Prototype Design

F2019 – Edit this document into a deliverable.

|  |  |  |  |
| --- | --- | --- | --- |
| Lab Section: | 6 | Group: | 5 |

# 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 | Added Ultrasonic Distance Sensor for Front Directional Sensing (trig on pin 2.5, echo on pin 1.7) | The Ultrasonic Distance Sensor was not available at the time of the demo |
| 2 | Added Ultrasonic Distance Sensor for Back Directional Sensing (trig on pin 2.5, echo on pin 2.7) | The Ultrasonic Distance Sensor was not available at the time of the demo |
| 3 | Added voltage dividers for Ultrasonic Distance Sensors | To read from digital inputs on pin 1.7 and 2.7 the voltage has to be 3.3 V but the Ultrasonic Distance Sensor returns a 5 V echo response |

**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. LaunchPad is set to 2 MHz which shows internally as SMCLK at 1 MHz. This caused a lot of problems for getting TIMER\_A to work. |
| 2 | Carefully examine the circuit when debugging/testing the Feasibility Model. Not checking proper pin connections for debugging tools such as the oscilloscope caused a lot of time wasted doubting if the circuit was wired correctly. |
| 3 | MSP430FR4133 has a lot of examples online on using components in the board such as the timer. Using the examples helped demonstrate the usage of the component which helped in setting up the timer for the use of the bicycle sensors. |

# 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 |
| GND (X) | Ground | Any |  |  |  |
| 5V0 | Voltage | Any |  | 5 V |  |
| BE1 | Voltage | Back Ultrasonic Sensor Echo |  | 5 V |  |
| BE2 (X) | Voltage | Back Ultrasonic Sensor Echo - Divided | -0.3 V | 3.3 V | 4.1 V |
| FE1 | Voltage | Front Ultrasonic Sensor Echo |  | 5 V |  |
| FE2 (X) | Voltage | Front Ultrasonic Sensor Echo - Divided | -0.3 V | 3.3V | 4.1 V |
| Buzz | Voltage | Buzzer on | 0 V |  | 3.3 V |
| GLED | Voltage | Green LED on | 0 V |  | 3.3 V |
| YLED | Voltage | Yellow LED on | 0 V |  | 3.3 V |
| OLED | Voltage | Orange LED on | 0 V |  | 3.3 V |
| RLED | Voltage | Red LED on | 0 V |  | 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 |
| Digital In | P2.7 (I/O) | J1 pin 7 | Back Ultrasonic Sensor Echo Out |
|  | P1.7 (I/O) | J2 pin 2 | Front Ultrasonic Sensor Echo Out |
| Digital Out | P2.5 (I/O) | J1 pin 5 | Ultrasonic Sensor Trigger |
|  | P5.2 (I/O) | J2 pin 6 | Buzzer Signal |
|  | P5.3 (I/O) | J2 pin 7 | Green LED |
|  | P1.3 (I/O) | J2 pin 8 | Yellow LED |
|  | P1.4 (I/O) | J2 pin 9 | Orange LED |
|  | P1.5 (I/O) | J2 pin 10 | Red LED |
| Power | 5V | J3 pin 1 | 5V |
| Ground | GND | J2 pin 1­ | GND |