ELTR 190 – Electronics Capstone Project Project Concept Submission

**1. Describe your project in a single sentence.**

To construct an 8 bit modular computer for teaching Electronic course concepts.

**2. Describe the basic operation of your project's electronic system.**

The 8 bit computer has 9 modules plus power supply:

Module 1 The System Clock

Module 2 Registers store values can be see by LED indicators

A register

B register

Instruction Register

Module 3 Arithmetic unit (ALU)

Sum and subtraction operation...in time permits expand ALU (\* /)

Module 4 Random access memory (RAM)

Module 5 Program counter

Module 6 Output Register

Displays on seven segment displays the value of the resulting operation between register A to Register B.

Module 7 The Bus communication

Module 8 CPU control logic handles the instruction sequences

Module 9 power supply

This might just be an AC adapter if the rest of project meet Course Specs. And during the development of project for safety.

**3. How will your project include theory from ELTR 100 (Electrical Network Analysis)?**

The project includes components such as resistors, LEDs, Capacitors, and Transformer action. Therefore during the testing and troubleshooting of the modules we will employ Ohm's law to perform calculations and use meters to take voltage and ohm readings and more.

**4. How will your project include theory from ELTR 130 (Digital Logic Systems)?**

There are plenty of logic circuits in this project from simple AND OR Invert logic to timers, counters, latches, memory, registers and control logic, even some programmed logic.

**5. How will your project include theory from ELTR 150 (Semiconductor Devices)?**

The power supply will use a 4 way bridge rectifier which are diode plus a number of integrated circuits (IC). Can submit parts list attached.

Alternate plan if time is limited and the project meets specifications is to use an already made AC adapter to power the device.

**6. What is the MVP (minimum viable product) version of your project?**

Simulate and BreadBoard each module 1 by one as proof of concept.

Starting with the System Clock, Registers and ALU

**7. What are some ways that your project could be expanded or improved from that MVP?**

The project would move forward a module at a time until the power supply would be implemented.

At this point I would Revisit the ALU to expand operations for multiplication and division.

The 8 bit premise was just for time management and actual scale of the project to keep to the Electronic course curriculum concepts.

They could be expanded to 16 OR 32 bit to handle 32 bit floating point numbers.

Output to LCD could be added. When we get into networking wifi or ethernet can be added

Parts List Below

Build an 8-bit computer from scratch

Qty. Description

14 Breadboard

1 22 AWG Solid Tinned-Copper Hook-Up Wire

10 1kΩ resistor

9 10kΩ resistor

1 100kΩ resistor

24 470Ω resistor

1 1MΩ resistor

1 1MΩ potentiometer

6 0.01µF capacitor

16 0.1µF capacitor

1 1µF capacitor

4 555 timer IC

2 74LS00 (Quad NAND gate)

1 74LS02 (Quad NOR gate)

5 74LS04 (Hex inverter)

3 74LS08 (Quad AND gate)

1 74LS32 (Quad OR gate)

1 74LS107 (Dual JK flip-flop)

2 74LS86 (Quad XOR gate)

1 74LS138 (3-to-8 line decoder)

1 74LS139 (Dual 2-line to 4-line decoder)

4 74LS157 (Quad 2-to-1 line data selector)

2 74LS161 (4-bit synchronous binary counter)

8 74LS173 (4-bit D-type register)

2 74189 (64-bit random access memory)

6 74LS245 (Octal bus transceiver)

1 74LS273 (Octal D flip-flop)

2 74LS283 (4-bit binary full adder)

3 28C16 EEPROM

3 Double-throw toggle switch

3 Momentary 6mm tact switch

1 8-position DIP switch

1 4-position DIP switch

44 Red LED

8 Yellow LED

12 Green LED

21 Blue LED

4 Common cathode 7-segment display

1 Arduino Nano

2 74HC595