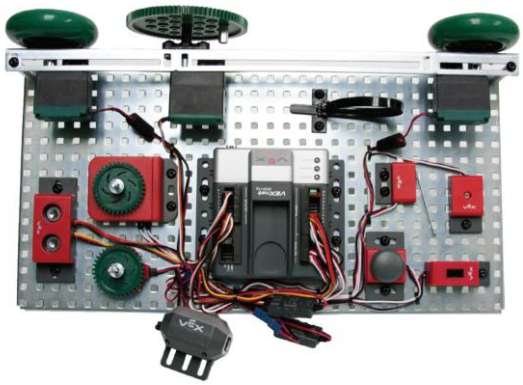
Activity 3.1.6 Open and Closed Loop Systems – VEX

Introduction

Many devices function without ever knowing whether they are doing the job that they were programmed to do. They might run for a specific amount of time or perform one function and then stop. For example if you set the clothes dryer to run for 45 minutes, your clothes might be dry or they might not be dry. A clothes dryer is an open loop system because the process provides no feedback to the device. Newer clothes dryers possess moisture sensors. The moisture sensors inform the machine when the clothes are dry, at which point the dryer can stop running. The feedback provided by the sensor makes this a closed loop system.

Equipment

- Computer with ROBOTC software
- POE VEX® testbed
- PLTW ROBOTC template



POE VEX Testbed

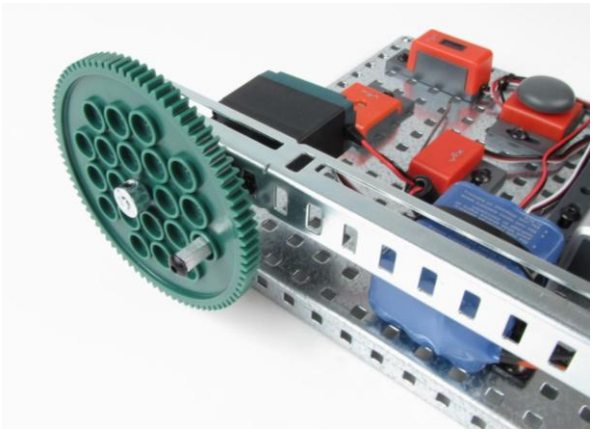
Procedure

In this activity you will design an open loop program to control a motor to oscillate. Then you will design a closed loop system utilizing feedback from an input to control the motor.

1. Modify the test bed so that the left motor has a gear attached as shown below.
    a. Remove the wheel from the left motor.
    b. Thread a ¾ in. bolt through a ½ in. standoff.
    c. Insert this through the gear as shown and thread a ½ in. standoff onto the bolt.
    d. Install gear assembly on the left motor.

Install Standoffs on Gear

Gear Assembly



Gear Assembly on Motor

2. Open the PLTW ROBOTC template. Click File, Save As, select the folder that your teacher designated, and then name the file A3_1_6_Part1.
3. Write a program that will oscillate the motor 0.5 s each way 20 times. Add comments in your program to explain the purpose of each step. Print the program to submit with this activity. Save the program.

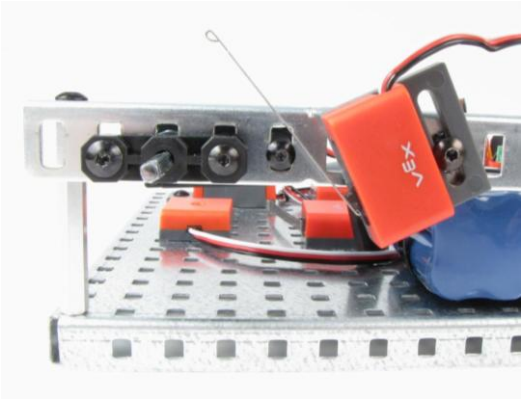
4. Where did the indicator bar stop? Is this an open loop or closed loop system?

5. Where do you think the gearbox would have come to rest had you set the program to cycle 120 times?

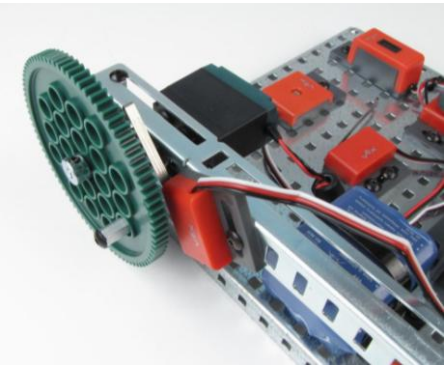
6. Obtain the teacher's approval before proceeding to the next step.

   Instructor's Signature _____ Date _____

7. Modify the test bed so that the left motor has a gear attached as shown below.
   a. Remove the gear assembly from the left motor.
   b. Add a limit switch as shown below. The position may need to be altered slightly in a subsequent step.
   c. Install gear assembly on the left motor.
   d. Adjust the limit switch position so that the standoff activates the limit switch (listen for an audible click to verify activation).
   e. Rotate the gear so that the indicator standoff is against the limit switch.



Limit Switch on Left Motor



Gear Assembly Installed

8. Open the PLTW ROBOTC template. Click File, Save As, select the folder that your teacher designated, and then name the file A3_1_6_Part2.
9. Develop a program that will oscillate the motor each way 20 times. One direction will use the limit switch sensor input. The opposite direction will use a 0.5 s time limit. Begin with the standoff resting against the limit switch. Run the program and observe the final resting place of the indicator standoff. Add comments in your program to explain the purpose of each step. Print the program to submit with this activity. Save the program.

10. Where did the indicator standoff stop? Is this an open loop or closed loop system?

11. Where do you think the gear assembly would have come to rest had you set the program to cycle 120 times?

12. What problems and inefficiencies might this process cause if it were used in an assembly mechanism designed to run 24 hours per day for several days?

13. Obtain the teacher's approval before proceeding to the next step.

Instructor's Signature _____ Date _____

Conclusion

1. Describe an open loop system that has not already been given as an example. Could the system benefit from feedback? Justify your answer.

2. Describe a closed loop system that has not already been given as an example. Describe the feedback utilized. Explain why this type of feedback is utilized.