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Homework 4

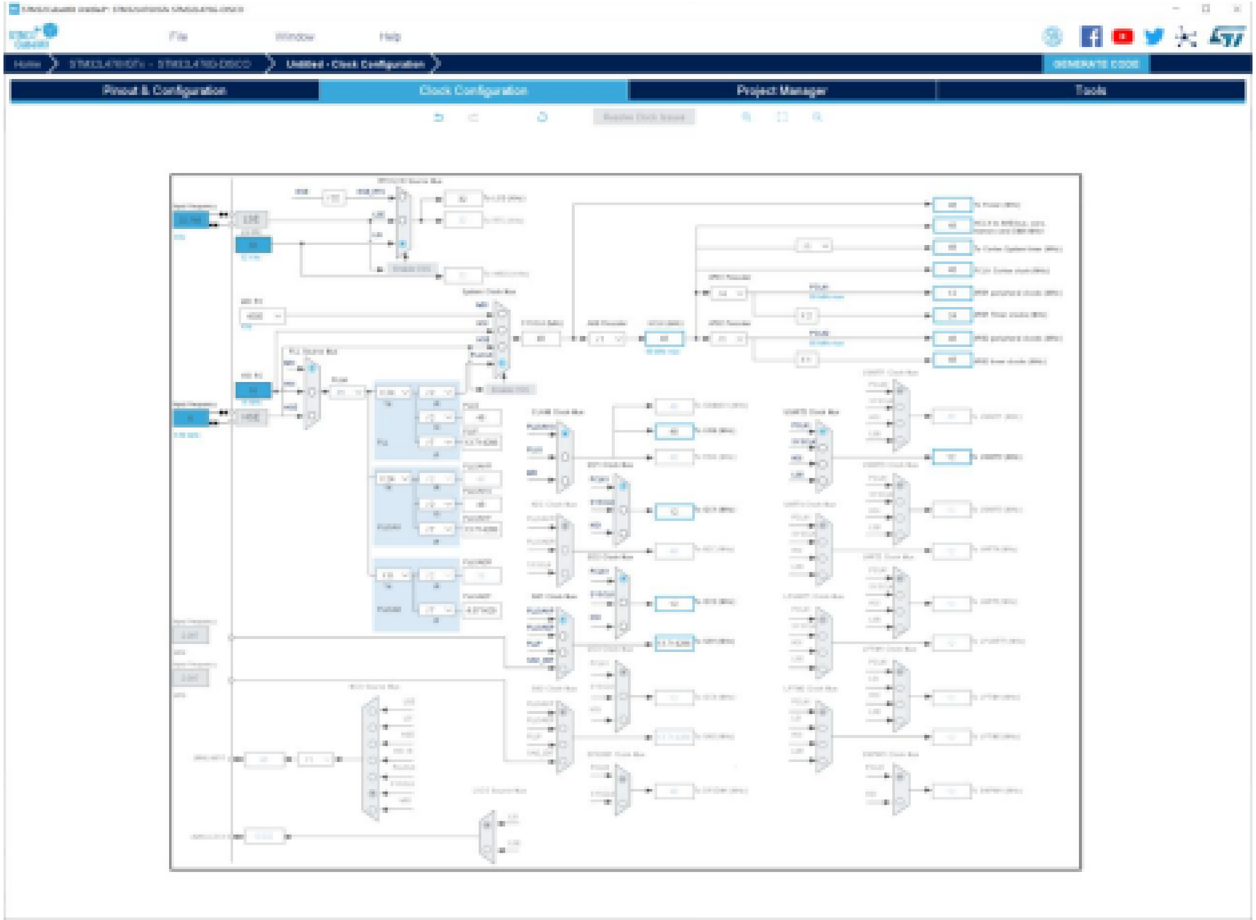
Real-Time Embedded Systems - ECEN 121

Due May 1, 2024 – 5:30 PM – 40 points

Problem 1:

a) (20 points)

I want to program Timer 2 to interrupt at 20Hz and Timer 16 to interrupt at 12 Hz. The clock configuration page of the project looks like this:



You cannot change anything on the clock configuration page.

Tell me all of the settings you need to change on the Pinout and Configuration page to configure Timer 2 to interrupt at 20Hz and Timer 16 to interrupt at 12 Hz and how they should be changed.

- You can access CubeMX in the ECC labs or over remote terminal if that helps. • You may want to review section 2.1.5 of the STM32L476VGT6 Reference manual.

First I need to activate both clocks. Tim2 is more nuanced as I have to set it to internal clock instead of just clicking activate (like I did for tim16). General clock prescaler is set so I cannot touch that. Timer 16 will see 48MHz at default and timer 2 will see 24MHz at default. To get timer 16 at 12Hz and timer 2 at 20Hz, I used a static counter period of 50000 (49999 in register) and prescaler of 80 (79 in reg) for tim16 and prescaler of 24 (23 in reg) for tim2.
48000000/(50000*80)=12 and 24000000/(50000*24)=20
b) (10 points)

You need to add 2 lines of code to main() to start the timers. Write those two lines of code here:

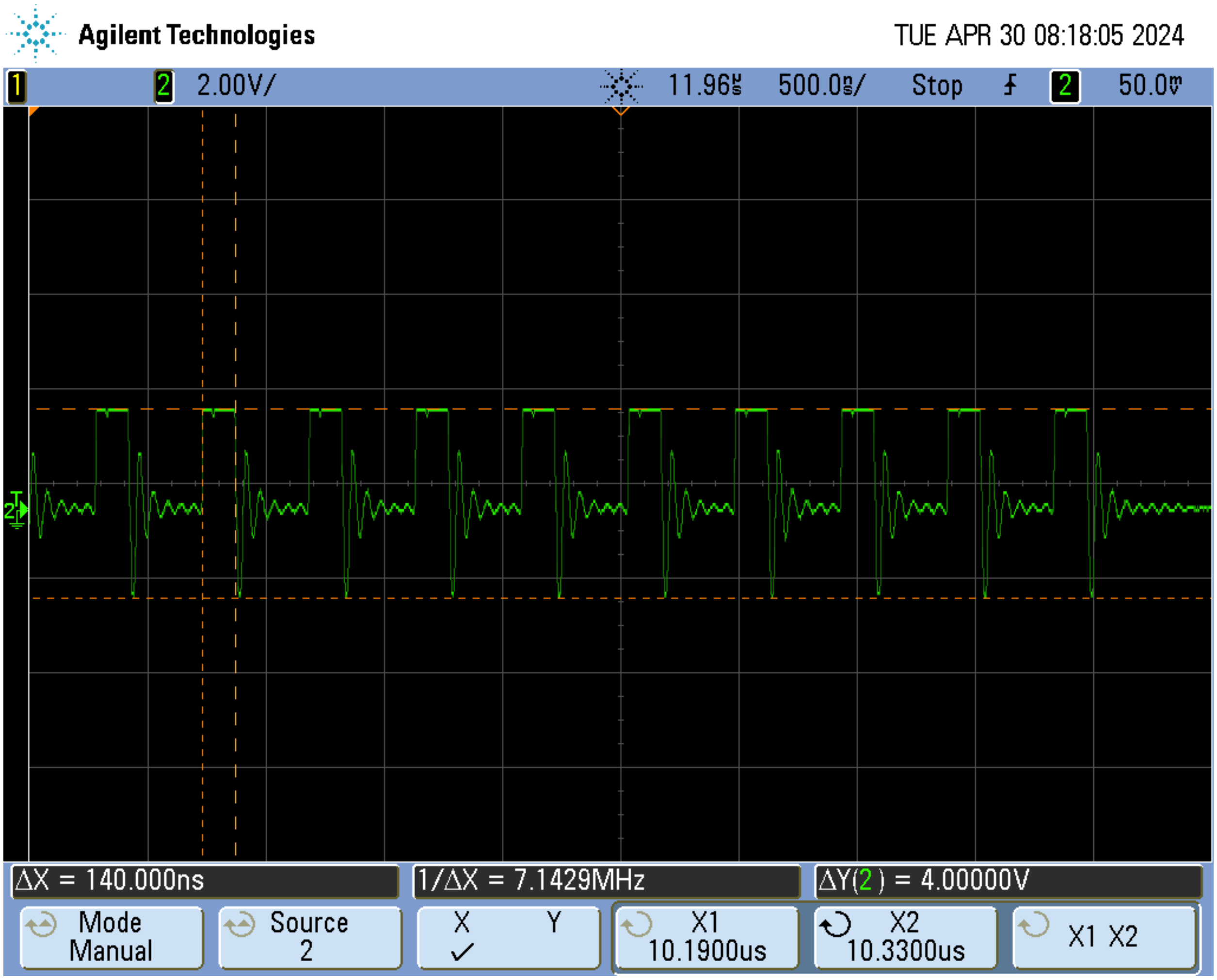
```
HAL_TIM_Base_Start_IT(&htim16);

HAL_TIM_Base_Start_IT(&htim2);
```

Problem 2: (10 points)

1. Set up your Lab 3 system to operate.

2. Using an oscilloscope – determine the duration of the high and low segments of each SCK pulse. Provide photographic evidence.

HIGH (approx 140ns):



Agilent Technologies TUE APR 30 08:18:05 2024

1 2 2.00V/ 11.96µs 500.0ns/ Stop 2 50.0mV

ΔX = 140.000ns

1/ΔX = 7.1429MHz

ΔY(2) = 4.00000V

Mode Manual

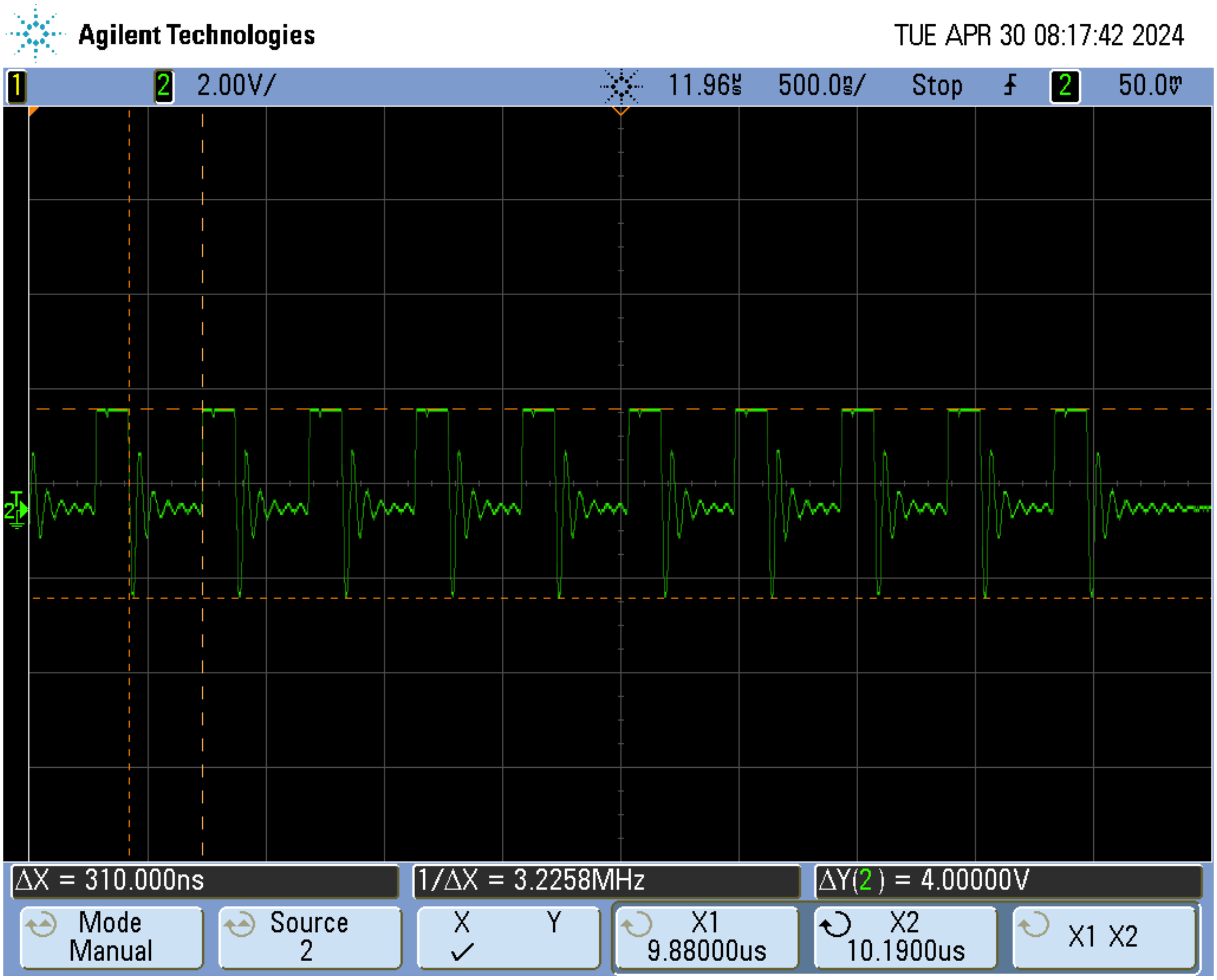
Source 2

X Y ✓

X1 10.1900us

X2 10.3300us

LOW (approx 310ns):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1 2 2.00V/ 11.96us 500.0ns/ Stop 2 50.0mV

ΔX = 310.000ns

1/ΔX = 3.2258MHz

ΔY(2) = 4.00000V

Mode Manual

Source 2

X1 9.88000us

X2 10.1900us

3. Calculate the time required to send a complete 60-LED message to your LED strip. Explain each formula you use.

(310+140)*62*32=892800ns or 892.8 microseconds or .8928 millisesonds
I used this formula, because one full period (on and off) represents one light getting its message and one period is low+high time. After that I just multiplied it by the number of lights plus the start and end frame (62). Then I multiplied it by 32 which is the number of bits in one instruction.