EE 109 - Fall 2021

Project - Rangefinder

Name: _____

Lab ☐ 12:30 W ☐ 2:00 W ☐ 3:30 W
Section ☐ 11:00 F ☐ 12:30 F ☐ 2:00 F

TA/Instructor initials: _____

Item	Outcome	Score	Max.	
Rangefinder Operation (15 points)				
Checkpoint 1				
• Splash screen with student's name	Yes/No		1	____
• Measures distance, handles out-of-range case	Yes/No		4	____
• Range display changes in 0.1 cm steps	Yes/No		1	____
Checkpoint 2				
• Encoder adjusts near and far distance thresholds between 1 and 400cm with minimum 5cm separation	Yes/No		3	____
• Near and far distance thresholds stored in EEPROM	Yes/No		1	____
Checkpoint 3				
• LED shows correct colors for various distances	Yes/No		4	____
• Buzzer sounds for range below near threshold	Yes/No		1	____
Code Organization (15 points)				
• Code is indented properly and includes comments	Yes/No		1	
• Program broken into separate files based on function	Yes/No		1	
• Correctly initializes appropriate I/O ports	Yes/No		1	
• EEPROM data checked for valid value	Yes/No		1	
• TIMER1 initialized correctly	Yes/No		1	
• ISR used correctly to measure echo pulse width	Yes/No		2	
• Distance calculation **does not** use floating point	Yes/No		2	
• TIMER2 used correctly for PWM signal	Yes/No		1	
• Buzzer uses TIMER0 for delay	Yes/No		1	
• Review Question 1: Cost analysis provided and reasonable	Yes/No		2	
• Review Question 2: Sensible and well-thought-out response to potential reliability issues and mitigation	Yes/No		2	
Open ended comments:				

Review Problems

1. Cost Analysis: Assume we are building 1000 units of this system. Use the provided part numbers (see the webpage) and the digikey.com or jameco.com website to find the total cost per unit (again assume we build a quantity of 1000 units) for these range finding systems. Itemize the part costs (list each part and its unit cost when bought in units of 1000) and then show the final cost per unit below. Note: You only need to price the components used in the project (not all the components in your lab kit. Also, you do not need to account for the cost of the circuit board or wires. In a real environment we would manufacture a PCB (Printed Circuit Board). As an optional task, you can search online for PCB manufacturers and what the costs and options are in creating a PCB.

2. Reliability, Health, Safety: Assume this system was to be used in a real industrial monitoring application.

- What scenarios might you suggest testing (considering both HW and SW) before releasing the product for use?
- How might you make your design more reliable? By reliability we don't just mean keeping it running correctly (though you should consider that), but also how you can detect that a connected component has failed to gracefully handle such situations. You can consider both HW and SW points of failure, issues related to the operational environment, etc. and how to mitigate those cases.