CE MicroDisplay

GVSU Senior Project Team 6

Team: Elora Ferrie, Justin Wolters, Hector Garcia, Mitchell Hoeker, Trinity Roodbeen, Ben Keil
Advisors: Dr. Ryan Krauss, Dr. Philip Hittepole
Sponsor: GVSU College of Engineering, Computer Engineering Department

Project Objective:

"Create a functioning and artistic model of a microprocessor core."

Key Specifications

- Model data flow in a Harvard Architecture microprocessor core
- Create a operator interface to configure the system (wired & wireless interface)
- Maintain reliable control over thousands of addressable LEDs
- Be able to be hung on wall
- Powered from 120V wall outlet

Project Inspiration

- Inspired by University of Michigan's ENIAC display - the first re-programmable digital computer

Above: ENIAC Display (University of Michigan Electrical Engineering and Computer Science Department)

Target Users & User Considerations

Observer - All who view the system
- LED refresh rate must not be too fast - can follow the progression of data throughout the system.
- LED brightness cannot be blinding.
- Catch the attention of passersby, intrigue observers to understand whats being shown.

Operator - Responsible for setup, configuration, etc.
- Program must be configurable to demonstrate different operations (logical AND, OR, etc.)
- Able to bring system to events such as trade shows or university events

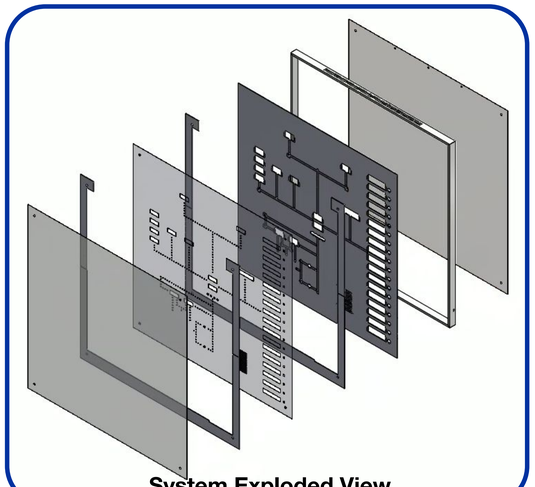
Business Case

"Starting conversations about electrical & computer engineering"

- System serves to get the attention of prospective students & ignite curiosity.
- Increase interest and enrollment in [electrical & computer] engineering programs at the College of Engineering.
- Showcase the College of Engineering's hands on approach to education.

Design Challenge - Addressable LEDs

- System consist of 2,274 addressable LEDs
- Concern 1: Provide enough power for all LEDs
  - Max 300 LEDs per power circuit (per manufacturer).
- Concern 2: Reliably control a large magnitude of LEDs
  - Max 1300 LEDs per circuit to maintain signal integrity



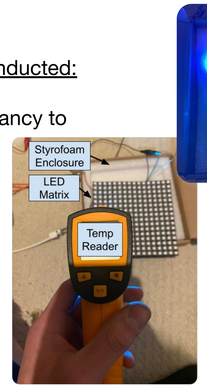
System Exploded View

Design Challenge - Enclosure

- Create an enclosure to fit all components while being able to hang on wall.
  - Limited to 4" depth by ADA regulations
- Design components to be manufactured with on-campus equipment
  - Segment components to fit equipment build space

Testing

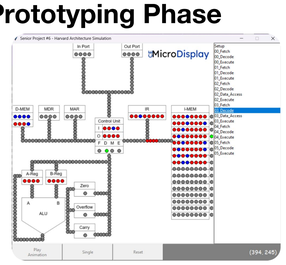
(Some) Tests Conducted:
- LED Heat test
- Adhesive relicancy to cleaning materials
- Power draw testing

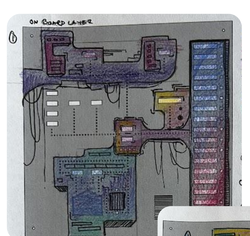


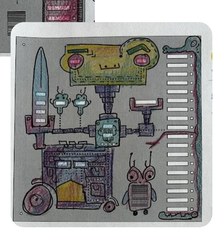
Above: Result of LED heat test (total failure at 149°F)

Left: LED Heat test setup; determining maximum operating temperature of LEDs

Prototyping Phase

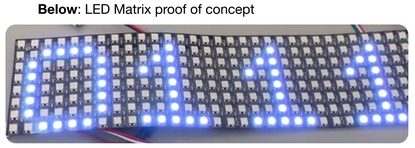






Left & Below: Initial art sketches (Elise Kahel)

Above: Software simulation of data flow
Below: LED Matrix proof of concept

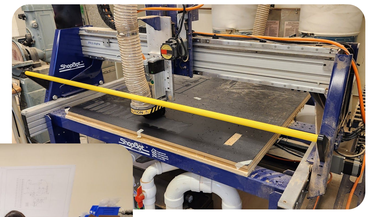


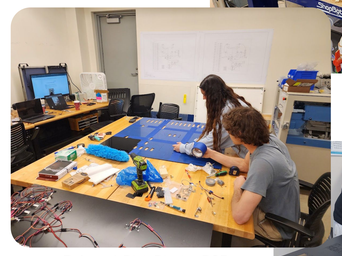
Project Team

(From left to right) Trinity Roodbeen, Dr. Ryan Krauss, Hector Garcia, Mitchell Hoeker, Ben Keil, Justin Wolters, Elora Ferrie

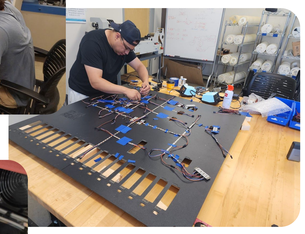
Build Phase

Right: CNC machine routing back plate
Below: Assembling front plate segments

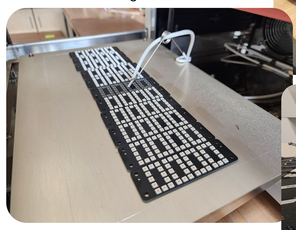




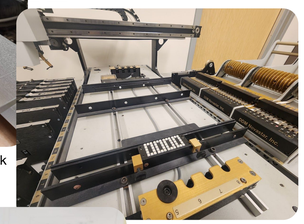
Below: Wiring LED displays & LED strips

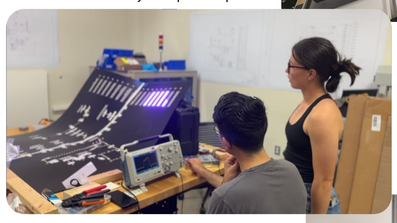


Below: 4-Digit Display PCBs entering reflow oven

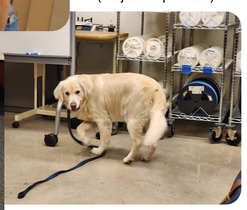


Right: 4-Digit display populated using pick & place machine
Below: First system power up





Below: Enzo (Project Supervisor)



Left: Test assembly

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