Experiment no.2

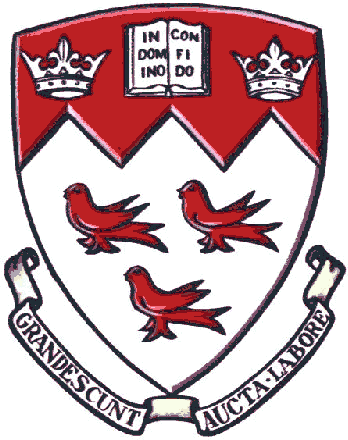
Sensor Data Acquisition, Digitizing, Filtering, and Digital I/O

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**Abstract**

The goal of the experiment presented in this report is to implement a temperature data acquisition system using the STM32F407 Discovery board and display the acquired data through the use of the on board Light Emitting Diodes (LEDs) in order to create a simple output display. This report will show how the built-in temperature sensor of the STM32F407 Discovery board as well as the analogue to digital converter and LEDs were used to achieve the desired system. It will also be shown how filtering of the raw data was done and how pulse width modulation was utilized in order to realize the desired display effects.

**Problem Statement**

In this experiment, the internal processor temperature sensor of the STM32F407 Discovery board is used to get temperature readings of the microprocessor that will be converted into a visual LED display in order to let the user know if the temperature is increasing, decreasing or if the temperature has reach an upper threshold. The display is to be created using the LEDs that are positioned in a diamond shape on the board (i.e. LED 3 to LED6). While in normal operation (i.e. below the upper threshold), only one LED should be on at any one time. For each increase of 2 degrees Celsius, the display should cycle through the four LED lights in a clockwise fashion. In other word, if LED3 is currently lit, after an additional increase of 8 degrees Celsius, the display should have cycled through the four LEDs and LED3 should be lit again. For every decrease of 2 degrees Celsius, the display should cycle through the four LEDs in a counter clockwise manner. If the temperature of the microcontroller exceeds an upper temperature threshold, the display should enter an overheating alarm mode. The alarm mode consists in the four LEDs simultaneously flashing in a fade-in/fade-out manner. When the temperature falls back under the threshold, the alarm mode should be exited and normal mode should resume. Several challenges are associated with the LED display. While in normal operation, the transitions between LEDs should be as definitive as possible (i.e. the LED should ideally not flicker back and forth during a transition from one LED to the next). While in the alarm mode, all four LEDs must smoothly fade-in and fade-out from all the way off to fully on in a cyclic manner. In alarm mode, the LEDs should not be flickering on and off.

**Theory and Hypothesis**

**Implementation**

**Testing and Observations**

**Conclusion**

**References**

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Appendix