AE6705 Lab 6: Data Acquisition

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1. *Compare the use of the internal system oscillator (which is a digitally-controlled oscillator) vs using a crystal oscillator for sourcing a clock. For what applications would you want to use a crystal rather than a digitally-controlled oscillator, and vice versa?*

   Digitally controlled internal system oscillator uses capacitor charge rate to generate frequency, it uses less power than crystal but isn't as precise. This might be more suitable for something like a thermostat that can be set to run at a certain time. Since the timing does not need to be super precise, and we want the device to consume low power and run for a long time, a DCO would be a more suitable clock.

   Crystal oscillator uses a piezoelectric material such as quartz that vibrates at precise frequency when a voltage is applied. However, it consumes more power as it needs a constant voltage supply. This would be used in something like a flight controller where precise timing is critical for real-time feedback control.

2. *Explain what is the difference between MCLK, MFCLK and LFCLK.*

   (a) **MCLK** is the main system clock, which runs between 32kHz and 80MHz

   (b) **MFCLK** is the medium frequency clock which runs at 4MHz

   (c) **LFCLK** is the low frequency clock which runs at 32kHz

   Generally speaking, the higher clock frequency corresponds to higher power consumption, since the system is constantly charging and discharging capacitors, so lower frequency clock would be better for lower power applications to help the battery last for longer.

3. *What are the advantages of the general purpose timer TIMG compared to SysTick?*

   SysTick can only be tied to MCLK, and the max period available for SysTick timer is $2^{24} = 16,777,216$ due to the size limit of the 24-bit register that stores the reload value / time period. If we need longer delays or different time triggers for different peripherals, SysTick might not be a suitable timer to use.

   TIMG is a general purpose timer that can be tied to other clocks, used to generate PWM signals, and tied to intterupts. Different timers can be configured differently if different peripherals need to run at different frequencies.