

Prototype Design

S2019 – Edit this document into a deliverable.

Lab Section: 001

Group: 12

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	Shift all keypad column pins to GPIO port 1 on Launchpad	Vectored interrupts are only supported on GPIO port 1.
2	Hooked up ultrasonic sensor trigger to PWM pin 1.7 on Launchpad.	Could not use Timer A to generate a 10uS pulse for triggering the ultrasonic sensor.
3	Needed to connect jumper wires to the female side of the Launchpad.	There was interference between GPIO signals if the female side of the jumper cables was connected to the male side of the Launchpad.
4	Had to change the Timer A pulse to 11 uS	The 10uS pulse was too short, while with an 11uS pulse, the ultrasonic sensor was triggered.
5	Add diodes to keypad rows	This is to prevent shorting in case 2 buttons are pressed at the same time

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	Port 5 on the MSP board does not support any vectored interrupts
2	The Ultrasonic sensor response is embedded in the response signal itself, and not in the timing difference between corresponding trigger and echo

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
- 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
ECHO*	Pulse Width	Distance Measuring On	116us		23.2ms
TRIG*	Pulse Width	Distance Measuring On		10us	11us
RED LED	Voltage	Distance Measuring On	0V		3.3V
ORG LED	Voltage	Distance Measuring On	0V		3.3V
YEL LED	Voltage	Distance Measuring On	0V		3.3V
GRN LED	Voltage	Distance Measuring On	0V		3.3V
KPD_C1*	Voltage	User Input On	0V		3.3 V
KPD_C2*	Voltage	User Input On	0V		3.3 V
KPD_C3*	Voltage	User Input On	0V		3.3 V
KPD_R1*	Voltage	User Input On	0V		3.3 V
KPD_R2*	Voltage	User Input On	0V		3.3 V
KPD_R3*	Voltage	User Input On	0V		3.3 V
KPD_R4*	Voltage	User Input On	0V		3.3 V

**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
PWM Out	P1.7 (PWM)	J2 pin 19	Distance Sensor Trigger
ECHO IN	8.1	J1 pin 2	Distance Sensor Echo
KEYPAD_R1	1.6	J2 pin 18	Keypad Row 2
KEYPAD_R2	5.3	J2 pin 14	Keypad Row 1
KEYPAD_R3	5.2	J2 pin 15	Keypad Row 4
KEYPAD_R4	5.0	J2 pin 17	Keypad Row 3
KEYPAD_C1	1.3	J2 pin 13	Keypad Column 1
KEYPAD_C2	1.4	J2 pin 12	Keypad Column 2
KEYPAD_C3	1.5	J2 pin 11	Keypad Column 3
LED_RED	8.0	J1 pin 6	Red LED Resistor
LED_ORG	2.7	J1 pin 5	Orange LED Resistor
LED_GRN	1.1	J1 pin 3	Green LED Resistor
LED_YEL	1.0	J1 pin 4	Yellow LED Resistor