

# Embedded Systems Design

## EECE 4038C, Embedded System Design

Ranga Vemuri

### Laboratory Assignment – 2

#### Preparation:

Go through Chapters 4-5 in “What’s a Microcontroller?” (version 3.0) and perform all the activities described in these chapters on the Basic Stamp 2 HomeWork Board.

#### Assignment:

1. Using your Parallax Basic Stamp HomeWork Board and kit, determine the highest and lowest RCTIME values corresponding to the two extreme positions of the potentiometer knob as requested on page 153 of “What’s a Microcontroller?” book. Use these values in the rest of this assignment when needed.

Using the knowledge you have gained from these activities, develop the following embedded systems using the Basic Stamp 2:

#### 2. Rudder Controller

The rudder of a ship is controlled by a microcontroller which in turn receives input from a power steering. The rudder has an angular range of  $\pm 45^\circ$  from the neutral position. You are required to design a prototype demonstrating a microcontroller for this situation. Use entire range of rotation of the wiper of a potentiometer to model the power steering. Use the servo horn 45 degrees to 135 degrees range to model the rudder position. Moving the pot knob to a desired position should move the servo horn to the corresponding position and hold.



### 3. Wiper Controller

The windshield wiper of an automobile moves within the angular range of 15 degrees to 160 degrees. It moves at different speeds based on the setting selected by the driver by rotating a “smooth” rotary knob. A microcontroller receives input from the rotary knob and controls the speed of the wiper assembly. You are required to build a prototype microcontroller demonstrating this situation. Model the rotary control using the knob of the potentiometer. Use the entire range of the pot such that one end represents the zero speed setting and the other end represents the maximum speed setting. Use the servo motor to represent the wiper assembly. The horn should imitate the motion of the windshield wiper, moving at different speeds as smoothly as possible based on the position of the pot’s knob.



Remember all the precautions discussed in the class and the current source/sink limitations of the microcontroller.

Include photographs of your circuit setups in your report. Submit the PBASE programs as separate files.

In addition note that,

1. Your report must include a flow chart for your solution.
2. You must draw the circuit diagram and include a photograph of your circuit setup. You must describe the design decisions made during the circuit design process and any other alternative designs you have considered.
3. Your code must be well documented and must correspond to your flow chart.
4. You must use macros and subroutines wherever appropriate to improve modularity and maintainability of the code.
5. You must use a good template design for your program, following the coding practices you have noticed in your reading assignments.
6. You must discuss the algorithmic, circuit design and programming choices you have made while developing this solution.