EE 149: Microcontroller Programming in C
Interfacing Sensors and Actuators with iRobot Create

Prelab Exercises

Read through the reference documents listed at the bottom of the lab guide (additional resources are optional). There are many documents; you should at least be familiar with the topics within each document before beginning this lab.

1. **Understanding the platform:**
   a. Which microprocessor is in the Luminary Micro LM3S8962?
   b. How many pins on the Luminary Micro can be used for general purpose input or output (GPIO)?
   c. Does the Luminary have native support for floating point operations?
   d. How many sensors are on the bottom of the iRobot? Given the placement of some of the sensors, what problems might this cause?
   e. What is the maximum sampling rate of the ADC on the Luminary Micro?
   f. For accelerometer signals, what frequency (or range of frequencies) is of interest? Would you implement a filter?
   g. Ideally, the X and Y axes of the accelerometer should both be at a 45° angle with respect to the front of the iRobot. In practice, there will be some skew. How might this affect your program, and what steps should be taken to counteract the error?

2. **Understanding the protocols:**
   a. According to iRobot OI, what sequence of bytes must be sent to drive the iRobot forward (straight), at a velocity of 300mm/s?
   b. What is the command sequence to request a single sensor packet from the iRobot?
   c. What is the command sequence to enable a continuous stream of sensor packets?
   d. What is the format of a sensor stream packet received from the iRobot, if the iRobot has been instructed to send a stream of packet ID 0?

3. **Understanding the architecture:**
   b. The template project contains several //TODO comments suggesting code additions. Qualitatively (ergo without writing any code) discuss these suggestions, and how you might extend the project template to achieve your goals.
   c. In the provided project template, the UART interrupt handler uses the xqueue data structure, which requires the size of the data buffer to be a power of two. Why is this size restricted, and to what benefit?
   d. At what frequency is the screen updated in the template project? Would you increase this value? Why not update continuously?
   e. How does the template account for lost or corrupted sensor packets (in both the case where iRobot sensors are polled or interrupts are used).