}$ , so if we know the velocity of the transmitted wave and the time it takes for the wave to be received, the distance can be calculated. Since the time measurement is round trip, there and back, time is divided by 2. More information is available online about ultrasonic sensors at [http://en.wikipedia.org/wiki/Ultrasonic\\_sensor](http://en.wikipedia.org/wiki/Ultrasonic_sensor)

3. What are some applications of these technologies? In biosensing? In engineering? In performing any specific tasks?

Example answers: Color sensor used in recycling sorting, distance sensor used in a vehicle with a back-up sensor technology, sound sensor used in “the clapper” technology for lights, and touch sensor used in control panel or keyboard buttons.

4. How can engineers use sensors to create technologies that are helpful in society? What are some examples of existing engineered technologies that use sensors?

Example answers: Biometric applications such as insulin monitoring systems, cell phone accelerometers, parking sensors in cars to alert drivers when nearing objects.