University of Colorado Boulder

HOMEWORK 5

BY

SIDDHANT JAJOO

UNDER THE GUIDANCE OF:

PROFESSOR RICHARD HEIDERBECHT,
UNIVERSITY OF COLORADO BOULDER

4/10/2019

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

TABLE OF CONTENTS

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 dequeueing 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.

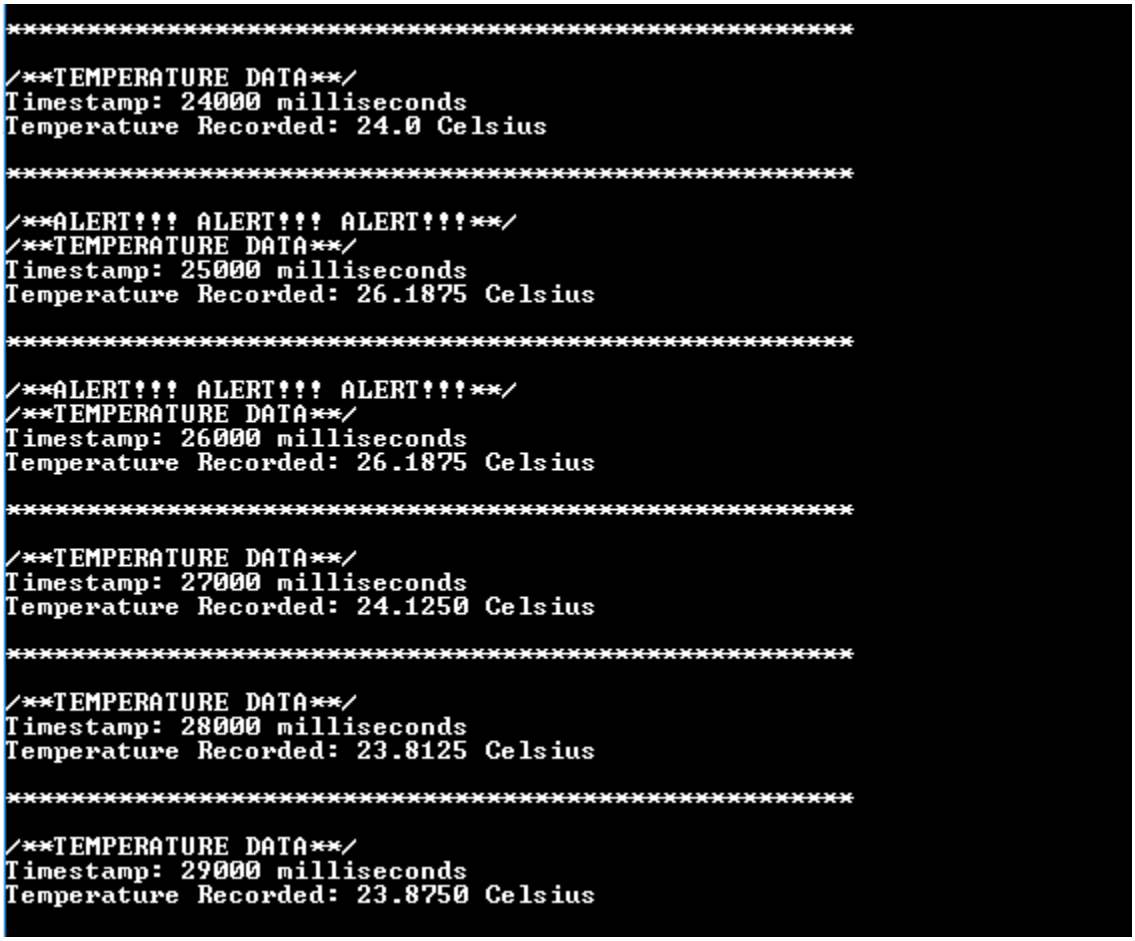
TEMPERATURE AND LED DATA SCREENSHOT

COM22 - Tera Term VT

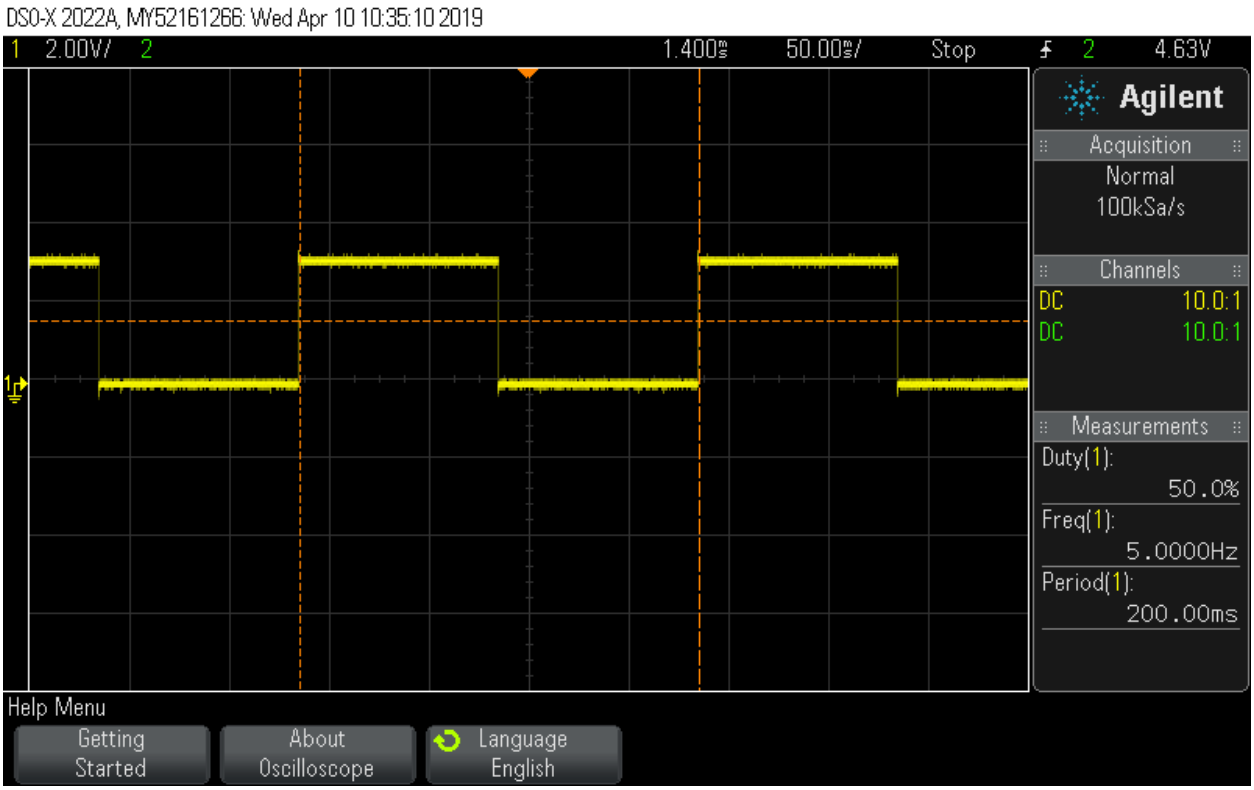
File Edit Setup Control Window Help

```
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



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