Lab 09: Zephyr ADC

Medical Electrical Equipment (BME590L)

2023-03-27

1 Enable ADC Measurements

- Create a new project based on your submitted timer-based blinking LED project.
- Keep your `sleep` and `reset` button functionality, but remove the blinking frequency increase and decrease button functionality.
- Enable ADC channel `AIN0` to use `ADC_REF_INTERNAL` and modulate the blink rate of `LED 3` on the DK to blink between 1-5 Hz as the voltage on `AIN0` ranges from 0-3.3 V using 8-bit resolution. For example, when V_{AIN0} = 0, blink rate = 1 Hz; when V_{AIN0} = 3.3 V, blink rate = 5 Hz, and everything in between.
  - It would be good to make this calculation of blink rate from voltage be its own function (to enable unit testing down the road).
  - The blink rates should not be hard-coded in the function, but specified using `#define` macros.
- Enable ADC channel `AIN1` to use `ADC_REF_VDD_1_4`[1] and modulate the blink rate of `LED 2` on the DK to blink between 5-10 Hz as the voltage on `AIN1` ranges from 0-3.3 V using 12-bit resolution. Follow the same coding guidelines as for `AIN0`.

2 Testing

- Using the power supply and oscilloscope:
  - Quantify how linear the relationship is between the voltage applied to `AIN0` and the `LED 3` blinking frequency.
  - Quantify how linear the relationship is between the voltage applied to `AIN1` and the `LED 2` blinking frequency.
- You can choose the best way to quantify this relationship.
- Generate a PDF showing your measurement data and associated analysis, and include this PDF in your submitted zip archive.

[1] The `nRF52833DK` can only use the 0.6 V internal reference or `VDD/4`.

3 What to Submit & Grading

This lab exercise is due Friday, March 24 at 17:00.[2]

- Upload a zip archive of your project to Gradescope. Your zip archive should include all of your project files to build your application **and** the PDF of your functional measurement analysis.[3]
- Please make sure that your uploaded zip archive does not include:
  - A `build/` directory.
  - A `.git/` directory.
  - Any Zephyr / Nordic SDK installation files (e.g., `ncs/`).
- Code will be graded on functionality **and** efficieny of code logic **and** code "readability". "Readability" does not mean a lot of verbose comments; it means that the structure of the code, the naming of variables, etc. convey meaning and logical flow.
- Rigor of your quantiative functional analysis will be evaluated. If the relationship is not as your expected, please include some discussion as to why this may be.

[2] Another lab exercise will be assigned before this is due, but the due date is delayed to give you time surrounding the upcoming spring break.

[3] If you are using a git repository, the zip archive you can download through the web interface should be appropriate.