Paul Fischer

PHYS 580

10/13/20

Dr. Kwon

Project 2: Development and Management Plan

1. Design Plan:
    a. Define the Problem (Scenario):
        i. (From Week 7 Lecture Notes) Use the DAQ as a DC power supply and Voltmeter to measure the I-V characteristic of diodes
    b. Inputs:
        i. Minimum applied voltage ($V_{applied} \leq 0$)
        ii. Maximum applied voltage
        iii. Number of data points to measure
        iv. Scale (linear or log)
        v. Resistance of reference resistor (used measure the current)
        vi. Delay between application of voltage and measurement
        vii. Peak current (to abort before reaching maximum applied voltage to protect diode)
        viii. Stop button
    c. Outputs:
        i. Graph indicator of current vs. diode voltage (or log(current) vs. diode voltage)
        ii. Data arrays of:

1. Applied voltage
2. Current
3. Diode voltage

iii. Diode forward voltage when diode forward current is 20mA

iv. Slope of semi-log plot (iii)

v. Diode ideality factor (η)

vi. File Path Out

d. Additional Requirements:

i. Peak current has a default value of 30mA

ii. Reaching the peak current will abort the measurement

iii. The graphs must:

1. Be updated with each new data point as it is measured
2. Show two cursors
3. Be a scatter plot (include solid line for fit of semi-log plot)

iv. When the measurement stops, the user should receive a prompt asking to analyze the data (including outputting V_F, slope, η) or stop the program without analyzing it. The user should have the option to choose the file path to save a data file or if it should be saved under a default name. This data file must contain:

1. All user inputs
2. Tested diode information
3. Collected data
4. Time the measurement stopped

e. Algorithm:

i. Read minimum applied voltage

ii. Read maximum applied voltage

iii. Read peak current

iv. Read number of data points to measure

v. Read delay between application of voltage and measurement

vi. Read resistance of reference resistor

vii. Read scale (linear or log)

viii. Output analog minimum applied voltage from DAQ

ix. Wait delay time

x. Measure voltage across reference resistor

xi. Use voltage across reference resistor with Ohm's law to determine current

xii. If current is greater than or equal to peak current, stop measurement

xiii. Measure diode voltage

xiv. Display current (or log(current)) vs. diode voltage on graph indicator (append data point)

xv. Display applied voltage in data array (append data)

xvi. Display current in data array (append data)

xvii. Display diode voltage in data array (append data)

xviii. If applied voltage us less than maximum applied voltage, increase voltage by step created by $\Delta V = \frac{V_{max} - V_{min}}{N_{points}}$ and go back to step (ix)

xix. Ask user if they want the data analyzed

xx. If answer to (xix) is no, stop

xxi. Ask user if they want to name data file or if a default name should be used

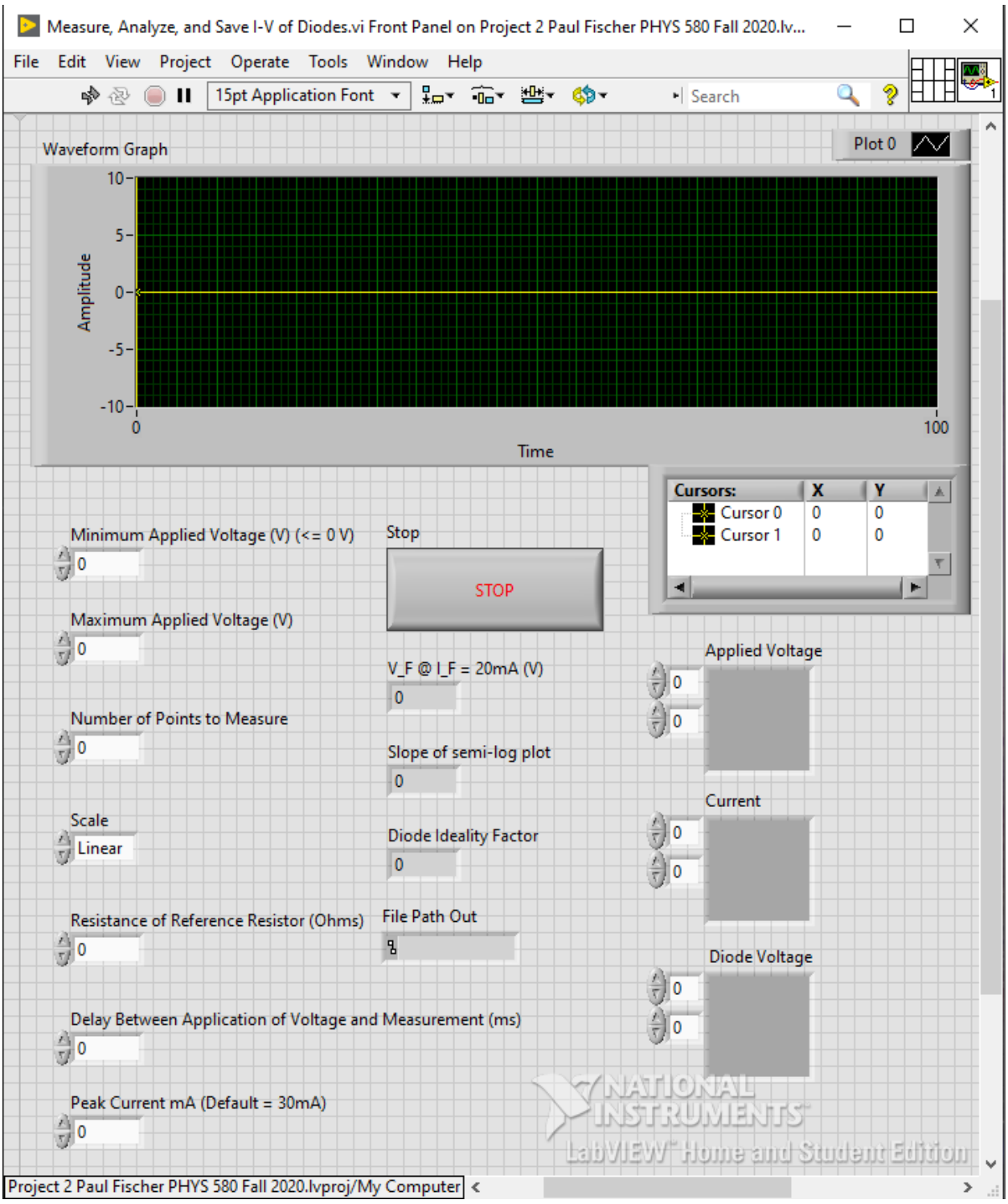
xxii. Display File Path Out on Front Panel

xxiii. Calculate forward voltage when current = 20mA and display on Front Panel

xxiv. Display slope of semi-log plot on Front Panel

xxv. Calculate diode ideality factor using Shockley diode equation and display on Front Panel

f. Front Panel:



2. Management and Testing Plan including Milestones, Timeline and Tracking Plan
    a. Development Plan: Oct. 13, Tuesday (A single pdf file to Dropbox)
    b. VI: Nov. 3, Tuesday (to Dropbox)
        i. Oct. 15:
            1. Build diode circuit
            2. Test Continuous output (non-regeneration) VI with circuit and see which elements can be used in this Block Diagram
        ii. Oct 22:
            1. Add all the steps from Algorithm to the VI except for writing to file or prompting user
        iii. Oct 29:
            1. Add user prompts and writing to log file to the VI
            2. Run measurements for R-G-B LEDs and diode rectifier and make table comparing forward voltages and diode ideality factors
    c. (Final) VI Screenshot and Description: Nov. 5, before the lab class to Discussion
    d. VI Demo: Nov. 5 in the lab
    e. Submit the final VI to Dropbox: After the presentation and before 4pm, Nov. 6 (to Dropbox)

3. Weekly benchmarks to track (to be checked during the lab)
    a. Oct. 15:
        i. Build diode circuit
        ii. Test Continuous output (non-regeneration) VI with circuit and see which elements can be used in this Block Diagram
    b. Oct 22:
        i. Add all the steps from Algorithm to the VI except for writing to file or prompting user
    c. Oct 29:
        i. Add user prompts and writing to log file to the VI
        ii. Run measurements for R-G-B LEDs and diode rectifier and make table comparing forward voltages and diode ideality factors