UNX511 Lab 5: I/O Control

Due: Sunday, June 15, 2025 (11:59pm)

In this lab, your task is to complete the missing sections of a hardware device driver. Most of the code is already provided, and you are required to implement the *read* and *ioctl* functions. Refer to the **TODO** comments in the driver code for guidance.

- The source code for the hardware device driver can be found at Makefile, hardwareDevice.h, and hardwareDevice.c. Additionally, scripts for loading and unloading the kernel module are provided as load.sh and unload.sh, respectively.
- A combined script, build.sh, is available to handle unloading, building, and loading the kernel module in one step. You may need to modify the permissions of these scripts using the command: **$ chmod 777 *.sh**
- The hardware device driver operates as a buffer managed by a thread that updates its content once per second. Your responsibility is to implement the ***read*** function, allowing a user-space program to access the buffer's contents. Additionally, you need to implement the ***ioctl*** function to support two commands: **HARDWARE_DEVICE_HALT** and **HARDWARE_DEVICE_RESUME**.
  - The **HARDWARE_DEVICE_HALT** command stops the buffer updates.
  - The **HARDWARE_DEVICE_RESUME** command restarts the periodic updates.
  - Details for **HARDWARE_DEVICE_HALT** and **HARDWARE_DEVICE_RESUME** can be found in the header file **hardwareDevice.h**.
- To test your implementation, a user-space program is provided in Makefile and userHardware.cpp.

- This program performs the following sequence:
  - Reads the buffer from kernel space three times at three-second intervals.
  - Issues the **HARDWARE_DEVICE_HALT** command.
  - Reads the buffer three more times, again at three-second intervals.
  - Issues the **HARDWARE_DEVICE_RESUME** command.
  - Reads the buffer three final times at three-second intervals before completing.
- Take note of the directory structure. The Makefile for **userHardware.cpp** requires access to the kernel header file, **hardwareDevice.h**, which it expects to be in a directory with the relative path **../kernel**.

Assignment Submission:

- Complete all steps, Add all output-screenshot and explanations (if required) to a MS-Word file.
- Add the following declaration at the top of MSWORD file

```
/*****************************************************************************
***
*  UNX511-Lab5
*  I declare that this lab is my own work in accordance with Seneca Academic Policy.
*  No part of this assignment has been copied manually or electronically from any other source
*  (including web sites) or distributed to other students.
*
*  Name: ____________________ Student ID: ________________ Date: _____________________
*
*
*****************************************************************************
**/
```

- Please answer the following two declarations:
    - D1) On a scale from 1 to 5, **How much did you use generative AI to complete this assignment?**
        - where:
        - **1** means you did not use generative AI at all
        - **2** means you used it very minimally
        - **3** means you used it moderately
        - **4** means you used it significantly
        - **5** means you relied on it almost entirely
        - **Your answer :**
    - D2) On a scale from 1 to 5, **How confident are you in your understanding of the generative AI support you utilized in this assignment, and in your ability to explain it if questioned?**
        - where:
        - **1** means "Not confident at all – I do not understand the generative AI support I used and cannot explain it."
        - **2** means "Slightly confident – I understand a little, but I have many uncertainties."
        - **3** means "Moderately confident – I understand the majority of the support, though some parts are unclear."
        - **4** means "Very confident – I understand most of the AI support well and can explain it with minor gaps."
        - **5** means "Extremely confident – I fully understand the generative AI support I used and can clearly explain or justify it if asked."
        - **Your answer :**

- Please submit the Source code (zip all .c, .h, and makeFiles)

Important Note:

- **LATE SUBMISSIONS for labs**. There is a deduction of 10% for Late assignment submissions, and after three days it will grade of zero (0).
- This labs should be submitted along with a video-recording which contains a detailed walkthrough of solution. Without recording, the assignment can get a maximum of 1/3 of the total.
    - Note: In case you are running out of time to record the video, you can submit the assignment (source code + screenshots) by the deadline and submit the video within 24 hours after the deadline.