EE4930 Advanced Embedded Systems
Section 011/021, Winter 2022/23

Professor: Kerry R. Widder, Ph.D.
Electrical Engineering and Computer Science Department
Milwaukee School of Engineering

Laboratory 5: “Low Power"

Pre-lab Submittal:	None.
Demonstration and Submittal:	Due by the end of the day of the Week 7 lab session. Late submittals will be penalized per the course syllabus.

Objectives

- Write code for a low power application.
- Use tools to measure and analyze code performance in terms of power and energy.

This is an individual lab. Each student must independently complete this assignment. While discussing ideas and potential solutions with your classmates is permitted, sharing code is prohibited.

All software must be written in C using the CCS IDE.

For this laboratory, you will explore the low power performance of the TI MSP432. You will need to write C code to run on the MSP432 system to implement a remote temperature measurement system, then measure the power consumption to verify that the specifications are met. This system will be designed to measure the temperature in an eagle nest as part of a study to monitor their habits.

Eagles must maintain a temperature of about 105 deg. F in the eggs. Eggs normally take 35 days to incubate. Nests typically contain 1 – 3 eggs. Eggs are laid three days apart. The system will need to run a minimum of 70 days to allow time to get it installed well ahead of eggs being laid, time for all eggs to hatch, and uncertainty as to exactly when the eggs will be laid.

Specifications:

- The code must use the A/D to measure temperature in degrees F (resolution of 0.1 deg. F min.) using a TMP36 sensor. The temperature reading must be stored in a global variable that the wireless radio can access, and the radio must be notified that a new value is available for transmission (e.g., set an output high for some short time interval, then back low).
- Temperature readings must be taken about every ten minutes and transmitted to the base station.
- The battery is a CR2032 lithium battery with a capacity of about 210 mAhr.
- Use the Energy Trace tool to analyze your code in terms of its time spent in various modes.
- Use a series resistor (e.g., 10 Ohms) in the power connection to measure the actual power supply current of the system on an oscilloscope (bench scope, not Analog Discovery).
- Calculate the estimated battery life of your system using both the Energy Trace data and the scope data.
- For code demo, set the time between readings to something more reasonable, like 10 seconds.

Submittal

In your lab report, include:

- Printed copies of your source code
- Schematic diagrams
- Data collected, and calculations performed. Include screen shots of Energy Trace output and scope screen shots as appropriate.
- Describe why you wrote your code the way you did and how it will achieve low power