SYSTEM DESIGN SPECIFICATIONS
ZIGBEE BASIC SYSTEM

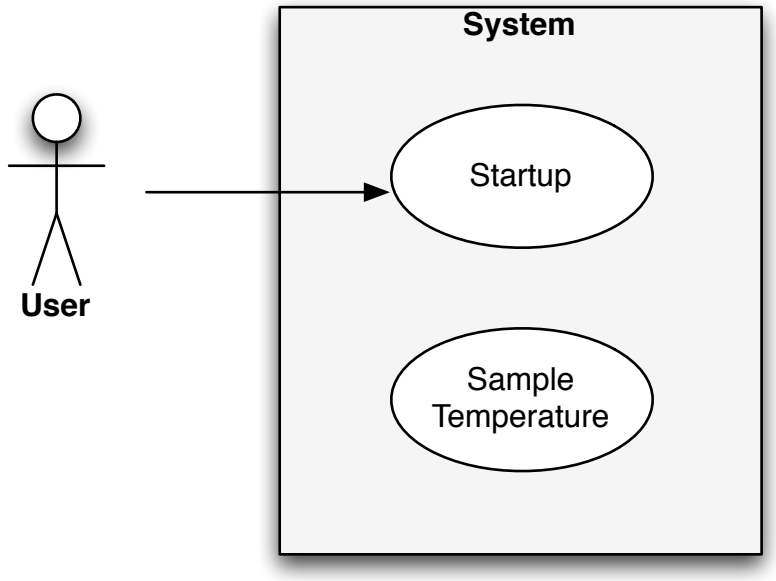
SYSTEM DESCRIPTION

This specification describes and defines the basic requirements of the CE3200 ZigBee temperature sensor mote. The ZigBee temperature sensor mote awakens from power-down idle every two minutes, takes a temperature sample, sends the sample using a ZigBee radio to a coordinator device, displays the temperature on its LCD panel for five seconds, and then returns to idle. The remainder of this document outlines the requirements, use cases, and system design specifications for the **second project week**. **Note** that the ZigBee radios ***will not be used yet in this lab***. The radios will be used in the third project week.

REQUIREMENTS

1. The system must be powered from standard U.S. 60Hz AC line power.
2. The system does not need power-failure or system failure recovery.
3. The system must operate in standard room temperature.
4. The system must sample temperature every two minutes.
5. The system must package the temperature data into a transmission packet.
6. The system must send the transmission packet as USART data.
7. The system must display temperatures in Fahrenheit and Celsius on the LCD.
8. The system must display a power-on heartbeat on the LCD panel when not idle.
9. The system must power-down to idle between samples.

USE CASE DIAGRAM



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USE CASE EVENTS

1. Startup

    A. The user starts up the system.
    B. The system initializes.

2. Sample Temperature

    A. The sample temperature timer event awakens the system.
    B. The system samples the temperature.
    C. The system packages the data into a transmission packet.
    D. The system sends the transmission packet as USART data.
    E. The system updates the LCD panel with Fahrenheit and Celsius.
    F. The system powers-down to idle after 5 seconds.

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SPECIFICATION OF SYSTEM INPUTS AND OUTPUTS

1. System Inputs

   A. The system uses a LM34 analog temperature sensor.

      i. The LM34 is powered by the Atmega32 power supply rails.
      ii. The LM34 output is valid for 0°F to 300°F.
      iii. The LM34 output is connected to an Atmega32 ADC pin for conversion using the full 10-bit ADC resolution.

   B. The system uses a 8-bit input port to specify packet destination address.

2. System Outputs

   A. The system uses a standard Hitachi 14-pin LCD panel as a status display.
   B. The system uses the USART transmit signal.

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SYSTEM FUNCTIONAL SPECIFICATION

The system uses control software written in either Atmega32 assembly language or C.

1. The system initializes at power-on reset.

    A. System variables are initialized.
    B. A half-second timer interrupt is initialized for the power-on heartbeat.
    C. A welcome message is displayed on the LCD panel.
    D. A temperature sample is taken and displayed for five seconds on the LCD panel.
    E. The system powers-down to idle mode.

2. The power-on heartbeat timer interrupt event occurs.

    A. The global volatile **heartbeat** variable is set.
    B. The interrupt service routine exits.

3. The main program identifies a set volatile variable.

    A. Appropriate updates are made based on the set volatile variable.
    B. The volatile variable is cleared.
    C. If five minutes have passed then a temperature sample is taken, packaged as a transmission packet, sent through the USART, and displayed for five seconds on the LCD panel.
    D. The main program powers-down to idle mode.

SUPPORTING DIAGRAMS

The required transmission packet is:

FIRST BYTE SENT			LAST BYTE SENT
SOURCE ADDRESS BYTE	DESTINATION ADDRESS BYTE	TEMPERATURE UPPER BYTE	TEMPERATURE LOWER BYTE

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TEST PLAN

1. **Connect** the LM34 to the Atmega32.
2. **Connect** the USART TX output to the laboratory oscilloscope.
3. **Set** an destination address on the input port pins.
4. **Power-on** the system.
5. **Verify** that the LCD panel functions.
6. **Verify** that the temperature is sampled and displayed on the LCD panel.
7. **Verify** that the data transmission packet is sent correctly through the USART.
8. **Verify** that the system powers-down to idle after 5 seconds.
9. **Verify** that the system awakens from idle after 2 minutes.
10. **Verify** that temperature readings change.

DELIVERABLES

1. Laboratory testing and demonstration must be completed by the end of Fall quarter week 9. Use the instructor's office hours or visit him during any of his Fall quarter laboratory periods. This will successfully clear the ZigBee Project Week 2 demo from the incomplete laboratories listed for you in the grading spreadsheet.
2. Email well-commented source code in PDF format to the instructor after you successfully demonstrate your system.

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