



Robotics Lesson Plan

Middle School Level (Follow the Line/Wall)

Demonstration

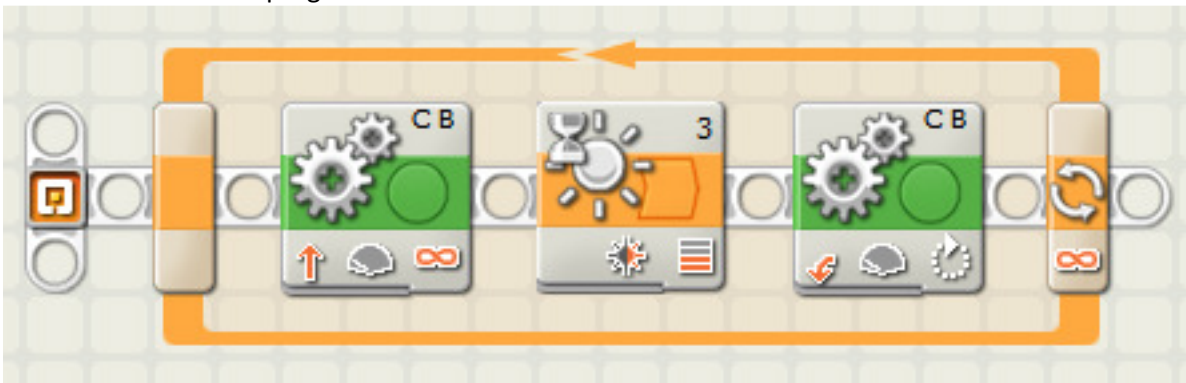
Create a rectangular loop of black electric tape, and modify a Lego Mindstorms NXT robot to point its light sensor down at the ground. The robot should move around the loop, following the path of the black tape. A similar version of this activity can be achieved by building walls with a large box, and using the distance sensor instead of the light sensor.

Hands-on Activity

Duplicate the demonstration. The “wall” version of this activity may be less abstract, and easier to understand for children who think in more tangible terms.

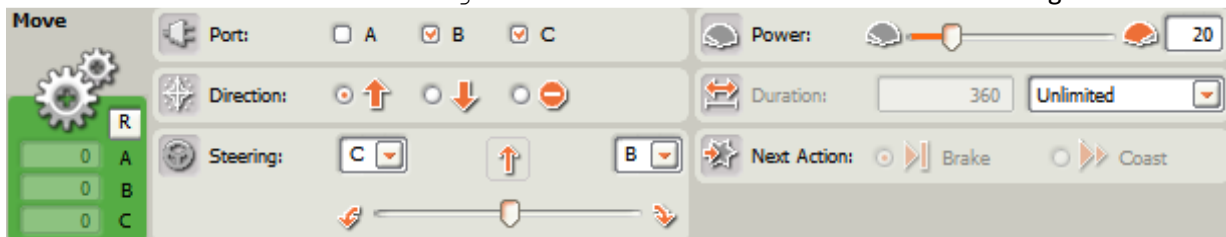
Sample Code

This is what the finished program should look like:



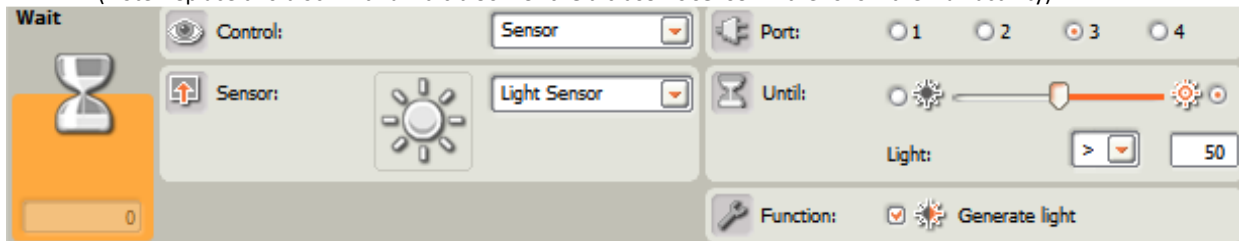
Begin by placing a **motor block** on the block diagram:

- Lower the Power to level 20
- Change the Duration to Unlimited
- Make sure that the Direction is pointing forward
- Make sure that the Steering slider bar is in the middle in order to travel straight forward



Next, place a **wait block for the light sensor** as the second command on the block diagram:

- Change the *Until* slider to >50
- (Note: replace this block with a **wait block for the ultrasonic sensor** in the follow the *wall* activity)



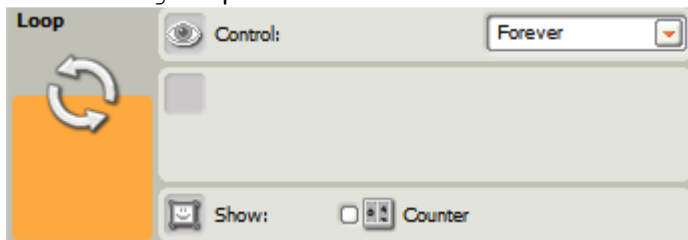
Now place another **motor block** on the block diagram:

- Lower the *Power* to level 20
- Change the *Duration* to 10 Degrees
- Make sure that the *Direction* is pointing forward
- Drag the *Steering* slider bar to the far left for a sharp left turn



Finally, place a **loop** onto the block diagram:

- Set *Control* to Forever
- Drag the previous three blocks into the loop in order to repeat them indefinitely



Engineering Concept(s) Walkthrough

Feedback loop (controls)

Feedback is a process whereby some proportion of the output signal of a system is passed (fed back) to the input. This is often used to control the dynamic behavior of the system. Examples of feedback can be found in most complex systems, such as *engineering, architecture, economics, thermodynamics, and biology*.¹

Closing discussion/bigger picture/apply to the real world

Remote controlled robots (e.g., NASA's Mars rovers), cruise control and fuel injection in automobiles

¹ Wikipedia, "Feedback", http://en.wikipedia.org/wiki/Feedback_loop

Elementary School Level (Bedroom Doorway Guard/Alarm)

Demonstration

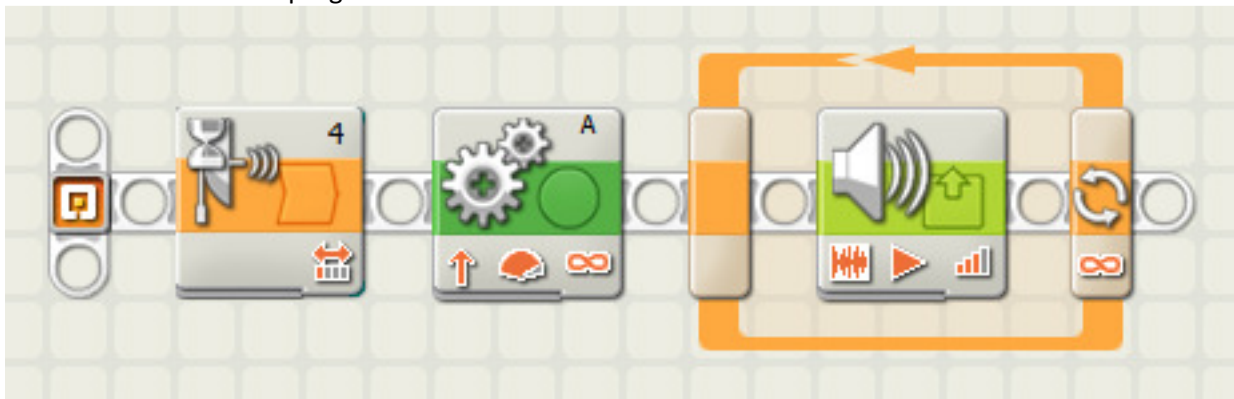
A Lego Mindstorms NXT robot will stand at the doorway at a fixed point. It will periodically scan left and right, through a 45 degree angle, with its distance sensor. If an object comes within 2-3 feet, spin the arm at 100% power and make loud noises. If desired, the robot can charge the target for 1 foot, before returning backwards to its original position.

Hands-on Activity

Duplicate the demonstration. May eliminate the left-right scanning and charging commands. These may be added during the second week of instruction.

Sample Code

This is what the finished program should look like:



Begin by placing a **wait block for the ultrasonic sensor** on the block diagram:

- Lower the `Until` slider bar to `<36`
- Make sure that `Show` is set to `Inches`



Next, place a **motor block** as the second command on the block diagram:

- Change the `Port` selection to `A only`
- Raise the `Power` to level `100`
- Change the `Duration` to `Unlimited`



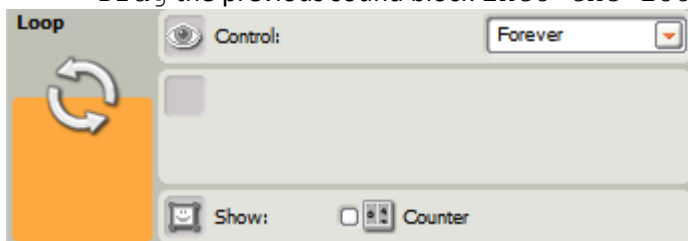
Now place a **sound block** on the block diagram:

- For the Action, select Sound File
- From File, select a sound of your choice, such as Shout



Finally, place a **loop** onto the block diagram:

- Set Control to Forever
- Drag the previous sound block into the loop in order to repeat it indefinitely



Engineering Concept(s) Walkthrough

Distance = Rate x Time

Ultrasonic sensors (also known as transducers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.²

Closing discussion/bigger picture/apply to the real world

SONAR, RADAR, motion sensors at supermarket doors or for driveway lights

² Wikipedia, "Ultrasonic sensor," http://en.wikipedia.org/wiki/Ultrasonic_sensor