1. Individually Latched (like SRAM)
   1. 12 x 8 Transistor Arrays (ULN2803, Current Sink, DK = $1.16 each)
   2. 12 x 74259 – 3 to 8 Line Addressable Latch (We Have)
   3. 1 x 74154 – 4 to 16 line decoder (We Have)
      1. Or 2 x 3 to 8 line and a 1 to 2 line decoder

* Uses 8 bits for control
  + 3 for LED Address (Addressable Latches)
  + 4 for Latch selection (Decoder)
  + 1 for LED Level
* Decoder runs Latch enable
* Can also use an 9th line for a master clear (latch)
* Can also use an 10th/11th line for a “no change” state (Decoder)
* Advantages
  + LED’s are constantly driven
  + Only 7 / 8 lines to control 128 outputs
  + Changes are on demand and individualized
    - No “constant” refresh needed between changes
* Disadvantages
  + A Lot Of Chips / Wiring (25 for the LEDs + 8051 + Sensors)
  + Higher Cost ($30)

1. Addressed LEDs - columns / rows (Like DRAM)
   1. 1 x 4017 – Johnson Counter (We Have)
   2. 1 x 8 Transistor Array (ULN2803, Current Sink, DK = $1.16 each)
   3. 8 x TIP31A Transistors (Current Sink,
   4. 2 x 8 Transistor Array (UDN2891, Current Source, DK = $2.13 each)

* Uses 14 bits for control
  + 2 for the Johnson Counter (Current Sink, Row?)
  + 12 for the Transistor Array (Current Source, Column?)
* Advantages:
  + Fewer Chips (4 for the LEDs + 8051 + Sensors)
  + Cheaper ($6)
* Disadvantages
  + LED’s are only “on” part of the time
    - Possible flickering if the refresh time is > 20ms
  + More control lines needed (14 vs. 7-9)
  + Must be constantly refreshed
  + Higher Currents needed to maintain brightness/continuity and could fry LEDs