System Software Review

**Kernel**: MicroC/OS-II

**Tasks and ISRs:**

- **StartTask**: Initializes MicroC/OS and creates the other three tasks.
  - Priority: 4, highest priority
  - Task Period: Executes once and is then disabled.
  - Estimated Execution time: 50us
  - CPU load: Approximately zero (does not execute after initialization)

- **KeyTask**: Scans the 16-character keypad for a keypress once every 10ms. If a keypress is detected, a semaphore is signaled and the ASCII value of the keypress is passed through the KeyPend function.
  - Priority: 5, highest priority after StartTask is disabled.
  - Task Period: 10ms
  - Estimated Execution time: 32us
  - CPU load: Avg. = 0.00237, Peak = 0.0032

- **DataTask**: Reads the digital temperature sensor and A/D converter and stores the current values. These values are then used to calculate the current altitude. This task is also able to display changing values on the LCD and store variables in EEPROM dependent on the current user mode.
  - Priority: 6
  - Task Period: 500ms
  - Estimated Execution time: 2.69ms
  - CPU load: Avg. = 0.00448, Peak = 0.00538

- **UITask**: Uses the keypress value from KeyTask to change user modes and LCD displays. It allows keypad numbers to be entered in specific modes. It is the main task for navigating the user interface.
  - Priority: 7
  - Task Period: Sporadic, executes once every keypress (approx. 100ms)
  - Estimated Execution time: 6ms
  - CPU load: Avg. = 0.0552, Peak = 0.0612

- **External Interrupt ISR**: Occurs when the microcontroller is in sleep mode and an input signal is detected on Port H pin PH7.
  - Task Period: Minimum, 6min
  - Estimated Execution time: 5us
  - CPU load: Avg., and Peak approx. = 0

**Overall CPU load**: Average: 0.0621, Peak: 0.0698
<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
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<tbody>
<tr>
<td>AltMain.c</td>
<td>This is the main module that performs all altitude, temperature, and pressure calculations. It also controls the user interface of the system depending on the keypad input.</td>
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<tr>
<td>LCD.c</td>
<td>Contains all of the functions to display data and user interface menus from on the LCD.</td>
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<tr>
<td>UcosKey.c</td>
<td>Monitors the 16-character keypad and returns an ASCII character corresponding to a keypress. Allows a task to pend on a keypress.</td>
</tr>
<tr>
<td>ADS1100IIC.c</td>
<td>Controls communication over the I2C bus using the ADS1100 A/D converter. Allows for reading and writing of the ADS1100.</td>
</tr>
<tr>
<td>M6662Spi.c</td>
<td>Controls communication over the SPI using the MAX6662 digital temperature sensor. Writes a command byte to the MAX6662 then reads its output registers.</td>
</tr>
<tr>
<td>ProgEeprom.c</td>
<td>Writes to the on-chip EEPROM of the 9S12. Erases contents and writes data to EEPROM sectors.</td>
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<tr>
<td>basicio.h</td>
<td>Controls communication between the 9S12 and a PC terminal emulator using the SCI.</td>
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<tr>
<td>math.h</td>
<td>Contains complex math operations using floating point input values.</td>
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<tr>
<td>Module</td>
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<td>LcdClrLine()</td>
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<td>LcdDispChar()</td>
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<td>LcdMoveCursor()</td>
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<td>LcdDispDecByte()</td>
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<td>EESectModify()</td>
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- The LCD.c, UcosKey.c, ADS1100IIC.c, and ProgEeprom.c modules are reused code from the Y drive under CODE401\WWU\emodules. Modifications were made to be specific for project.
- AltMain.c is all original code and M6662Spi.c is mostly original code, but is derived from the SPI module in the emodules directory.
Dataflow Diagram

AltMain.c

LCD Output

T_s = 10ms

UITask()

KeyTask()

T_s = 1/keypress

KeyPress. keyvalue

KeyPress. flag

OSSemPend()

Keypad I/O

T_s = 10ms

KeyScan()

KeyCodeTable

UcosKey.c

CurrentMode

T_s = 1/keypress

KeyPress()

OSSemPend()

ADS1100IIC.c

Pressure Sensor

T_s = 500ms

ADS1100Data()

SDA

ADS1100 A/D

SCL

Pressure Sensor

M6662Rd()

M6662Spi.c

M6662SPI

MOSI

MAX6662

Temp. Sensor

SS

SPI

SCIWrite

SCI/Serial Port Interface

OSMutexPost()

OSMutexPend()
Interrupt Service Routine Dataflow Diagram

AltMain.c

UITask(), KeyTask(), or DataTask() → PP1 → PTHIsr() → PH7

Port H Input

Pulse from keypad

or DataTask()
Note: Pressing the ‘#’ key in any mode changes the units displayed or used in calculations, nothing else changes.
System State Diagram continued

Sleep Mode: ON/OFF

Display current offset value

Altitude Reference: Set ON/OFF

Pressure Ref.: Set High or Low

Save or Restore System Settings

Zero Altimeter or restore previous setting

Calibrate altimeter to known altitude

All Other Corresponding Modes

Altitude Mode/Default State: Display temp. and altitude

Save or Restore System Settings

Zero Altimeter or restore previous setting

Calibrate altimeter to known altitude

Altitude Reference: Set ON/OFF

Display current offset value

Sleep Mode: ON/OFF

All Other Corresponding Modes

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B+C+D

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A