Demonstration points: (NOTE: these change based on the lab - enter the demo tasks specified in each lab)

Use at least 3 sensors and the motors to do something that would seem cool to a middle school kid using the LabVIEW NXT Toolkit _____

Post a YouTube video of complete cycle of operation _____

General Learning Objectives:

The general learning objectives of this lab was to become familiar with using the NXT Toolkit in LabVIEW. The users were to convert the previously constructed program which was created using the LEGO Mindstorm NXT software into a LabVIEW program.

General Steps Needed to Complete the Lab:

The general steps needed to complete this lab were to convert the NXT algorithm for the robot built into a LabVIEW algorithm. Once the software was completed, it is to be tested in order to ensure similar operations to that of the NXT algorithm previously programmed into the robot.

Procedure/ Detailed Steps to Complete the Lab:

The lab experiment was broken down into 6 steps:

1. The first step in this lab was to get acquainted with the LabVIEW environment. This would include understanding what each of the graphical icons, pertaining to what the sensors and motors, mean and how they are programmed. This was done by creating simple algorithms and uploading the program to the NXT controller. The program was then run and was tested in order to determine what each of the graphical icons did within the programs' structure.
2. The second step was to convert the NXT program previously created using the Mindstorm software to a LabVIEW program. The algorithm that was illustrated in Lab 0 is as follows:
    a. The robot starts after push button is pressed.
    b. The robot then moves forward and continues to move forward until the ultrasonic sensor detects an obstruction within 5 centimeters.
    c. If an obstruction was detected, then the robot moves backwards and the light sensor will be activated.
    d. The robot continues to move backwards until a white light is detected.
    e. If a white light of maximum intensity that can be detected by the sensor is detected, then the robot plays the C# note for one second.
    f. The robot continues to move backward and the sensor awaits detection of maximum darkness intensity. If a dark intensity is detected, then the robot plays the A note for one second and the backward motion continues.

g. The robot continues to move backward and the sensor awaits detection of maximum brightness intensity. If a bright intensity is detected, then the robot plays the C# note for one second then the robot begins to move forward and the noise sensor activates.
h. If the noise sensor detects a sound greater than 40 dB, then the robot stops moving.
i. If the robot is not moving, it can resume motion in the forward direction when the noise sensor detects a sound greater than 40 dB.
j. The forward motion continues and the steps b-i are repeated.

The robot was assembled by interfacing the ultrasonic sensor to port 4, the light sensor to port 3, the noise sensor to port 2, the touch sensor to port 1, and the motor to port B. This is illustrated by Figures 1 and 2, respectively.

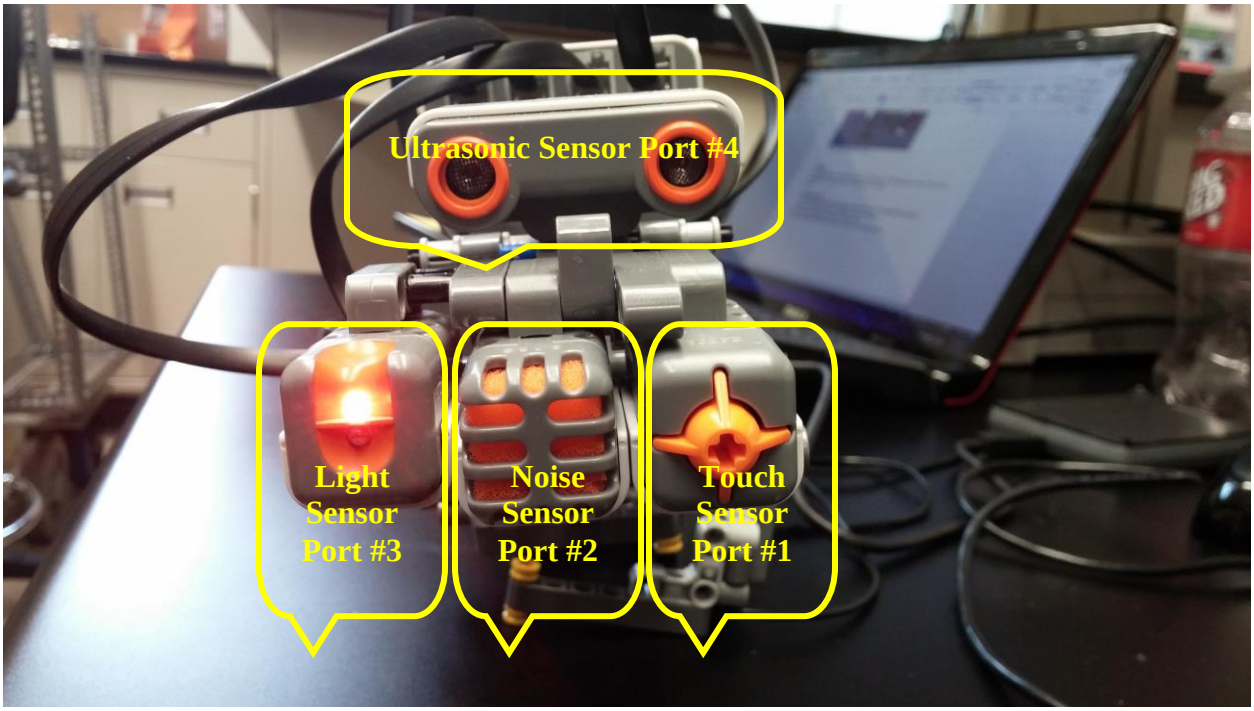

Figure 1: Sensor position on the robot

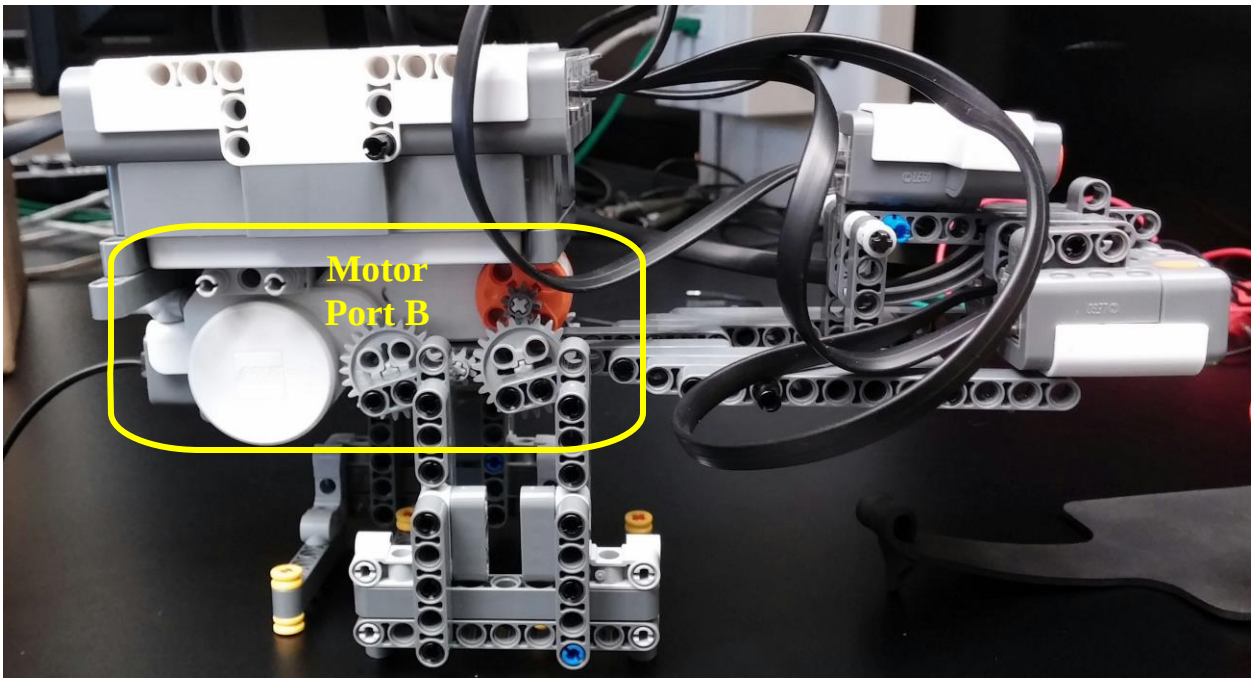

Figure 2: Motor position on the robot

3. The ultrasonic and noise sensor were programmed with values 5 centimeters & 40 dB respectively as per the algorithm. The motors were programmed for 50% power. The relevant audio files were selected for the output of the speaker. Adequate delays were inserted before activating sensors for proper functioning. One iteration of the program as per the algorithm was placed inside the while loop for continuous operation. The implementation in LabVIEW is shown by Figures 3-5.

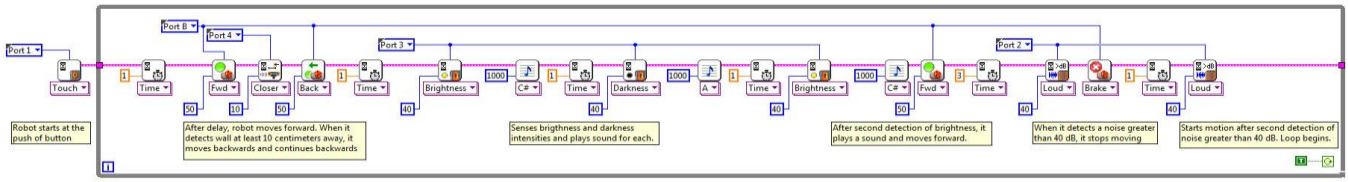

Figure 3: Full LabVIEW code

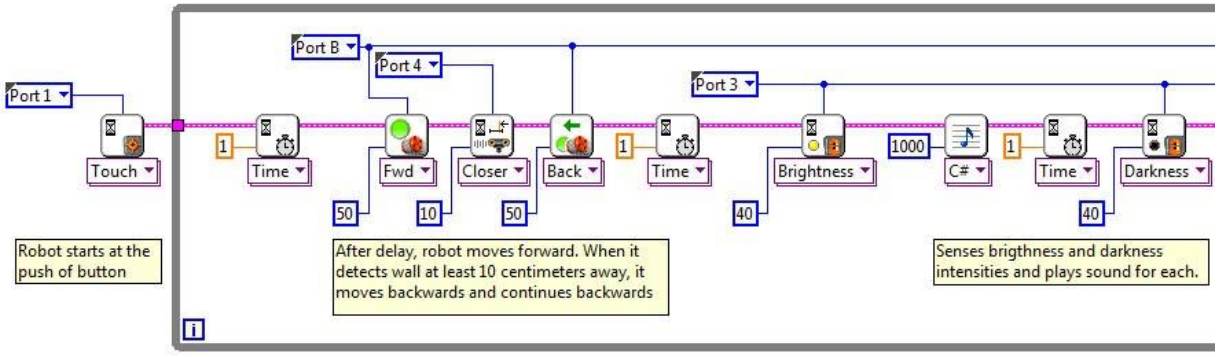

Figure 4: First half of LabVIEW code

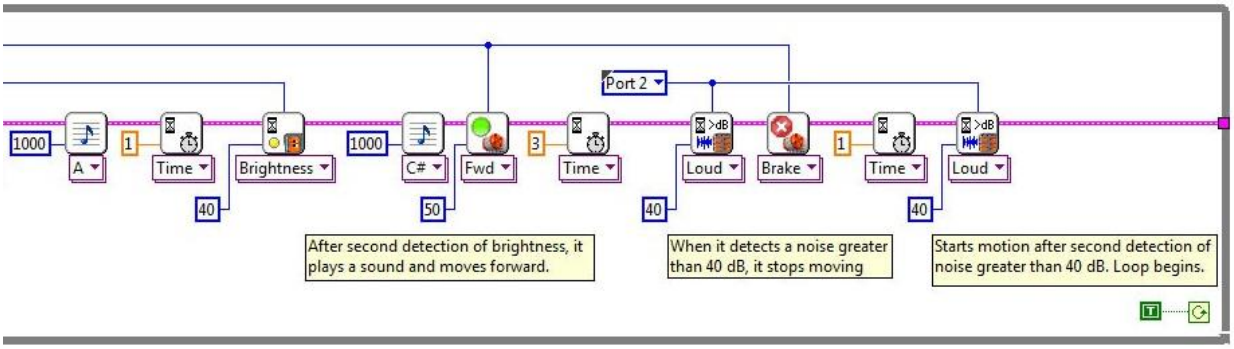

Figure 5: Second half of LabVIEW code

4. The previous LEGO MINDSTORMS NXT code for the Lab 0 is shown in the Figures 6-8 .Comparing both the codes we realize that the LabVIEW code doesn't have starting point as the LEGO MINDSTORMS NXT has.

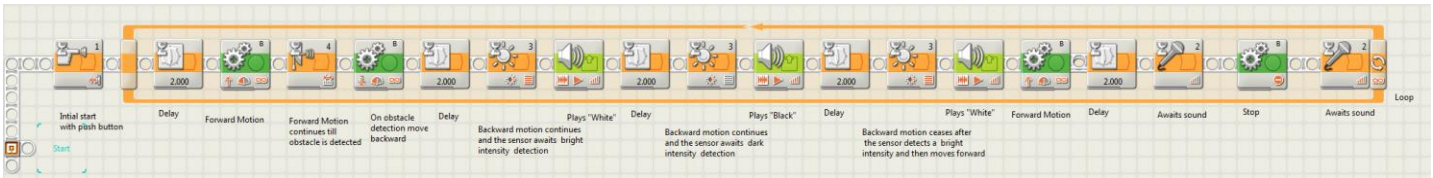

Figure 6: Full Lego Mindstorm code

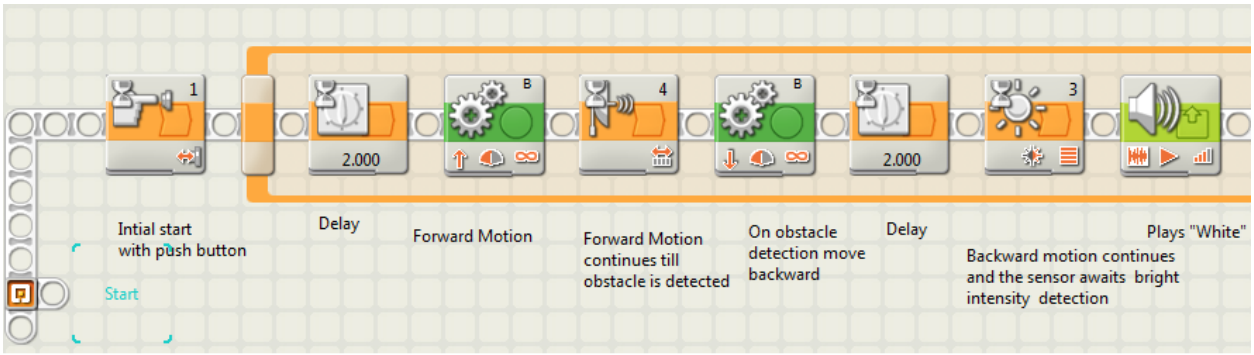

Figure 7: First half of Lego Mindstorm code

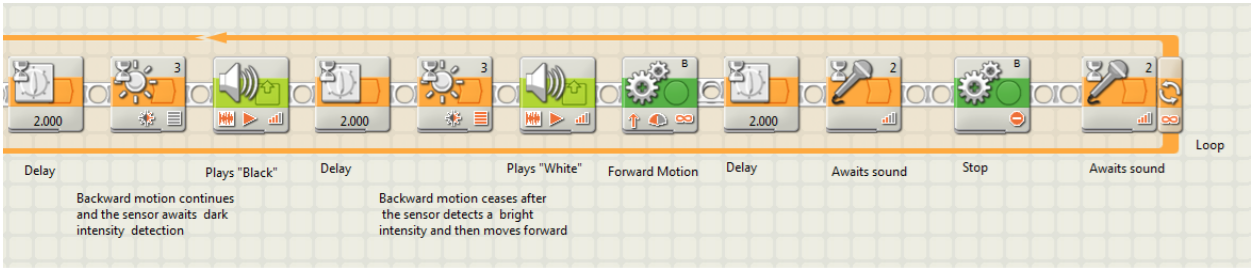

Figure 8: Second half of Lego Mindstorm code

5. The limiting values for the sensors are also different. The limiting values for the sensors like light, noise & ultrasound are on a scale of 100 for the NXT whereas they aren't on that scale for the LabVIEW graphical icons.
6. In LabVIEW graphical code port numbers & scaled values can be added to the device icon in the back panel window as compared to the LEGO MINDSTORMS NXT.

Observations while completing/testing the Lab:

There were several observations that were made while completing this lab experiment. Some important observations that were made were that before being able to successfully program using LabVIEW, the users must first be able to identify and understand how each of the graphical icons function. It was also observed that the graphical icons for both the NXT and LabVIEW were similar in their functionality. One last observation that was made was that by using various functional blocks, a whole system can be designed in LabVIEW.

Lesson Learned:

In this lab we learned the following concepts & implementations.
a. Usage of LabVIEW to configure & control various sensors like ultrasonic, bump, light & noise sensors.
b. To control motor & microphone output actions.
c. The usage of a while loop structure to re-iterate program flow.

Youtube Video of Robot:

https://www.youtube.com/watch?v=5YWpenpNeDM&feature=gp-n-y&google_comment_id=z12phjfixtnwehyy304ccpjgmnqiypughb0