

Robot Sensor Exploration

Sensors are used in everyday objects such as touch-sensitive elevator buttons and lamps which dim or brighten by touching the base. There are innumerable applications for sensors. You might even have a favorite toy that senses motion or sound. In this activity we explore the sensors in a robot and its applications.

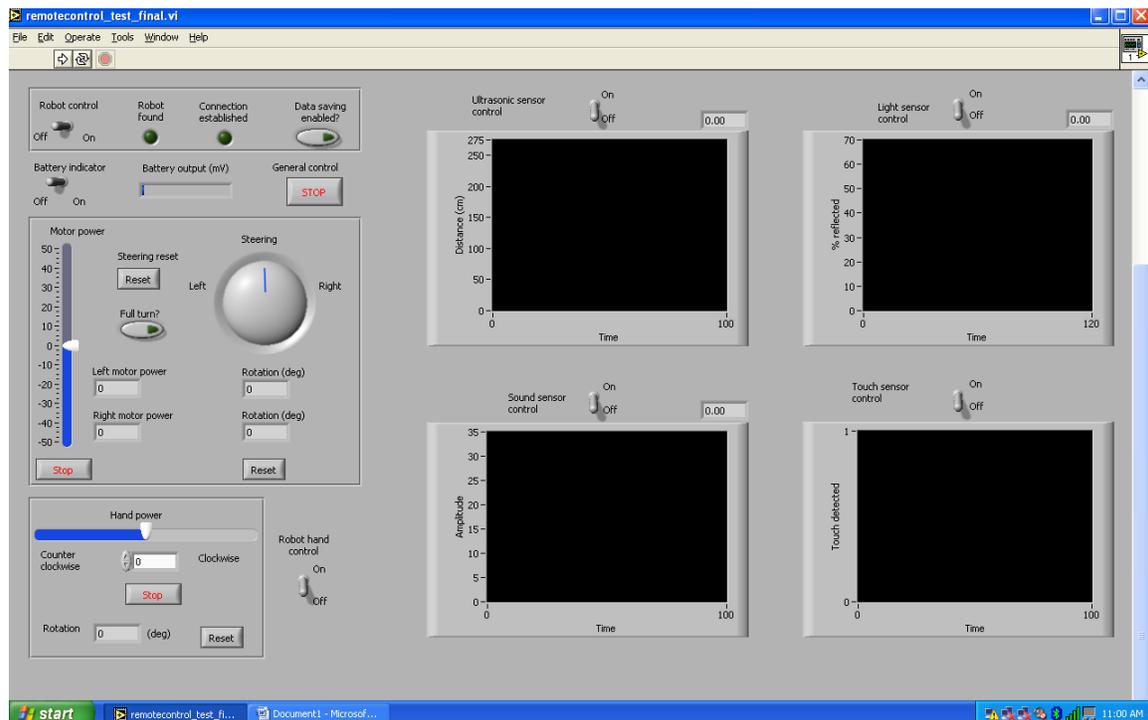
Explorer's Guide

Before You Start

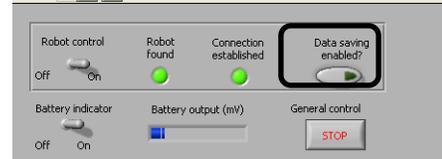
A student should volunteer to be the robot and your instructor should be the computer. The computer (instructor) can command the robot (student volunteer) to do simple commands like "move straight", "spin", "turn right", "tell me what you see", etc.

Learning by Doing

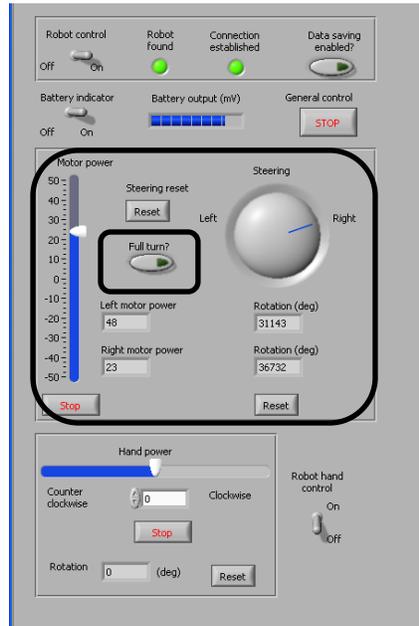
1. Establish a connection between the computer and the robot using Bluetooth menu of the NXT robot. Seek the assistance from your instructor if any error message occurs.
2. Start Robotics software as shown below. Provide the name of a log file.



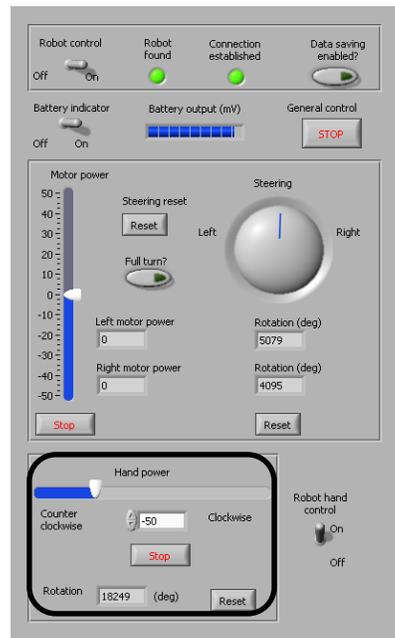
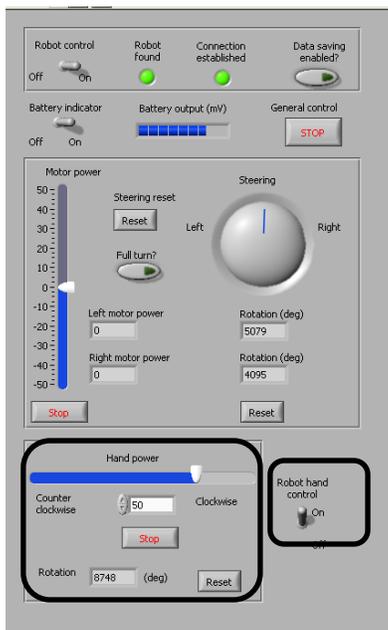
3. Turn on the Robotics control and Battery indicator. You will see the lights on when a connection is established. Disable data saving. Your screen should look as shown below.



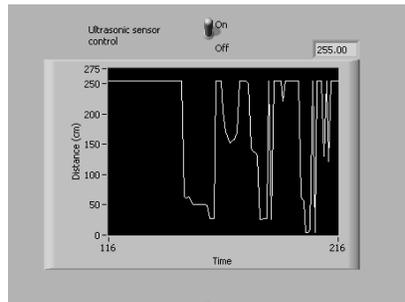
- Using the Motor power and Steering wheel navigate the robot across the room. Enable the Full Turn button to see the robot spin around.



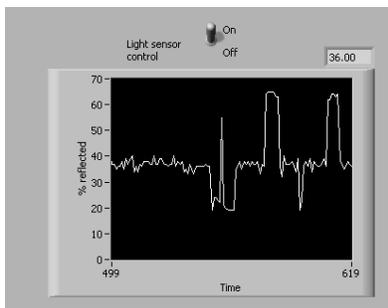
- Turn on the Robot hand control button and perform steering clockwise and counter clockwise rotation.



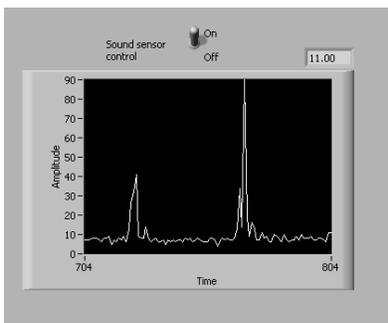
6. Turn on the Ultrasonic sensor control and navigate the robot to go near the wall. Observe the variations in the Distance vs. Time graph.



7. Turn on the Light sensor control and navigate the robot to go over a piece of white paper. Observe the variations in the %reflected vs. Time graph.



8. Turn on the Sound sensor control and yell while navigating the robot. Observe the variations in the Amplitude vs. Time graph.



9. Turn on the Touch sensor control and navigate the robot to go near the wall. Observe that the robot stops when the touch sensor touches something.
10. Now reset the steering and turn on the button for data saving and navigate the robot to go across the room.
11. Turn off the button once done. You can view your saved data in EXCEL.

How Does It Work

The Lego Mindstorm NXT kit includes four sensors, each with a different capability. The touch sensor detects whether it is currently pressed, has been bumped, or released. The light sensor detects the light level in one direction. The sound sensor has a microphone and can be used to detect a sound's amplitude (loudness). The ultrasonic sensors calculates the time interval between sending the signal and receiving the echo to determine the distance to an object. There

are a number of other sensors that can be added to the NXT robot, including: compass, accelerometers, near-infrared light sensor, etc.

In this activity, it is vital to establish a wireless communication with the robot and computer. We expect a periodic communication between the computer and the robot to change the current status of the robot and to plot various graphs for each sensor.



Additional Challenge

Drive the robot towards the wall with the data saving button enabled. What do you see in the ultrasonic sensor graph?

Vocabulary

Sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument.

Remote control is an electronic device used for the remote operation of a machine.

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