

Problem 4.2.4

Microcontrollers: Tollbooth Revisited

INTRODUCTION

Previously you created a tollbooth that was controlled as a state machine using an FPGA. In this lesson you are asked to integrate one of the new sensors or human input devices to the assembly and control this new tollbooth with a **microcontroller** .

You may choose which new sensors or human input devices to use, or your instructor may assign you specific design requirements.

Although the VEX® 2-Wire Motor is designed to operate with 7.2 V, the motor controller 29 allows the motor to act as a **servo**  within tolerances at 5 V. You do not need an H-Bridge for this design, since you are only operating one servo.

EQUIPMENT

- Circuit Design Software (CDS)
- Digital MiniSystem (DMS)
 - myDAQ
 - myDigital Protoboard
 - PLTW S7 FPGA Module
- Resistors
- VEX® Tollbooth Kit
- Variable power supply or 4 AA Batteries with holder
- #22-gauge solid wire



Procedure

Design

Your tollbooth should:

- Open when the (Open Pushbutton) is pressed and light up an LED indicator when the (Open Limit) has been hit.
- Close when the (Close Pushbutton) is pressed and light up an LED indicator when the (Close Limit) has been hit.
- Have the LED output and motor output remain on until the clear push-button is pressed. This requires the push-button to be latched with a flip-flop.
- Incorporate one of the new sensors or human input devices that you learned about in this lesson.

Note: The design does not necessarily need to behave as a state machine unless required by your instructor.

Design Proposal

Write a project proposal to your instructor describing your design intent and what sensor/human input device you would like to incorporate. Your instructor will outline how to deliver your proposal. Upon approval, you may begin creating your design.

Note: Your instructor may assign a specific design based on availability of sensors and human input devices.

CONCLUSION

Using your engineering notebook as a guide, write a conclusion (minimum 250 words) that describes the process that you used to design, simulate, and build your Tollbooth circuit. This conclusion must include all of your design work, preliminary and final schematics, parts list, and a digital photograph of your final circuit. The documentation should be complete enough that another student, with the same knowledge of digital electronics, could reproduce your design without any additional assistance.
