Fundamentals of Embedded Systems Design & Programming

U.C. Irvine Division of Continuing Education

EECS X497.32

Instructor: Saleem Yamani

Programming Assignment: Temperature Sensor Using ADC

Analog to Digital Conversion (ADC)

- **Integrating**
  - Dual Scope
  - Voltage to Frequency
- **Voltage Comparison**
  - Successive Approximation
  - Tracking

ADC on Xmega256A3BU

- 12-bit A/D, 2 million samples per second
- Conversion times 2.5us(8 bit resolution), 3.5us(12 bit resolution)
- ADC Enable, bit 0 (ENABLE) in CTRLA (address:0x200)
- Read section 28 of Xmega AU Manual
  http://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-8331-8-and-16-bit-AVR-Microcontroller-XMEGA-AU_Manual.pdf

Programming Assignment:
Temperature Sensor Using ADC

main code:

- The skeleton code displays current temperature
- Desired temperature is same as current temperature in skeleton code.

Need to add the following logic to the existing code.

1. Set Desired temperature using switch switch1 to increase Desired temperature, and switch2 to decrease Desired temperature
2. If current temperature is equal to desired temperature, both LED0 and LED1 are off
3. If current temperature is above desired temperature, turn LED0 on, LED1 off
4. If current temperature is below desired temperature, turn LED0 off, LED1 on

Use LED_off() and LED_on() functions to control LED0 and LED1

Use gpio_pin_is_low() function to check GPIO_PUSH_BUTTON_1 and GPIO_PUSH_BUTTON_2 state

Programming Assignment: Temperature Sensor Using ADC

ADC configuration for assignment:
See adc_sensors_init()

- signed, 12-bit resolution
- VCC / 1.6 reference
- 31 kHz max clock rate
- manual conversion triggering
- callback function
- Configure ADC A channel 1 using NTC sensor
- single-ended measurement
- interrupt flag set on completed conversion
- interrupts enabled

Programming Assignment:
Temperature Sensor Using ADC

Reading Temperature data:
See read_temperature()

- Initiate a temperature sensor reading
- wait for NTC data to ready
- Read the temperature once the ADC reading is done