Prototype Design

F2019 – Edit this document into a deliverable.

Lab Section: | 3 | Group: | 1

Necessary Changes and Notes

Answer these questions by editing and adding to Table 1 and Table 2 below.

Table 1: What changes had to be made to get your Feasibility Model working as expected?

Table 1: Necessary Design Changes

#	Change	Reason/Notes
1	Move zone setting information from LEDs to screen	Lack of GPIOs

Table 2: Lessons Learned – Is there anything you want to remember so that you don't make the same mistake again? Or, not waste time on something you already figured out?

Table 2: Important Notes

#	Note
1	MSP430FR4133 datasheet lists clock frequency as 16 MHz, but that's just a max freq. When using Timer_A counter, SMCLK was 8 MHz, so we needed to divide by 8 in order to count every microsecond. This caused problems for getting accurate readings on the ultrasonic sensors, which need to measure the time it takes for sound waves to echo back.
2	Pulldown resistors were needed for the keypad row inputs to ensure the voltage is never floating

Signal Specifications

Answer these questions by editing and adding to Table 3 below.

Table 3: For all the important signals in your Prototype:
- Name the signal
- State which signal property is important (voltage, frequency, rise time, etc.)
- State whether you need to include a Test Point (TP) on the PCB so you can probe the signal
- State which software mode will let you test the signal as indicated
  - You may need to create a special test mode in your code to exercise the signal to its limits
- State the Minimum (Min), Nominal, and Maximum (Max) acceptable values for that signal property, as appropriate
- Include signals for attached components, modules, sensors, etc. Do not include power rails.

Table 3: Hardware Signal Test Plan

Signal (TP*)	Property	Required Software Mode	Min	Nominal	Max
PWM Out (X)	Voltage	Buzzer on	1.0 Vp-p	3.0 Vp-p	20 Vp-p
	Period	Buzzer on	100 μs	250 μs	5000 μs
	Duty Cycle	Buzzer on	10 %	50 %	90 %
ADC In (X)	Voltage	N/A – Mic Read	2.7 V		5.5 V
Ultra_Trig (X)	Voltage	N/A – Ultrasonic Sensor	0 V		3V3
	Pulse Width	N/A – Ultrasonic Sensor		10 μs	
Keypad_Out	Voltage	Keypad Input	0 V		3V3
Keypad_In	Voltage	Keypad Input	0 V		3V3

*Indicates Test Point Required

Signal Mapping

Answer these questions by editing and adding to Table 4 below.

Table 4: How will your Prototype design electrically connect to the LaunchPad?

MSP430FR4133 IC pin <--> BoosterPack pin on J1/J2 of the LaunchPad <--> Your Prototype

Table 4: Hardware Signal Connectivity

Signal	MSP430FR4133 Pin	LaunchPad J1/J2 Pin	Prototype Connection
ADC In	P8.1	J1 pin 2	Mic In
GPIO Out	P2.7	J1 pin 5	Ultra1, Ultra2, Ultra3, Ultra4 Trig
GPIO In	P8.0	J1 pin 6	Ultra1_Echo
GPIO In	P5.1	J1 pin 7	Ultra2_Echo
GPIO In	P2.5	J1 pin 8	Ultra3_Echo
GPIO In	P8.2	J1 pin 9	Ultra4_Echo
GPIO Out	P8.3	J1 pin 10	LED
GPIO In	P1.5	J2 pin 11	Key_Row2
GPIO In	P1.4	J2 pin 12	Key_Row3
GPIO Out	P1.3	J2 pin 13	Key_Col3
GPIO In	P5.3	J2 pin 14	Key_Row4
GPIO Out	P5.2	J2 pin 15	Key_Col1
GPIO In	P5.0	J2 pin 17	Key_Row1
GPIO Out	P1.6	J2 pin 18	Key_Col2
PWM Out	P1.7 (PWM)	J2 pin 19	Speaker Vin