

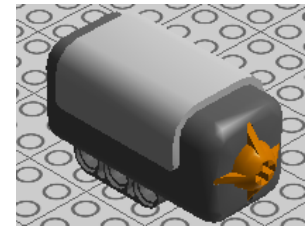


Reacting to Sensors

Now you can experiment with sensors, which will be used to make your project interactive.

Reacting to Touch

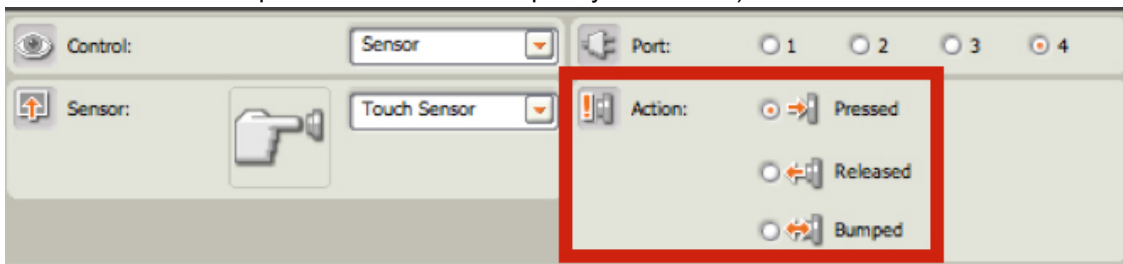
We will use the touch sensor (pictured to the right) to react to touch by pressing the button on the sensor. Plug it into **port 4** on the NXT using a connector cable, and plug in two motors into **port B** and **C**.



1. Start the sequence beam with a **Loop** block.
2. Place a **Touch Wait** block inside of the **Loop**. This block makes the program wait until the button on the sensor is pressed.



3. Set the **port** number to 4. To react you must set its **Action** to either Pressed (as soon as the button is pressed it will react), Released (as soon as the button is released it will react), or Bumped (as soon as the button is pressed and released quickly it will react). For this exercise set it to **Pressed**.



4. After the **Touch Wait** block place a **Move** block and set to it rotate forward for a **duration** of 1 second.
5. Add a final **Move** block and set it to rotate backward for a **duration** of 1 second.
6. Make sure you turn on your NXT and connect the USB to both your computer and the NXT. Locate the controller in the lower right of the work area and click the center button (Download and run.)

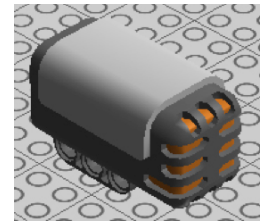
Action: Once the touch sensor is pressed the motors will spin forward and then backward.

Final Sequence Beam



Reacting to Sound 1

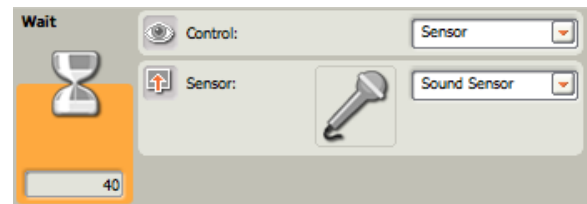
We will use the sound sensor (pictured to the right) to react to sound input. Plug it into **port 4** on the NXT, and plug two motors into **port B** and **C**.



1. Start the sequence beam with a **Loop** block.
2. Place a **Sound Wait** block inside of the **Loop**. This block makes the program wait until a certain volume of sound is heard through the sound sensor.



3. Set the **port** number to 4 and plug the USB cable into the NXT Brick. You now are able to read the volume values the sound sensor captures in the bottom left of the screen. Try talking into the sensor or clapping your hands.



Note: if the values do not change, try clicking the **Stop** button in **Download Control**. This will establish a connection to your NXT Brick.

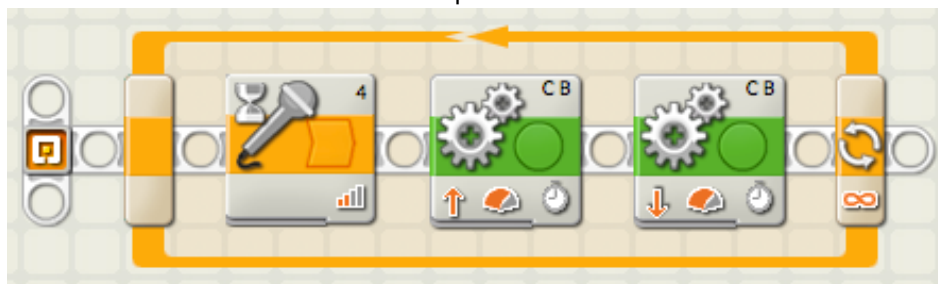
4. To react to sound you must set a range of volume values for the NXT to listen for. For this exercise we will set the range to be **greater than 50**, so adjust the **Until** value to **> 50**.



5. After the **Sound Wait** block place a **Move** block and set it to drive forward for 1 second.
6. Add another **Move** block and set it to drive backwards for 1 second.
7. Make sure you turn on your NXT and connect the USB to both your computer and the NXT. Locate the controller in the lower right of the work area and click the center button (Download and run.)

Action: Once the sound sensor is activated by a sound that is "50 or greater," the two motors will spin in one direction, and then they will spin in the opposite direction.

Final Sequence Beam



Reacting to Sound 2

In this exercise we will make the two motors move, but when the sound sensor is triggered it will react and change what the motors are doing.

1. Start the sequence beam with a **Loop** block.
2. Place a **Move** block inside of the **Loop** and set it to rotate forward. Set the **duration** to **Unlimited**; doing this will make the motors rotate forward until commanded otherwise.



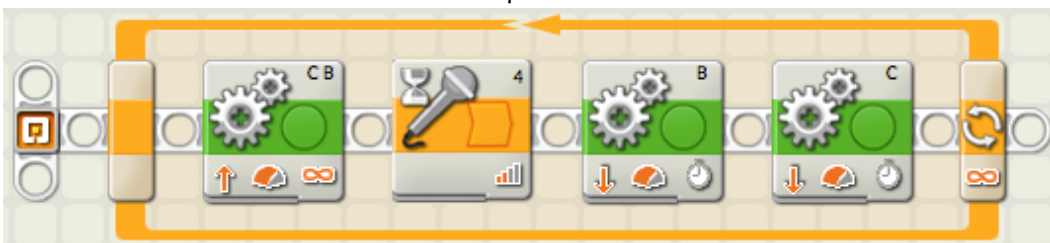
3. After the first **Move** block place a **Sound Wait** block.
4. To react to sound you must set a range of volume values for the NXT to listen for. For this exercise we will set the range to be **greater than 50**, so adjust the **Until** value to > 50 .



5. Add a **Move** block and set it to **port B** only and to rotate backward for 1 second.
6. Add a final **Move** block and set it to **port C** only and to rotate backward for 1 second.

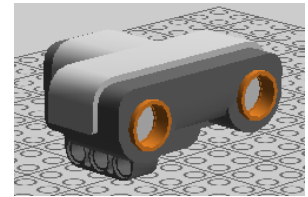
Action: The two motors will rotate forward continuously, then move backward individually once the sound threshold is met.

Final Sequence Beam



Reacting to Distance 1

We will use the distance sensor (pictured to the right) to react to objects in front of the sensor. Plug it into **port 4** on the NXT, and plug two motors into **port B** and **C**.

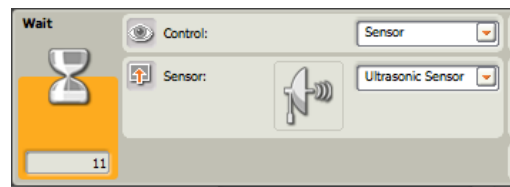


It will be called the ultrasonic sensor by the NXT software, but for simplicity it will be called a distance sensor in the following exercises.

1. Start the sequence beam with a **Loop** block.
2. Place a **Move** block inside of the **Loop** and set it to rotate forward. Set the **duration** to **Unlimited**; doing this will make the motors rotate forward until commanded otherwise.
3. Place a **Distance Wait** block inside of the **Loop**. This block makes the program wait until an object is a certain distance away from the sensor.

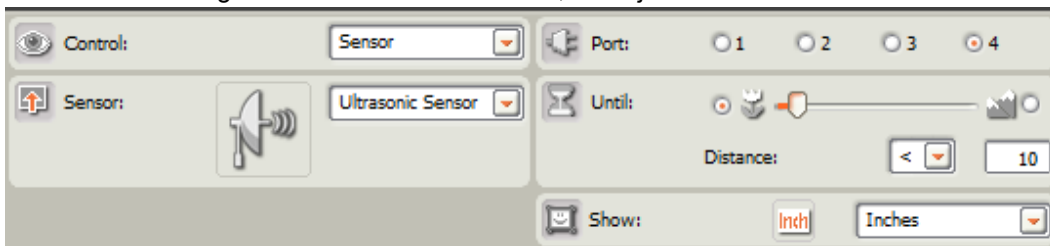


4. Set the **port** number to 4 and plug the USB cable into the NXT Brick. You now are able to read the values the distance sensor captures in the bottom left of the screen. Try slowly moving your hand closer and further away from the sensor.



Note: if the values do not change, try clicking the **Stop** button in **Download Control**. This will establish a connection to your NXT Brick.

5. To react to distance you must set a range of distance values for the NXT to look for. For this exercise we will set the range to be **less than** 10 inches, so adjust the **Until** value to **< 10**.



6. After the **Distance Wait** block place a **Move** block and set it to rotate backwards for 1 second.

Action: The two motors will move forward until an object comes within 10 inches of the distance sensor. The motors will then rotate backwards.

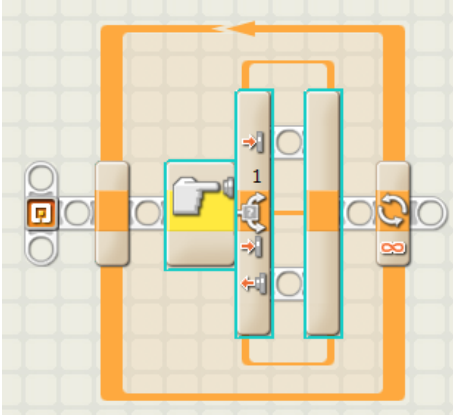
Final Sequence Beam



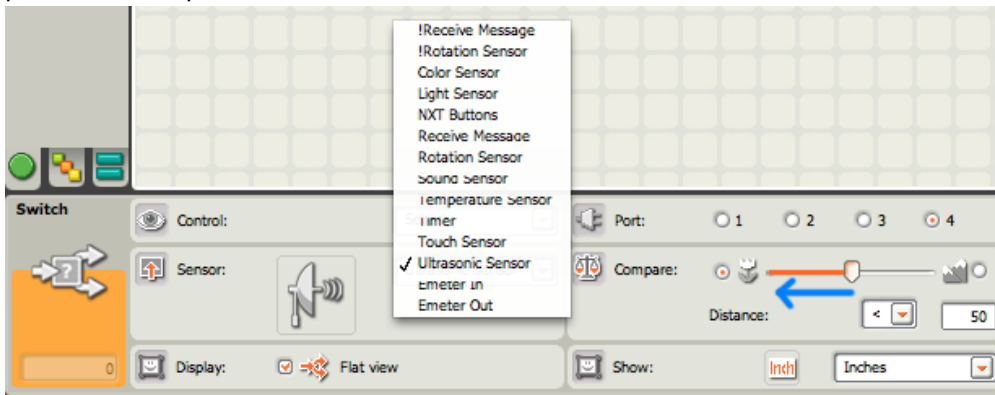
Reacting to Distance 2

In this exercise we will introduce a new type a block called a **Switch** block. It tells the NXT to look for two different conditions, and will react differently with each condition. If you have programmed in another language before it is equivalent to an “if” or “if else” statement.

1. Start by placing a **Loop** block on the sequence beam.
2. Place a **Switch** block within the **Loop** block.

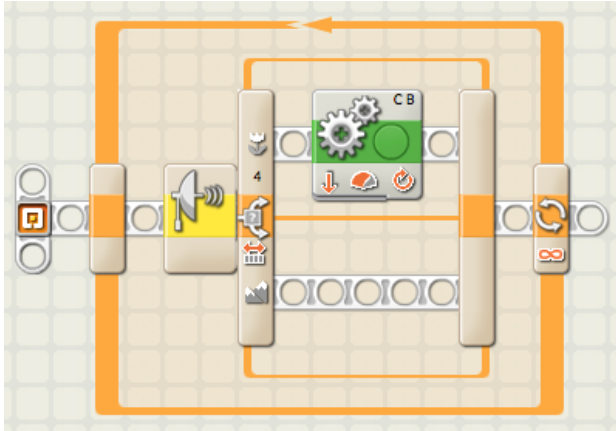


3. The **Switch** block's default setting is to use a touch sensor. This must be changed in the configuration panel in the **sensor** setting to the Ultrasonic Sensor (distance sensor). Blocks will be placed in the top and bottom beams of the **Switch** block.



4. In the **compare** settings of the configuration panel, the default setting of the slider is set to **50** with the “flower” side of the slider colored orange. This means that the “flower” side action of the **Switch** block will be executed if an object comes within the threshold of **50** inches. Since **50** inches is a pretty far distance we will move the slider to **10** inches. The “mountain” side of the slider is white and will trigger the “mountain” side blocks if something is not within **10** inches of the distance sensor.

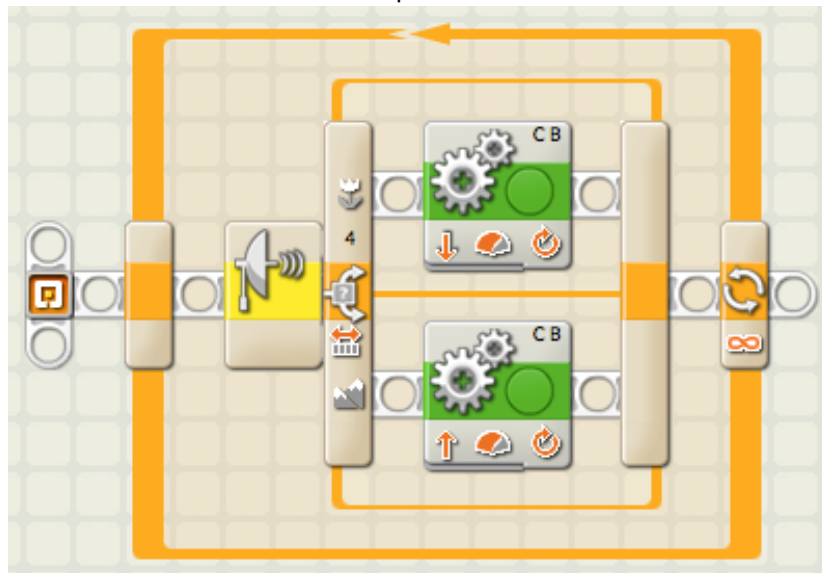
5. Place a **Move** block in the top beam of the **Switch** block (the “flower” side) and set it to rotate backwards for a **duration** of 2 rotations.



6. Place a **Move** block in the bottom beam of the **Switch** block (the “mountain” side) and set it to rotate forward for a **duration** of 1 rotation.

Action: The “mountain” side of the **Switch** block dictates what will occur if there is nothing within 10 inches of the sensor; in this case the motors will rotate forward. The “flower” side indicates what will occur if something is within 10 inches of the front of the sensor; in this case the motors will rotate backwards.

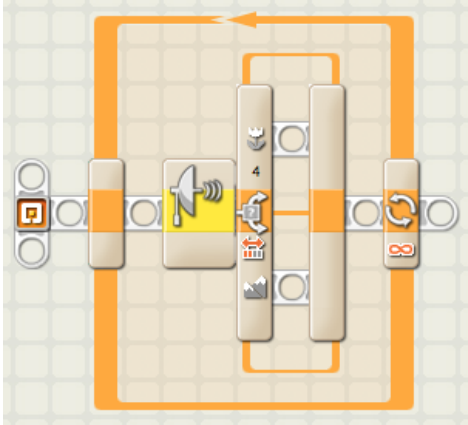
Final sequence beam



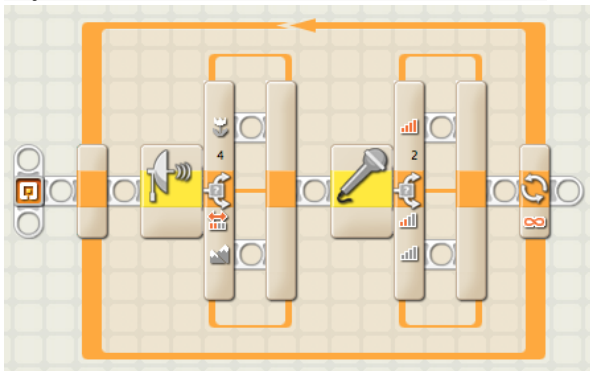
Reacting to Distance and Sound

In this exercise we will be using two sensors, distance and sound, and each sensor will be responsible for different movements performed by two motors. Plug the **distance sensor** into **port 4** and plug the **sound sensor** into **port 2**.

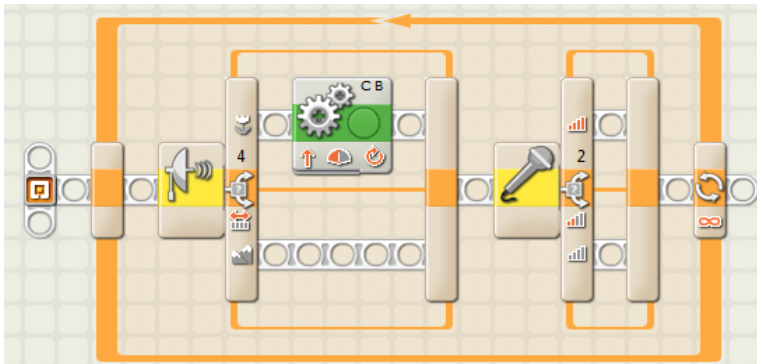
1. Start with a **Loop** block on the sequence beam.
2. Place a **Switch** block within the **Loop**, and set its **sensor** to Ultrasonic Sensor. This block will be checking if objects are passing the threshold given in the **compare** setting in the configuration panel, so adjust the **distance** value to a desirable length.



3. Place a **Switch** block within the **Loop**, and set its **sensor** to Sound Sensor. This block will be checking if noises pass the threshold given in the **compare** setting in the configuration panel, so adjust the **sound** value to a desirable volume.



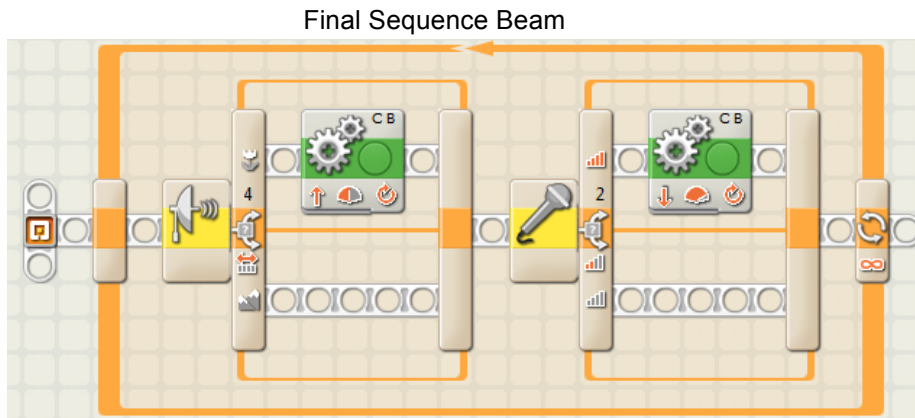
4. On the top beam of the **Distance Switch** block (the “flower” side) place a **Move** block and set it to rotate forward with a **power** setting of **50** for a **duration** of 1 rotation.



5. On the top beam of the **Sound Switch** block (the “louder” side) place a **Move** block and set it to rotate backwards with a **power** setting of **100** for a **duration** of 1 rotation.

The program is made of two switch blocks that are on a loop so they are constantly checking for sound and for distance. Once one of the thresholds is passed the actions in the top beam of either **switch** block will be executed by the NXT. Only one of the actions from the **switch** blocks can be executed at a time.

Action: The two motors will spin backwards when something is in front of it and forwards when a sound is heard.



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Please send any questions or comments to Adam Norton at anorton@cs.uml.edu