CoE 115 ME 2

March 28

1. Objectives

- To utilize the following concepts together
  - I2C
  - ADC
  - Timers and Interrupts
- To be able to build a temperature data logging system

2. System Overview

You will be designing a data logger system that will be tracking temperature vs time. Figure 1 shows a system diagram of the data logger:
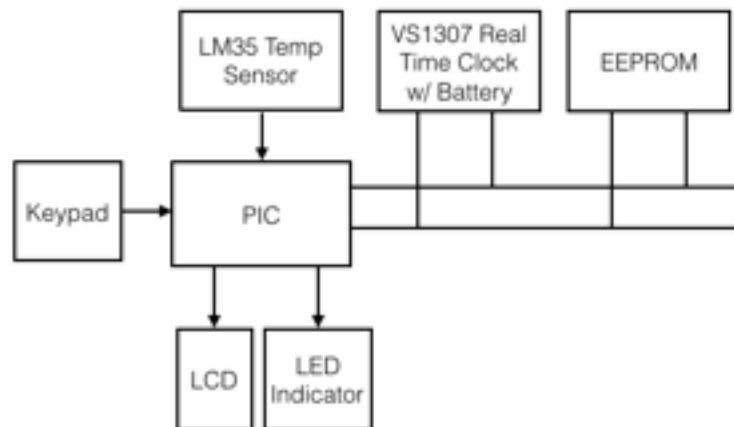

Figure 1. System Block Diagram

A keypad and LCD will serve as user I/O for the data logger.

3. Specifications

3.1. **Full Specifications**

On **first start up** the user will be asked to input current time and date. The LCD should initially display **HH:mm MM/DD/YYYY** (automatically set seconds as 00) on the bottom row and the user is prompted to input numbers using the keypad. (*) and (#) will be implemented as back and forward keys for the cursor. Once all numbers have been inputed, moving (#) after the last year digit will prompt a confirmation screen (Yes=# , No= *). Yes will write the date/time to the RTC and No will return to the previous screen.

The LCD should now display the current time/date in (HH:mm MM/DD/YYYY) on the top row. The LCD will now prompt the user for the setting of frequency of data logs. The user may choose between **5 seconds (0x01), 30 seconds (0x02) and 1 minute (0x03)**. Store the corresponding value in the EEPROM at 0x1FFF. This will determine how often the PIC will write both the time and temperature to the EEPROM. (Any interface for the selection will suffice, (#) should be used to confirm choice)

The system is now ready for data logging and will go into **data logging mode**. A data log

indicator LED should be set to blink (triggered to turn on for 100mS) every time the EEPROM is written to. The LCD should display the **last value** (Temperature and Time) written into the EEPROM and should also display the **current** Temperature and Time. If the maximum of **100 samples** is reached, the oldest value is overwritten. Storing data in the EEPROM ensures that the data is readable even after power off.

Each data point must be stored in the EEPROM in the following format:
Starting with address 0x0000:
8 bytes per datapoint
Lower 4 bytes = Temperature in Degrees Celsius in single-precision floating-point format
Upper 4 bytes = Date in the following format: HHmmMMDDYYYY

	Hours	Minutes	Month	Day	Year
Max Value	24	60	12	31	9999
No of bits	5	6	4	5	12

Table 1. Date Storage Format

While in **data logging mode**, the (#) button may be pressed to go into **data display mode**.

In **data display mode** pressing 2 and 8 in data view mode cycles through the values written to the EEPROM. Pressing 1 and 9 will display the oldest and newest value, respectively. Pressing (*) brings the system back into **data logging mode.**

If the system or components have already been set up previously, the system will go straight into **data logging mode**. The RTC and EEPROM **must** be checked for these settings (RTC is set up, EEPROM has values and/or frequency settings) at start up.

The data logger system must be able to read and handle any EEPROM or RTC module attached to it. For checking, the I2C components of the system must be modular. Specifications for these modules are in part 4.

3.2. Milestones
In cases where you are not able to make the full system work, the following partial systems may be considered. Each succeeding milestone supersedes the previous: if you reach a higher milestone, there is no need for you to achieve the lower ones. The full system discussed previously supersedes all milestones in the partial system. The following sections discuss partial system milestones from lowest to highest, and their respective points garnered if accomplished.

3.2.1. Milestone 1 (25%)
Current temperature is displayed on the LCD and logged into the EEPROM for a hard coded set time interval (<30 seconds). Pressing any button will stop the logging and display previously logged data. Keypad can be used to go through previous logs using 2 and 8.

3.2.2. Milestone 2 (40%)
Same as above except with RTC also implemented and saved on the EEPROM.

3.2.3. Milestone 3 (60%)
    System can switch between the following modes via (#) and (*)
    • Complete data logger with **hard coded** date/time/logging frequency (no user input for settings)
    • Complete data display mode with RTC and Keypad implemented

3.2.4. Milestone 4 (85%)
    Same as Milestone 3 except time and logging frequency are always user inputted on startup
    Complete system except for the startup check for RTC and EEPROM values

4. External Circuit Specifications

Both the RTC module and the EEPROM must be easily removable from the circuit.

The EEPROM may be connected directly on the breadboard, as long as it is ensured to be easily accessible and removable.

For modularity, the RTC circuit must be implemented on a cut PC401/201 board with a male header as its connection to the main data logger circuit on the breadboard. The circuit in Figure 2 will be implemented as the RTC module:
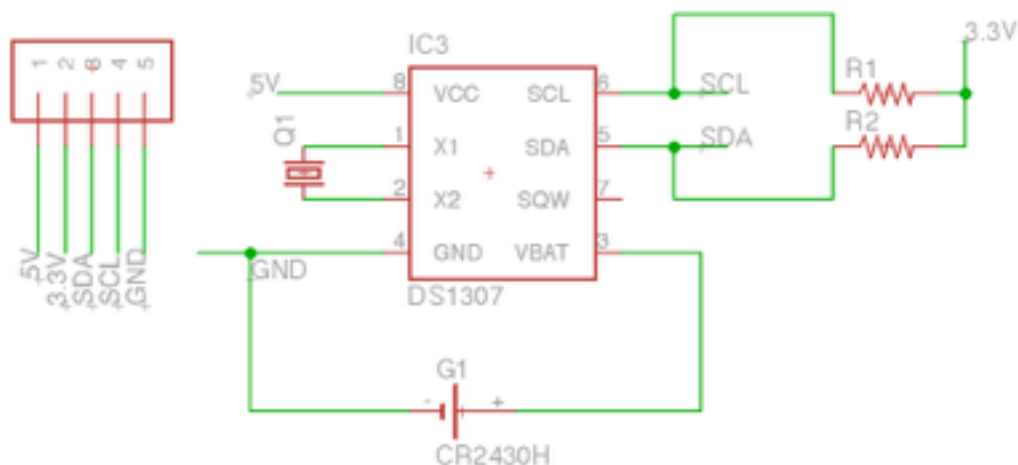

Figure 2. RTC Module Schematic

Please follow the order of the male header pins on the left for uniformity. The coin battery on the module will allow the RTC to retain and continue keeping time while disconnected from the 5V supply. 5V and 3.3V should come the PIC boards.

5. Submission

This ME will be an INDIVIDUAL submission. Submission will be done only during class. Deadline for this ME will be on the week of April 17. There will be no late checking for this ME.