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 |