



University of Colorado  
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# HOMEWORK 5

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BY

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GITHUB LINK: [https://github.com/jajoosiddhant/Advanced-Embedded-Software-Development-AESD/tree/master/FreeRTOS%20TIVA%20\(HW5\)](https://github.com/jajoosiddhant/Advanced-Embedded-Software-Development-AESD/tree/master/FreeRTOS%20TIVA%20(HW5))

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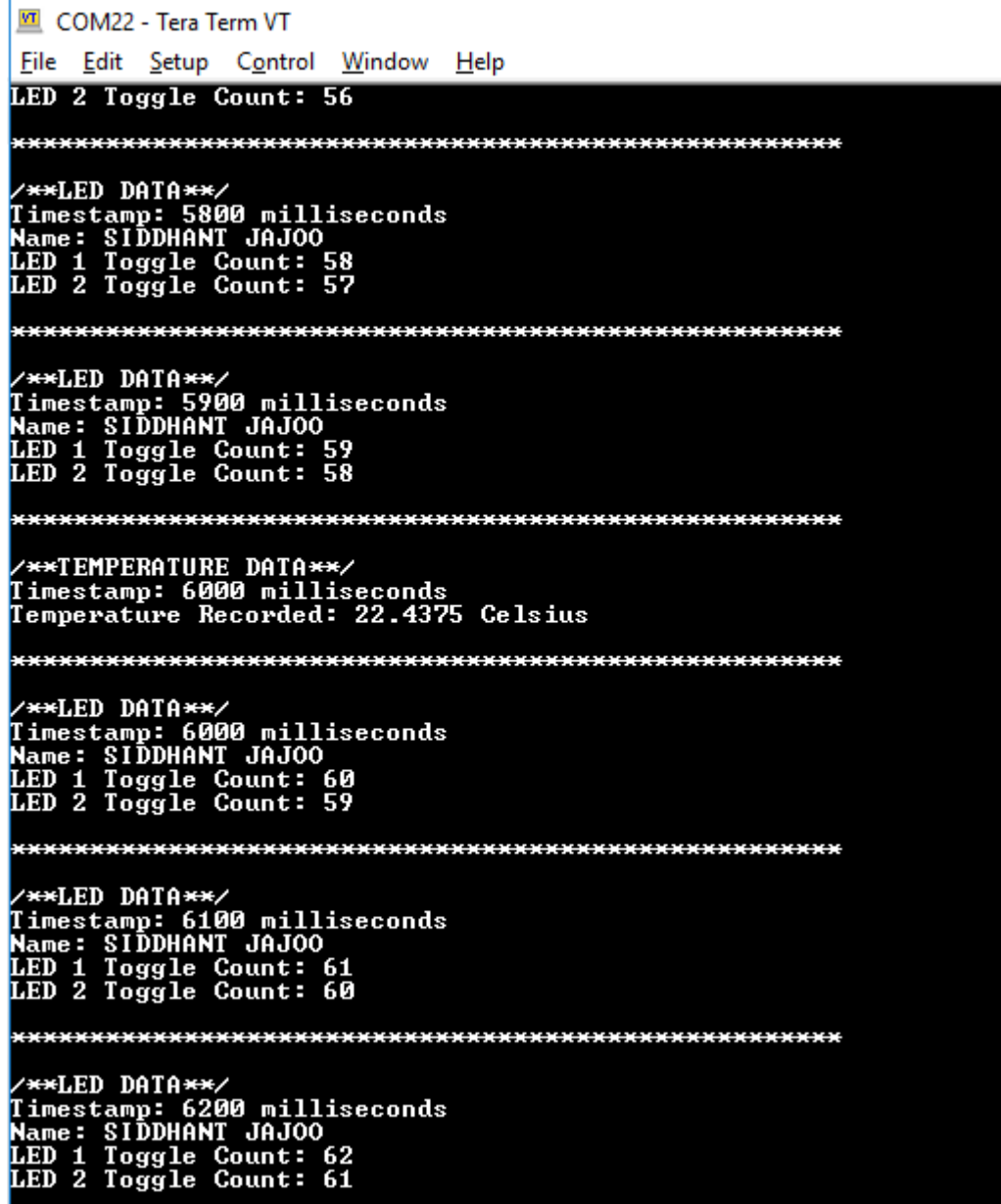
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## OVERVIEW

This project reads and prints temperature data, LED data and toggles LED at regular intervals of time. The LEDs toggle at 100 milliseconds and temperature is obtained every 1 second from the TMP102 sensor with the help of semaphores. In order to obtain data at their respective rates, hardware timers have been used. Two hardware timers are used with the timeouts as 1 second and 100 milliseconds for temperature and LED tasks respectively. The code consists of 4 tasks: Temperature task, LED task, Logger task and Alert task. The hardware timer callback functions release semaphores for the functioning of temperature and LED tasks. The LED and temperature task wait for the semaphores to get released. As soon as the semaphores are released the temperature task notes the timestamp, reads temperature data using I2C from TMP102 and sends it to the logger task to print on the host console via UART. The LED task toggles every 100 milliseconds and keeps a toggle count, notes the timestamp and sends this information along with a string hardcoded in the program code. Both the tasks repeat their functionality in a while loop waiting for the semaphores to be released. In order to send and receive data between different tasks message queues are used. The logger task receives information by dequeuing the data sent from the temperature task and LED tasks. The logger task prints this data. An alert task is also implemented which is run when the temperature crosses a certain threshold value. The APIs that are used for this are: `ulTaskNotifyTake()` and `xTaskNotifyGive()`. Refer <https://www.freertos.org/index.html> for more information. This alert task notifies that the temperature has crossed its threshold value by printing an ALERT message on the host console.

The limitation in this code is that it cannot display negative temperatures. This can be done by making slight changes to the code.

## TEMPERATURE AND LED DATA SCREENSHOT

A screenshot of a Tera Term VT window titled 'COM22 - Tera Term VT'. The window has a menu bar with 'File', 'Edit', 'Setup', 'Control', 'Window', and 'Help'. The main display area shows a sequence of data outputs. It starts with 'LED 2 Toggle Count: 56' followed by a separator line of asterisks. Then it shows 'LED DATA' with a timestamp of 5800 milliseconds, name 'SIDDHANT JAJOO', and LED 1 and 2 toggle counts of 58 and 57 respectively. This is followed by another 'LED DATA' block at 5900 milliseconds with counts of 59 and 58. Then a 'TEMPERATURE DATA' block at 6000 milliseconds showing a temperature of 22.4375 Celsius. This is followed by 'LED DATA' blocks at 6000, 6100, and 6200 milliseconds, with toggle counts increasing to 60, 61, and 62 respectively. Each data block is separated by a line of asterisks.

```
COM22 - Tera Term VT
File Edit Setup Control Window Help
LED 2 Toggle Count: 56
*****
/**LED DATA**/
Timestamp: 5800 milliseconds
Name: SIDDHANT JAJOO
LED 1 Toggle Count: 58
LED 2 Toggle Count: 57
*****
/**LED DATA**/
Timestamp: 5900 milliseconds
Name: SIDDHANT JAJOO
LED 1 Toggle Count: 59
LED 2 Toggle Count: 58
*****
/**TEMPERATURE DATA**/
Timestamp: 6000 milliseconds
Temperature Recorded: 22.4375 Celsius
*****
/**LED DATA**/
Timestamp: 6000 milliseconds
Name: SIDDHANT JAJOO
LED 1 Toggle Count: 60
LED 2 Toggle Count: 59
*****
/**LED DATA**/
Timestamp: 6100 milliseconds
Name: SIDDHANT JAJOO
LED 1 Toggle Count: 61
LED 2 Toggle Count: 60
*****
/**LED DATA**/
Timestamp: 6200 milliseconds
Name: SIDDHANT JAJOO
LED 1 Toggle Count: 62
LED 2 Toggle Count: 61
```

## TEMPERATURE ALERT SCREENSHOT

```
*****
/**TEMPERATURE DATA**/
Timestamp: 24000 milliseconds
Temperature Recorded: 24.0 Celsius
*****

/**ALERT!!! ALERT!!! ALERT!!!**/
/**TEMPERATURE DATA**/
Timestamp: 25000 milliseconds
Temperature Recorded: 26.1875 Celsius
*****

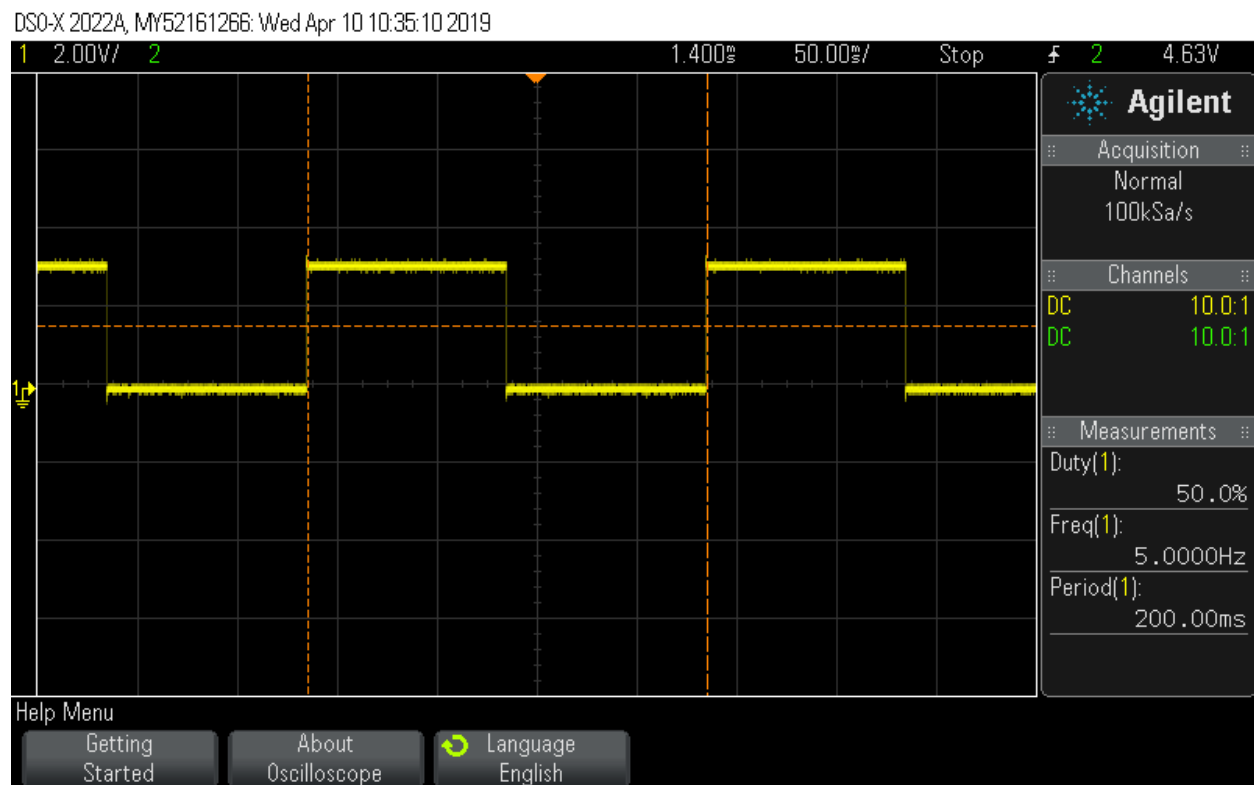
/**ALERT!!! ALERT!!! ALERT!!!**/
/**TEMPERATURE DATA**/
Timestamp: 26000 milliseconds
Temperature Recorded: 26.1875 Celsius
*****

/**TEMPERATURE DATA**/
Timestamp: 27000 milliseconds
Temperature Recorded: 24.1250 Celsius
*****

/**TEMPERATURE DATA**/
Timestamp: 28000 milliseconds
Temperature Recorded: 23.8125 Celsius
*****

/**TEMPERATURE DATA**/
Timestamp: 29000 milliseconds
Temperature Recorded: 23.8750 Celsius
```

## LED SCOPE SCREENSHOT



## REFERENCES

- <https://www.sparkfun.com/products/13314>
- <http://www.ti.com/lit/ds/symlink/tmp102.pdf>
- <https://www.freertos.org/index.html>
- <https://www.digikey.com/eewiki/display/microcontroller/I2C+Communication+with+the+TI+Tiva+TM4C123GXL>