Teacher Answer Key: Clap On, Clap Off
Introduction to Mobile Robotics > Clap On, Clap Off

Construct: Write Your Program

Observations:

1. The sound value you got for “quiet”
   This will differ depending on the background noise in the room. It should range between about 3 and 25. It will never be 0, as the Sound Sensor reads vibrations as noise, as well, so even minor air movements or movement of the sensor will give readings above 0.

2. The sound value you got for “loud”
   This will also vary widely, depending on the students and the classroom. It should generally range between 50 and 100.

3. The threshold value you calculated
   This is the average of the numbers listed in the two previous questions. To get this number, students add the two answers above, and divide the result by 2.

   Example:
   “Quiet” Value = 4
   “Loud” Value = 62

   Threshold Value = ("Quiet" Value + "Loud" Value)/2 = (4 + 62)/2 = 66/2 = 33

Contemplate

4. Write a brief description of what each block in your program does.

   Wait For Block 1: Waits for a sound above the threshold level to register.
   Wait For Block 2: Wait for a sound below the threshold level to register (for it to get quiet again after the first sound)/
   Motor Block 1: Turns on Motor C forward.
   Motor Block 2: Turns on Motor C forward.
   Wait For Block 3: Waits for a second sound above the threshold level to register.
   Wait For Block 4: Waits for “quiet” after the second sound.
   Motor Block 3: Turns off Motor C.
   Motor Block 4: Turns off Motor B.
   (Loop block added in the Continue Phase: Makes this whole behavior repeat an infinite number of times.)

5. Define the “Wait for Clap” behavior you built in the program.
i. What are the two blocks that make up the behavior?
The "Wait For Clap" behavior uses a Sound Sensor to wait for a single sound louder than the threshold level. It is made up of two blocks: one that waits for it to get loud, and one that waits for it to get soft (so you know the loud part has ended).

ii. Why isn’t a single Wait For Sound block good enough?
If you didn’t wait for it to get soft using the second Wait For block, then you would never know whether or not the loud sound had ended. Therefore, you wouldn’t know if it was a clap, or a long, extended scream, which might lead you to count the same sound twice. This way you can differentiate one loud sound from the next one, no matter what the sound duration.

6. What does the threshold for the sound sensor do? What would happen if you set the threshold higher? Lower?
The threshold for the Sound Sensor lets the sensor know what is “loud” and what is “quiet.” If the threshold were lower, then even softer sounds would be considered “loud.” If it were higher, then it would take a really, really loud sound for the sensor to recognize it as “loud.”

7. Why did you use a value from the sound sensor that was halfway between silence and clapping for your threshold value?
Students may have many different answers for this question. The halfway point is a good number to use because then loud sounds don’t always have to hit the same number (or above) to be considered “loud.” If “quiet” is always within the same range of numbers, then anything above that range could be considered “loud,” which is how the halfway point separates the values.
The halfway point also adds a little bit of leeway above the normal “quiet” range to account for other stray sounds that you don’t want the Sound Sensor to recognize. It is also a good point to use because it is easy to calculate, and you can calculate it the same way every time.

8. Does your robot respond only to claps, or do other sounds trigger the starting and stopping as well? Why do you think this is?
Any loud sound will trigger the Sound Sensor. It can’t tell the difference between claps and other loud sounds, it just hears them all as “loud.” Interestingly, it will also respond if you were to tap the Sound Sensor, because it would “hear” the sound of your finger hitting the casing. It is also triggered if you were to blow on the Sound Sensor, because it would “hear” the vibrations from the air.

9. Marisa is using the robot as an actor in a class play. She wants the robot to start running across the stage on cue. The cue will be the sound of a door slamming as another (human) actor goes off stage.
   i. How should she go about programming her robot to recognize the correct sound and begin its performance at the right time? Be specific.
   Depending on how specific the student is being, the answer might go something like this:

   Marisa would first need to get sound level from the stage area, so she knew what to set her threshold to. She would take sound readings during a typical play, and then slam the door on the stage and take sound readings of that. From these sound readings, she can calculate the threshold level for the sensor. Then she would program it.
The robot should wait for loud, then wait for quiet again (which would be it waiting for the sound of the door slamming), and then should be programmed to go forward however far Marisa wants it to, and then stop. This behavior should not repeat in a loop.
ii. What possible problems might there be with this plan?

Other sound would be the biggest problem, because the robot would respond to other loud sounds, as well. For example, if the human performer was slamming the door in anger, then he/she was probably yelling before going offstage. This yelling might trigger the robot prematurely. Or, if the performance was particularly good, the audience might start clapping, which would also trigger the robot, possibly causing it to go at a time when it wasn’t wanted.

10. The cafeteria staff at LeGou Middle School keeps order in the lunchroom by turning off the lights whenever the room gets too noisy. They’re tired of having to sit by the light switch the whole period though, and have heard that a robot may be able to help them out. Explain briefly how a sound sensor-equipped robot might be able to simplify or automate this task for them.

Simply put, the robot can use its sound sensor to wait for the noise level in the room to get above a certain level (threshold). It can alert the staff when this happens by beeping, so that they can go over and turn off the light manually. In a more advanced robot, when this happens, a robotic arm could switch off the lights, so that staff wouldn’t have to do anything. In another application, the entire light switch could be robotic, with the sound sensor built in, so that when the sensor has been triggered, the switch can turn itself off, no robotic arm needed. Then the robot could wait for it to get quiet again, and use the robotic arm or switch backwards to turn the lights back on. If these behaviors were put in a loop, the robot could do this an infinite number of times every lunch period. The only problem is, the students may not “listen” to the robot, and a staff member may have to be on hand to quiet them down anyway.

Continue

Answer the following:

11. How did the loop change the robot’s behavior?

The loop didn’t change the robot’s behavior; it just made the behavior repeat.

12. How many times will the loop run?

The loop will run an infinite number of times, because that is the default configuration (you can check the setting in the configuration panel).

Note: Answer Key and Teacher Notes for the Continue Activity “Frequency and Amplitude” can be found separately in the “Frequency and Amplitude Teacher Notes” document.