FLIPSIDE
DISPLAY BOARD

NEED

Signage is an essential marketing component and embodiment of a brand which differentiates one company from the next. It serves as a primary link between businesses and customers. In this age of ubiquitous digital screens, that key connection to the consumer can get lost with the use of digital signage[1]. Electro-mechanical displays offer a refreshing and engaging mode of communication. However, existing products retail for over $40,000 - a price point few companies can meet.

Key Metrics

- Cost
- Customizability

CONCEPT

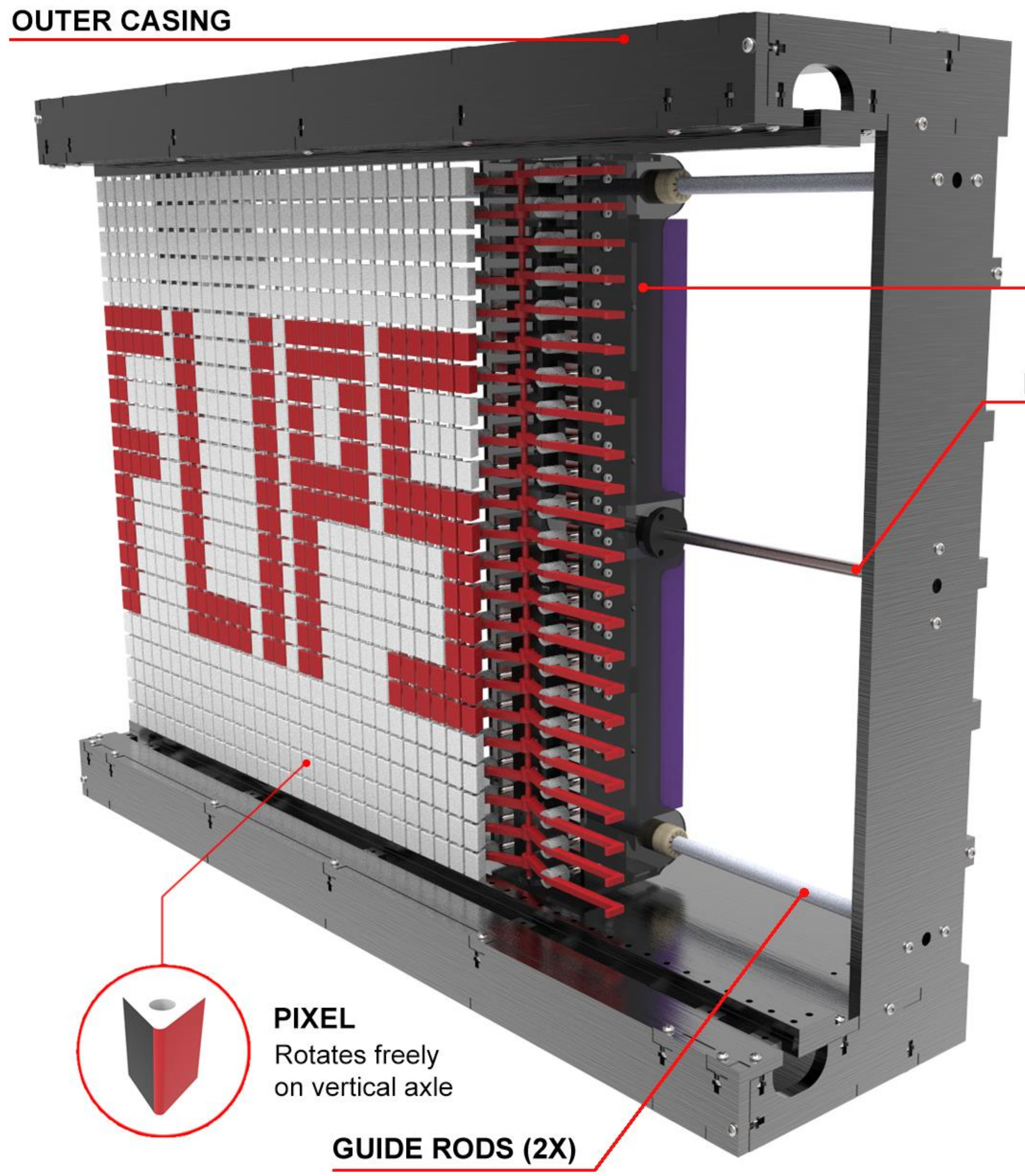
FlipSide is a non-illuminating electro-mechanical display board tailored to those who desire an eye-catching sign with an old-school feel without sacrificing the same level of web-based control and automation as modern electrical displays. This modularized, pixelated design board will maintain a significantly lower price point than existing mechanical display boards. The sign consists of a uniform array of tri-colored pixels that can be individually turned. A carriage of 46 solenoids moves along a horizontal lead screw, actuating relevant pixels to produce the desired message.

USER INTERFACE

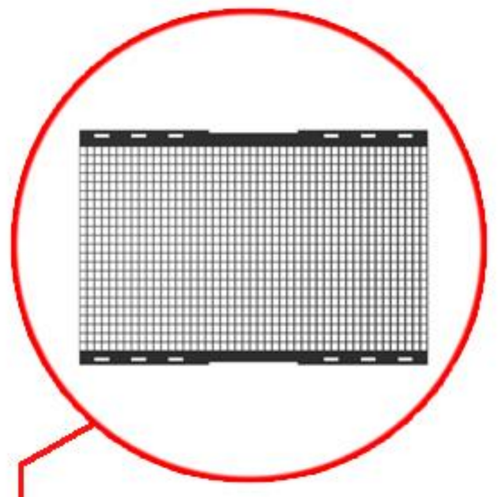
This system is designed to be fully customizable and easy to operate for any user. A Raspberry Pi with WiFi capabilities is connected to a custom web interface where users can initiate sign changes with ease.

CHARACTERISTICS

Size: 1ft x 2ft x 6in[3]
Weight per module: <25 lbs[2]
Cost per module: <$1500
Power Consumption: 62 W
Time required for sign change: 6 minutes



CARRIAGE
Travels laterally along a lead screw and two guide rods, houses solenoids used for actuation



MOVING GRID
Fulfills pixel turns, ensuring the face is flush to the front

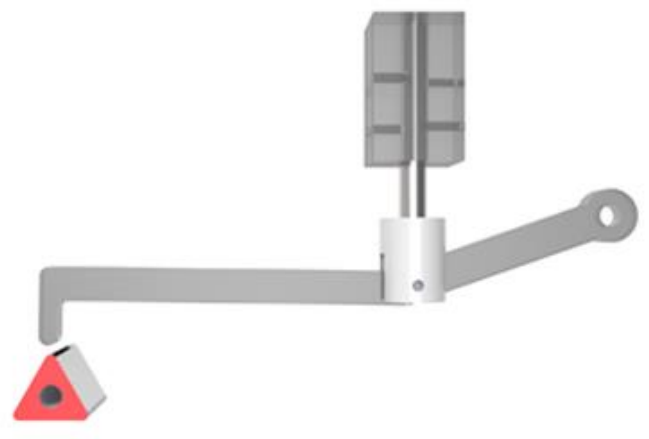
PIXEL
Rotates freely on vertical axle

FRONT VIEW

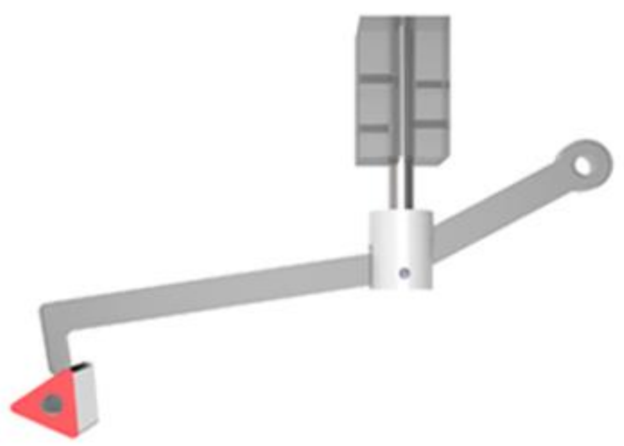
SIDE VIEW

ACTUATION

A lever arm is attached to each solenoid, allowing the carriage to reach the leftmost and rightmost pixels and minimizing bezel. When the solenoid is fired, the lever arm is pushed out at an angle. The carriage then moves and the tip contacts the pixel, turning it. The lever arm retracts back to its original position after the pass. The grid moves over each pixel to complete the rotation, smoothing the front face of the display.



BEFORE PASS



DURING PASS

ANALYSIS

Bending analysis

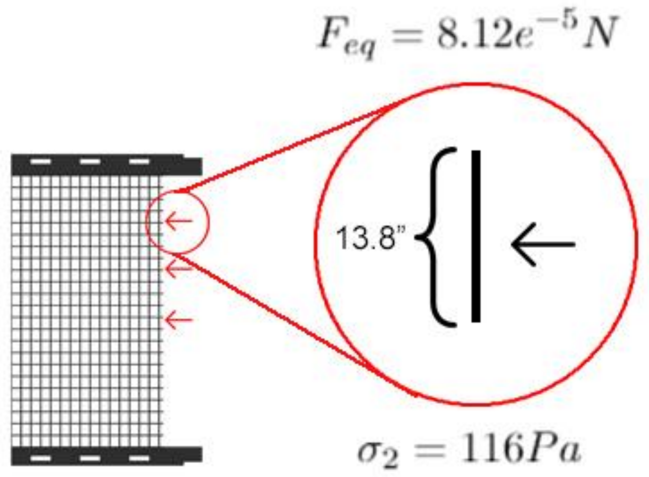
No horizontal members:

$F_{eq} = 1.87e^{-3}N \quad \sigma_1 = 61.3MPa$

This is greater than the rupture stress, $\sigma_{rupture} = 30MPa$

Including horizontal bars reduces this stress.

$F_{eq} = 8.12e^{-5}N$



$\sigma_2 = 116Pa$

Torque analysis

$$T_{friction} = \frac{F}{2\pi\rho e} = .41 \text{ oz-in}$$

$$T_{acceleration} = \frac{\omega}{gt}(J_{load} + J_{lead\ screw} + J_{motor}) = 8.875 \text{ oz-in}$$

$$T_{total} = T_{friction} + T_{acceleration} = 9.28 \text{ oz-in}$$

TEAM FLIPSIDE

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ACKNOWLEDGEMENTS

Faculty Advisor: Dr. Mark Yim
Special Thanks: Eli Gottlieb | Dr. Graham Wabiszewski | Peter Szczesniak | Joe Valdez
Sponsors: Mark Kuhn & John Halko from Oat Foundry

REFERENCES

[1] Müller, et al. "Display Blindness: The Effect of Expectations on Attention towards Digital Signage," Lecture Notes in Computer Science Pervasive Computing, vol. 5538, pp. 1–8, 2009.
[2] Ergonomics eTool: Solutions for Electrical Contractors - Materials Handling: Heavy Lifting. [Online] https://www.osha.gov/SLTC/etools/electricalcontractors/materials/heavy.html#weight. [Accessed: 08-Dec-2018].
[3] ADA Standards for Accessible Design, Section 4.30, 1994
[4] Protruding Objects, ADA Standard 307.2, 2010

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