Prototype Design

F2019 – Edit this document into a deliverable.

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| --- | --- | --- | --- |
| Lab Section: | 1 | Group: | 22 |

# 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 : Necessary Design Changes

|  |  |  |
| --- | --- | --- |
| # | Change | Reason/Notes |
| 1 | Remove the keypad entirely | After trying to implement the keypad and the workload associated with getting that right, we decided to steer clear of using the keypad and are now using a button implementation instead. |
| 2 | Add resistors to step up and down the voltage signals | We were unaware of the voltage difference that we had to add to the MCU connection with the IO pins. After this, we added our resistors for the feasibility design. For the final model we will create our own step and down device out of a MOSFET and resistors. |
| 3 | Ultrasound sensor output code | We were also unaware that the showHex() function outputs numbers in Base 4. For a while, we thought our sensor was buggy and started finding ways to get around the bug; until we found out about the base display. Now, we are using our own function to display sensor values in base 10. |

**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 : Important Notes

|  |  |
| --- | --- |
| # | Note |
| 1 | Understand the functions we are using at a deeper level. We ended up missing the base 4 part from showHex() and wasted a lot of time on finding the root problem when there was no problem at all. |
| 2 | Figure out the input/output voltage that each connection can handle so that we can properly flesh out the step up/step down logic and don’t ruin any of the pins/components. |
| 3 | We discovered that over time the LEDs would wear down faster if the current wasn’t limited. To fix this problem we added a resistor for current limiting. |

# 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.

**Note:** All the below signals occur only during user mode

Table : Hardware Signal Test Plan

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Signal (TP\*) | Property | Required Software Mode | Min | Nominal | Max |
| Echo 1(TP 1) | Voltage | Occurs after trigger pulse is sent (Ultrasonic Distance Sensor 1 input) | 0 V |  | 5 V |
| Echo 2(TP 2) | Voltage | Occurs after trigger pulse is sent (Ultrasonic Distance Sensor 2 input) | 0 V |  | 5 V |
| PWM(TP 3) | Voltage | Audio piezo on (Occurs when an object enters the user set thresholds of the front distance sensor) | 0 V |  | 3.3 V |
|  | Period 1 (First Threshold) | Audio piezo on (Occurs when an object enters the first user set thresholds of the front distance sensor) | 0 |  | 300 |
|  | Period 2 (Second Threshold) | Audio piezo on (Occurs when an object enters the second user set thresholds of the front distance sensor) High | 0 |  | 200 |
|  | Duty Cycle | Audio piezo on (Occurs when an object enters the user set thresholds of the front distance sensor) | 0% |  | 50 % |
| I/O 1(TP 4) | Voltage | Green LED on (Occurs when no objects are within the user thresholds) | 0 V |  | 3.3 V |
|  | Current | Green LED on (Occurs when no objects are within the user thresholds) | 0 A |  | 12 mA |
| I/O 2(TP 5) | Voltage | Orange LED on (Occurs when objects are within the first user threshold) | 0 V |  | 3.3 V |
|  | Current | Orange LED on (Occurs when objects are within the first user threshold) | 0 A |  | 12 mA |
| I/O 3(TP 6) | Voltage | Yellow LED on (Occurs when objects are within the second user threshold) | 0 V |  | 3.3 V |
|  | Current | Yellow LED on (Occurs when objects are within the second user threshold) | 0 A |  | 12 mA |
| I/O 4(TP 7) | Voltage | Red LED on (Occurs when objects are within the third user threshold) | 0 V |  | 3.3 V |
|  | Current | Red LED on (Occurs when objects are within the third user threshold) | 0 A |  | 12 mA |
| Trig 1(TP 8) | Voltage | Pulse sent periodically (Ultrasonic Distance Sensor 1 output) | 0 V |  | 3.3 V |
| Trig 2(TP 9) | Voltage | Pulse sent periodically (Ultrasonic Distance Sensor 2 output) | 0 V |  | 3.3 V |
| IVCC(TP 10) | Voltage | This is always on during User Mode | 0 V |  | 5 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 : Hardware Signal Connectivity

|  |  |  |  |
| --- | --- | --- | --- |
| Signal | MSP430FR4133 Pin | LaunchPad J1/J2 Pin | Prototype Connection |
| E1 | P8.2 (I/O!) | J1 pin 9 | Ultrasonic Distance Sensor 1 input |
| E2 | P8.3 (I/O!) | J1 pin 10 | Ultrasonic Distance Sensor 2 input |
| PWM | P1.7 (PWM) | J2 pin 19 | Audio piezo input |
| I/O 1 | P1.6 (I/O!) | J2 pin 18 | Green LED input |
| I/O 2 | P5.0 (I/O) | J2 pin 17 | Orange LED input |
| I/O 3 | P5.3 (IO!) | J2 pin 14 | Yellow LED input |
| I/O 4 | P1.3 (I/O!) | J2 pin 13 | Red LED input |
| T1 | P1.4 (I/O!) | J2 pin 12 | Ultrasonic Distance Sensor 1 output |
| T2 | P1.5 (I/O!) | J2 pin 11 | Ultrasonic Distance Sensor 2 output |
| IVCC | P8.1(I/O!) | J1 pin 2 | Ultrasonic Distance Sensor 1/2 VCC |