* **EL236 Final Project Overview (Ver. 2 – 07/14/11)**
* Parts Overview:
* 1 x 8051 Microprocessor
  + Used for overall control
* 12 x 74LS259
  + 8 bit Addressable Latch
    - Used to select / control a particular set of LEDs
      * 3 Address Lines (From the 8051, Port 0, Bussed)
      * 1 Data Line (From the 8051, Port 0, Bussed)
      * 1 Enable Line (Active Low, From the Decoder, Individual)
      * 1 Clear Line (From the 8051, Port 2, Bussed)
      * 8 Output Lines (To the ULN2803 Transistor Pack)
* 1 x 74LS154
  + 4 to 16 Line Decoder/De-multiplexer
    - Used to select a particular latch
      * 4 Address Lines (From the 8051, Port 0, Individual)
      * 2 Enable Lines (From the 8051, Port 2, Tied together)
      * 16 Output Lines (Individually run to the enable on the latches)
        + Active Low
* 12 x ULN2803
  + Darlington Transistor Array
    - Used to directly “Power” the sets of LEDs
      * 8 Inputs (From the Latches)
      * 8 Outputs (Individually run to sets of LEDs, Acts as the ground side)
      * 1 x Common (Tied to +12V in this case, Clamping Diode)
* 2 x 74LS541
  + Octal Buffer
    - Used to “Power” the bussed lines
      * 8 Inputs/Outputs
* 1 x 4116R
  + Resister Array
    - Used as Pull-Up resistors for the lines from Port 0
    - 10 KΩ
* 12 x 74LS04
  + Octal Inverter
    - Used to invert / boost the sensor outputs
* 2 x 74LS21
  + 2 x 4 input AND gate
    - Used to create an AND/AND network for the sensor interrupt
* LED Operation (How It Works):

Each latch controls 8 sets of LEDs (2 letters, Top to Bottom, Left to Right). The Decoder controls which individual latch is enabled.

* Hardware Sequence (Master Clear = High, Output Enable = High):

1. The 7 bit address is selected (Port 0) (4 Decoder bits, 3 Latch bits)
   1. This selects a particular Latch and a particular output (set of LEDs) on that Latch
2. The desired data bit (1=On/0=Off) is selected (Port 0)
3. The Output Enable (Decoder) is then brought Low, bringing the desired output of the decoder low, enabling the selected latch. The selected latch output switches to the data value, enabling or disabling the relevant transistor sink.
4. The Output Enable (Decoder) is then brought High. The data value is “stored” on the selected latch output.
5. Repeat from step 1

* Software Sequence:

1. The desired light pattern is placed in 030H 🡪 03BH (For each memory location, Bit 7 = Top of 1st Letter, Bit 4 = Bottom of 1st Letter, Bit 3 = Top of 2nd Letter, Bit 0 = Bottom of 2nd Letter)
2. The program “LEDOUTPUT” is called
3. The desired number of delay repetitions is run (25 ms each, number is placed in 050H)
4. Repeat from step 1 as needed
   * **8051 Input / Output Configuration**
     + Port 0 – LED Control
       - 0.0: Output - Bus - Latch - Address Bit 0
       - 0.1: Output - Bus - Latch - Address Bit 1
       - 0.2: Output - Bus - Latch - Address Bit 2
       - 0.3: Output - Single - Decoder - Address Bit 0
       - 0.4: Output - Single - Decoder - Address Bit 1
       - 0.5: Output - Single - Decoder - Address Bit 2
       - 0.6: Output - Single - Decoder - Address Bit 3
       - 0.7: Output - Bus - Latch - Data Bit

* + - Port 1 – Sensors
      * 1.0: Input - Single - Sensor 1
      * 1.1: Input - Single - Sensor 2
      * 1.2: Input - Single - Sensor 3
      * 1.3: Input - Single - Sensor 4
      * 1.4: Input - Single - Sensor 5
      * 1.5: Input - Single - Sensor 6
      * 1.6: Input - Single - Sensor 7
      * 1.7: Input - Single - Sensor 8
    - Port 2 – Misc
      * 2.0: Input - Single - Sensor 9
      * 2.1: Input - Single - Sensor 10
      * 2.2: Input - Single - Sensor 11
      * 2.3: Input - Single - Sensor 12
      * 2.4: Input - Single - Switch 0 - Test Patterns
      * 2.5: Output - Bus - Latch - Master Clear
      * 2.6: Output - Single - Decoder - Output Enable
      * 2.7: Not Used (Possibly Bad On This 8051 Board)
    - Port 3 – Interrupt
      * 3.2: Input - Single - Sensor Interrupt
        + (AND/AND Network Output)