Interactive LED Matrix

INSO 4151 - Capstone Project

Team:

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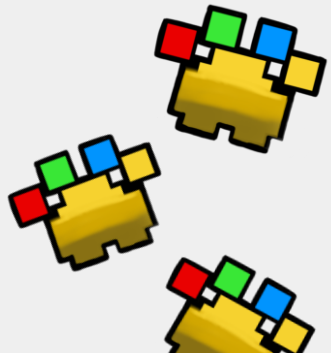
PROBLEM STATEMENT

- **Student communities need better ways to share updates, events, and opportunities**
  - **Traditional methods (emails, flyers, whiteboards) are static and often overlooked**
  - **TV signage is dynamic but energy-intensive and space-demanding**

- **IEEE CS UPRM Student Branch seeks a compact, energy-efficient, interactive platform**
  - **Our system enables real-time content updates and member participation**



OBJECTIVES

Hardware

Configure an internet-connected single-board computer with two 64x32 RGB LED panels; ensure synchronized display of test images with no visual errors

Backend

Build a robust image-handling backend supporting 50 images/week and 80%+ approval rate; test with 10 diverse edge-case images for reliability.

Web App

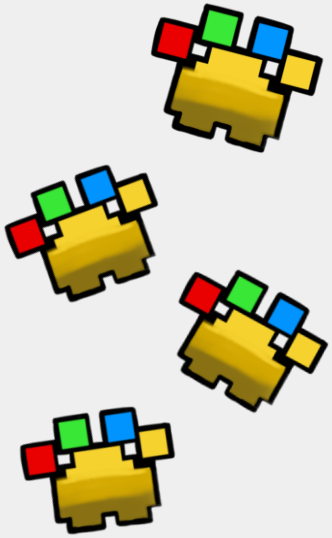
Deploy a user-friendly web app for uploading, previewing, and queuing designs; ensure cross-browser compatibility

Queue System

Implement a display scheduler to manage panel content timing accurately; test with 5+ designs to ensure smooth, error-free operation.

Admin Portal

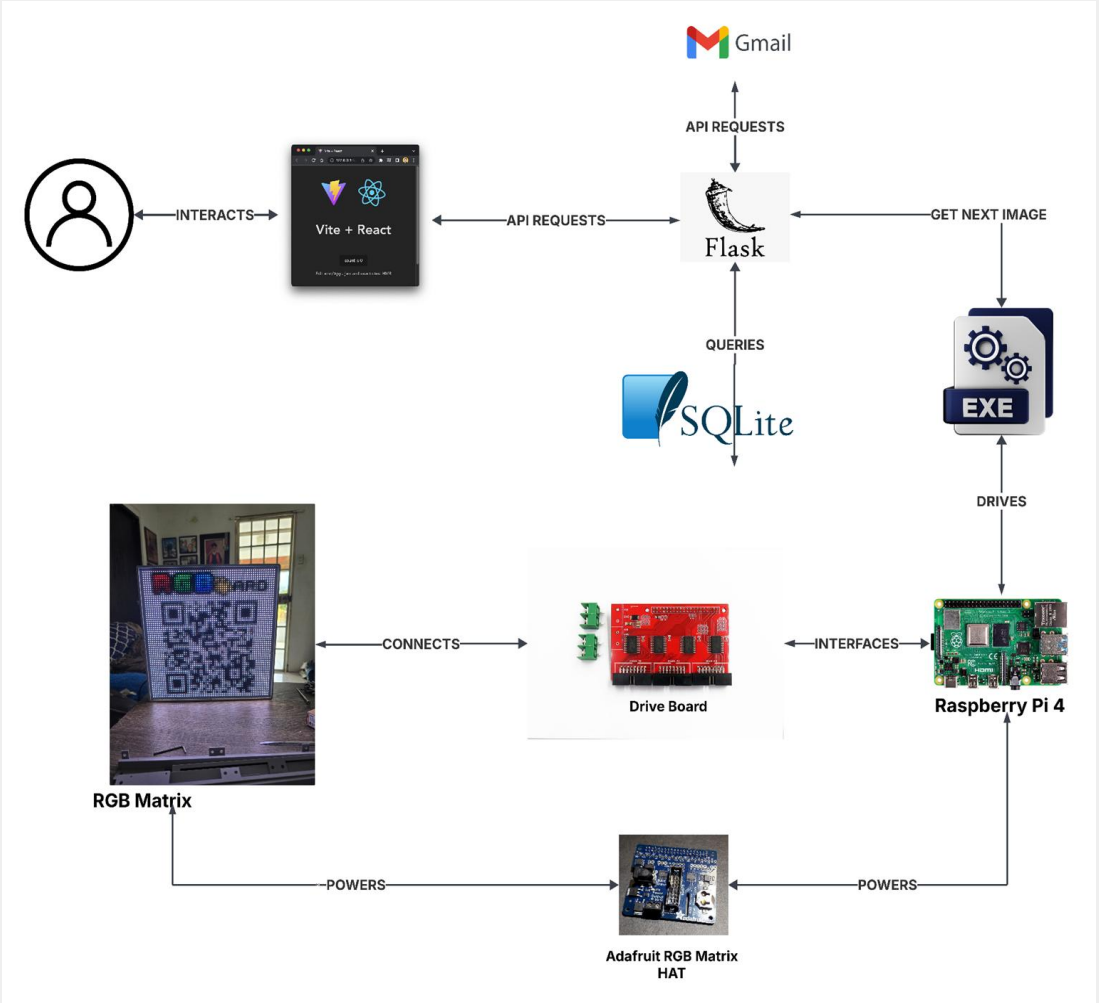
Provide admin tools for user management and queue editing.



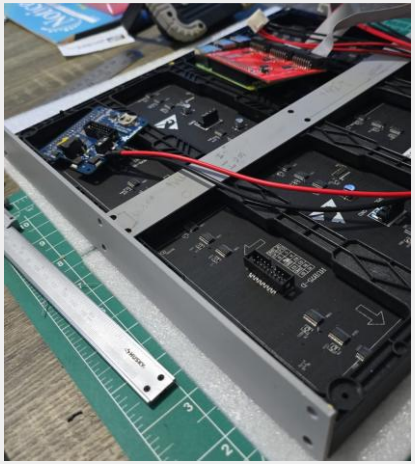
SOLUTION APPROACH

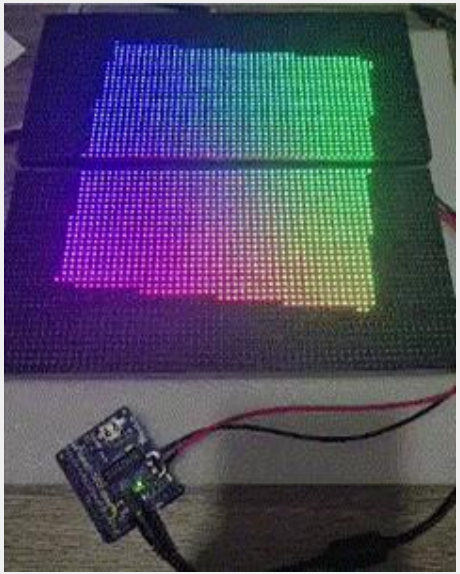
Solution Approach Architecture

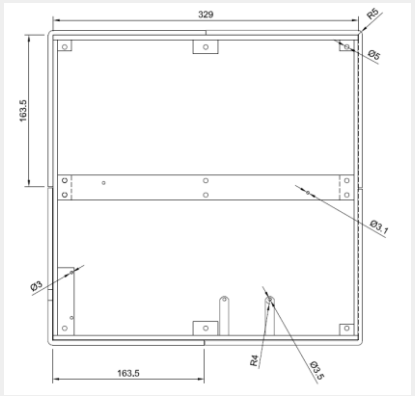
How does RGBoard work?

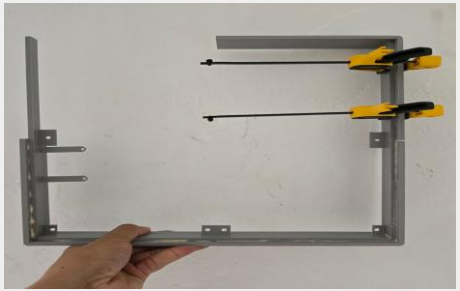


Solution Approach: Hardware









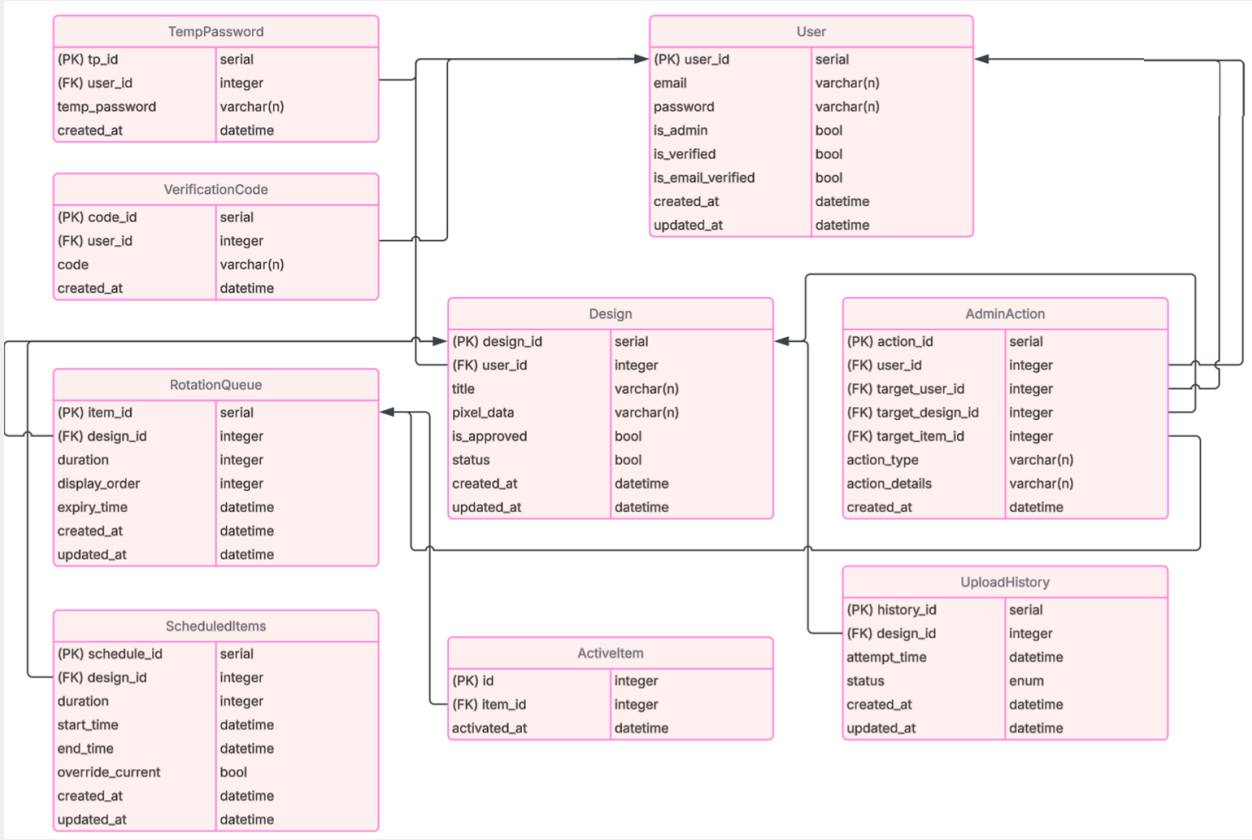
How does RGBoard start?

Items needed:

- 64x32 LED Matrix - 5mm Pitch
- Raspberry Pi 4 Model B 8GB
- 5V 10A Switching Power Supply
- Adafruit RGB Matrix HAT
- GPIO Ribbon Cable 2x8
- RGB Matrix Panel Drive Board
- rpi-rgb-led-matrix library

Solution Approach: Backend

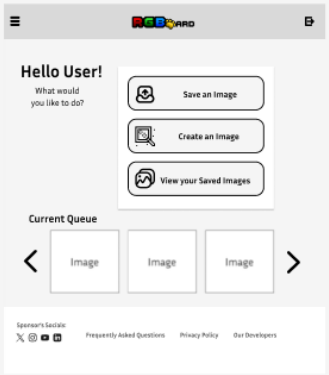
How does RGBoard connect with itself?



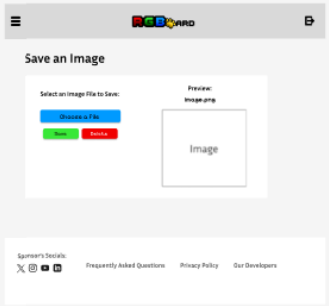
Solution Approach: Frontend

How does the User connect with RGBoard?

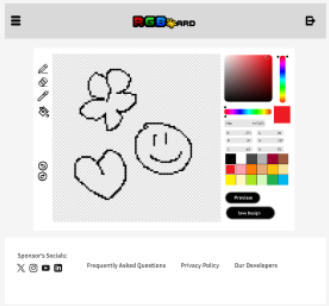
Homepage - User



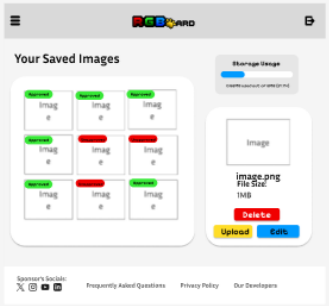
Save an Image



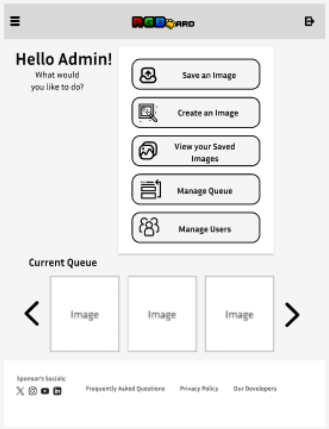
Create an Image



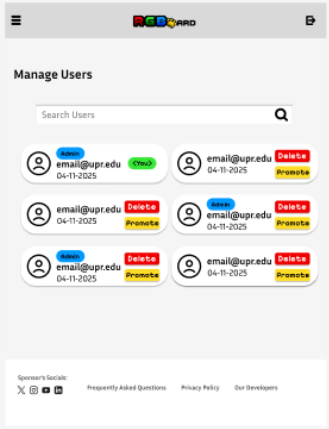
Saved Images



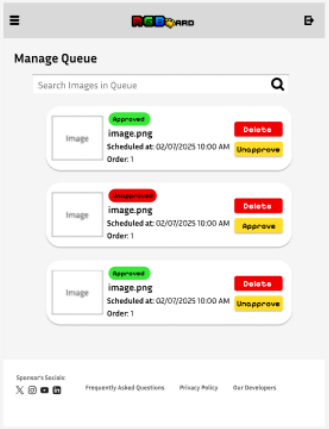
Homepage - Admin



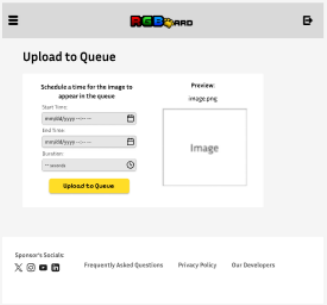
Manage Users

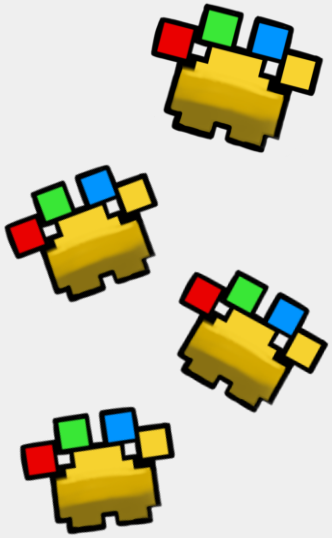


Manage Queue



Add to Queue

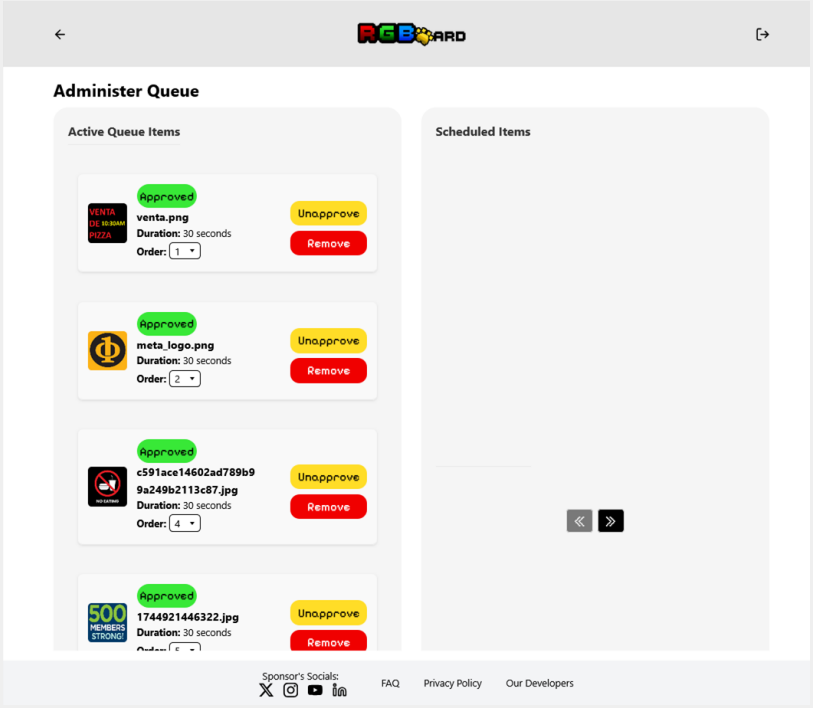




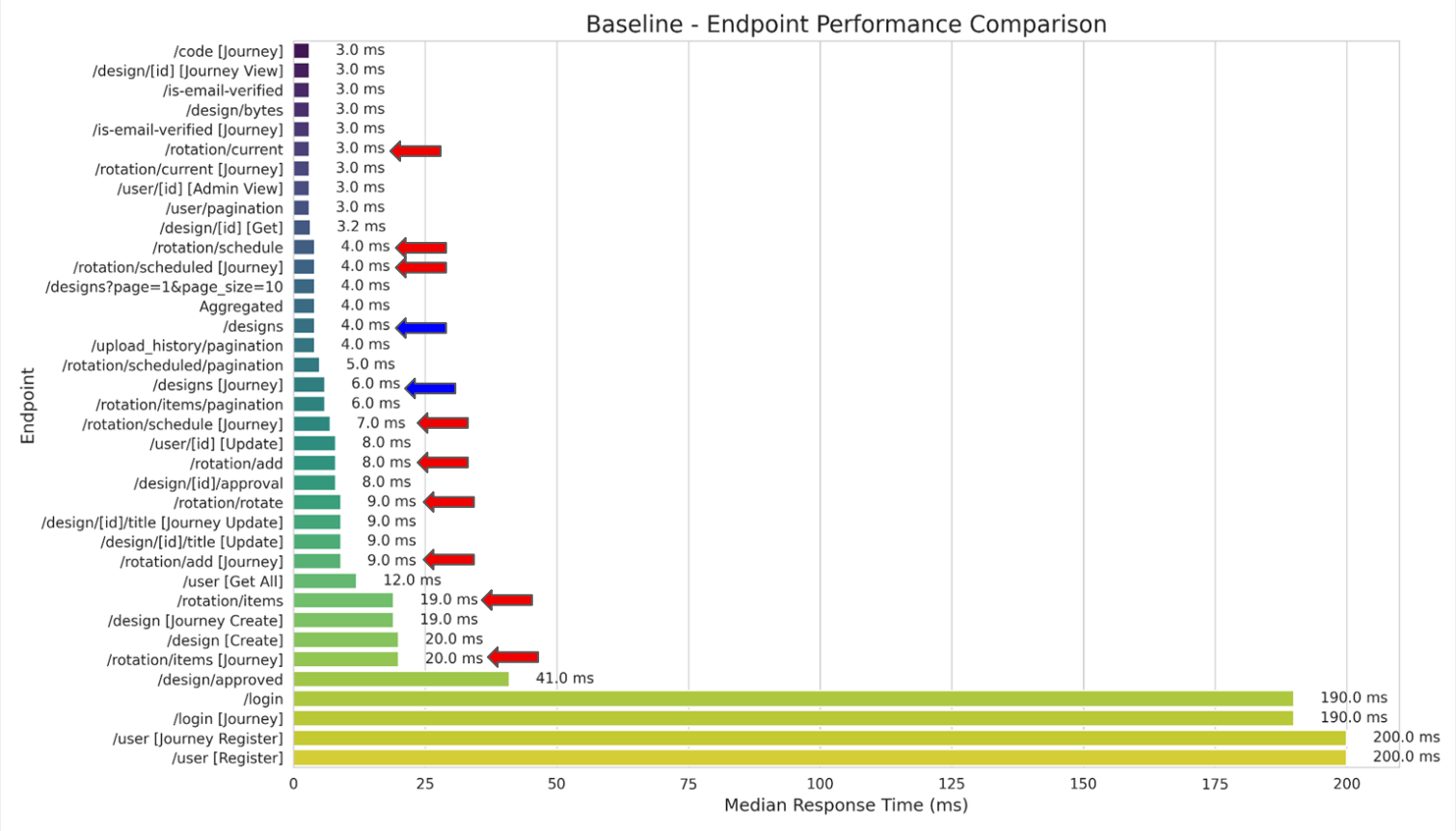
RESULTS

Results: Hardware

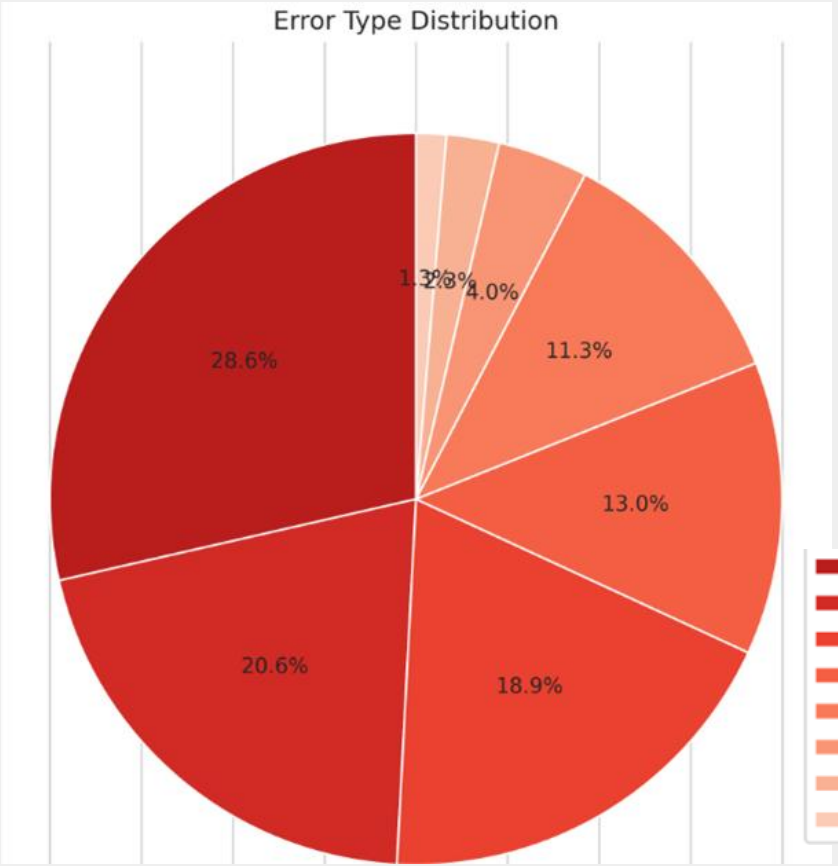
(x10 sped up)



Results: Queue System



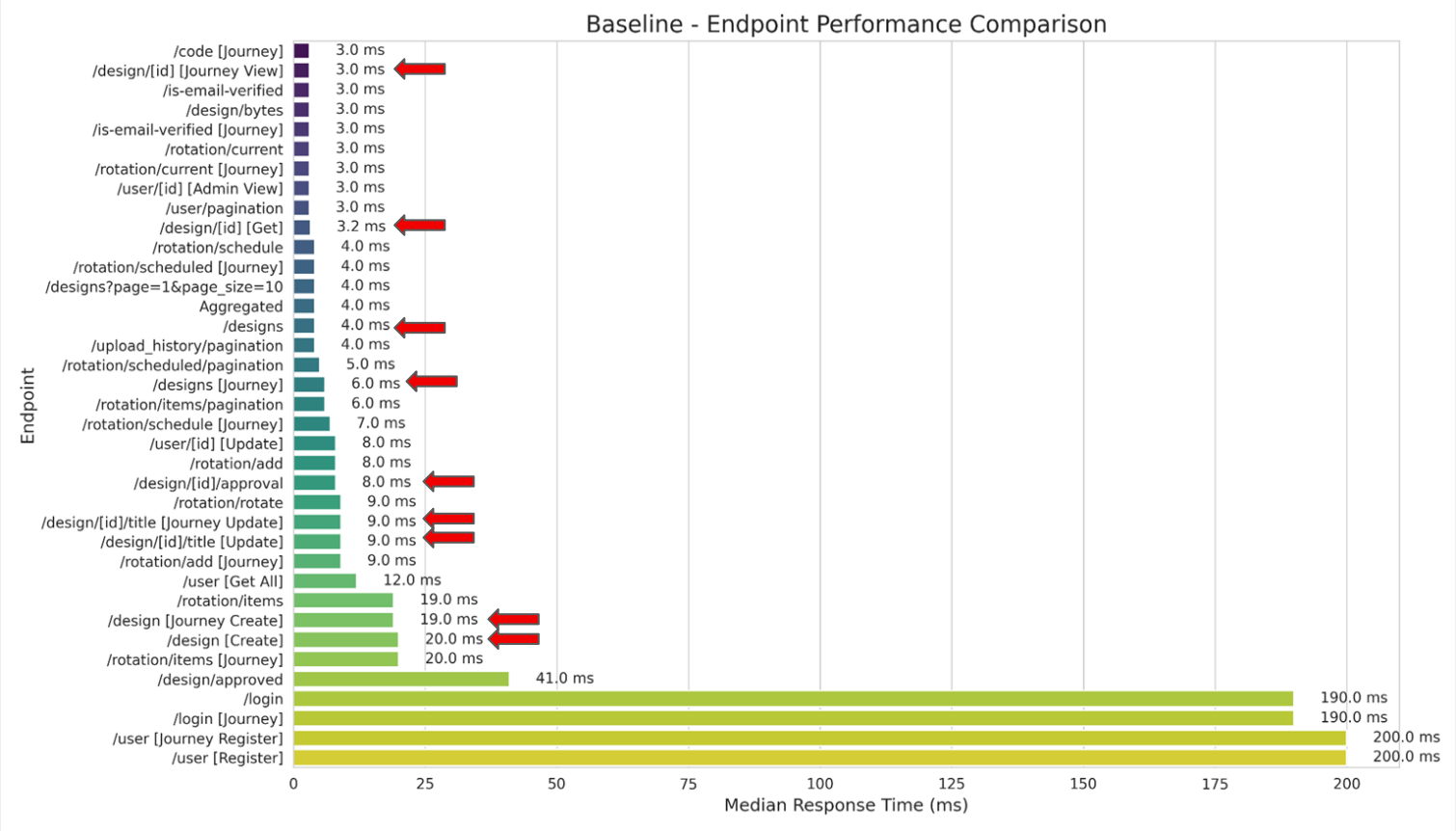
Results: Queue System



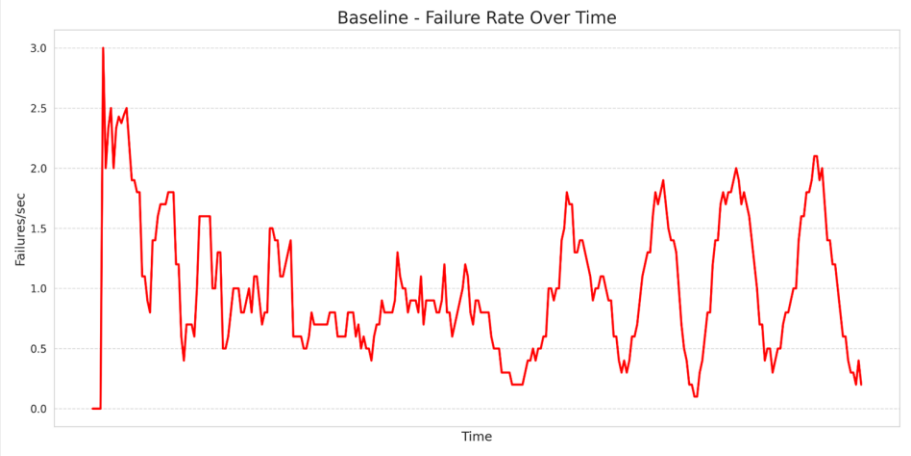
Failure Analysis

Error Type	Occurrences	% of Total Errors
HTTPError('403 Client Error: FORBIDDEN for url: /is-email-verified [Journey]')	86	28.57%
HTTPError('429 Client Error: TOO MANY REQUESTS for url: /code [Journey]')	62	20.60%
CatchResponseError('Failed to create design: 507 - {\n "error": "Memory limit exceeded."\n}\n')	57	18.94%
HTTPError('409 Client Error: CONFLICT for url: /rotation/schedule [Journey]')	39	12.96%
HTTPError('403 Client Error: FORBIDDEN for url: /is-email-verified')	34	11.30%
CatchResponseError('Failed to get designs: 404')	12	3.99%
HTTPError('404 Client Error: NOT FOUND for url: /designs [Journey]')	7	2.33%
HTTPError('409 Client Error: CONFLICT for url: /rotation/schedule')	4	1.33%

Results: Backend



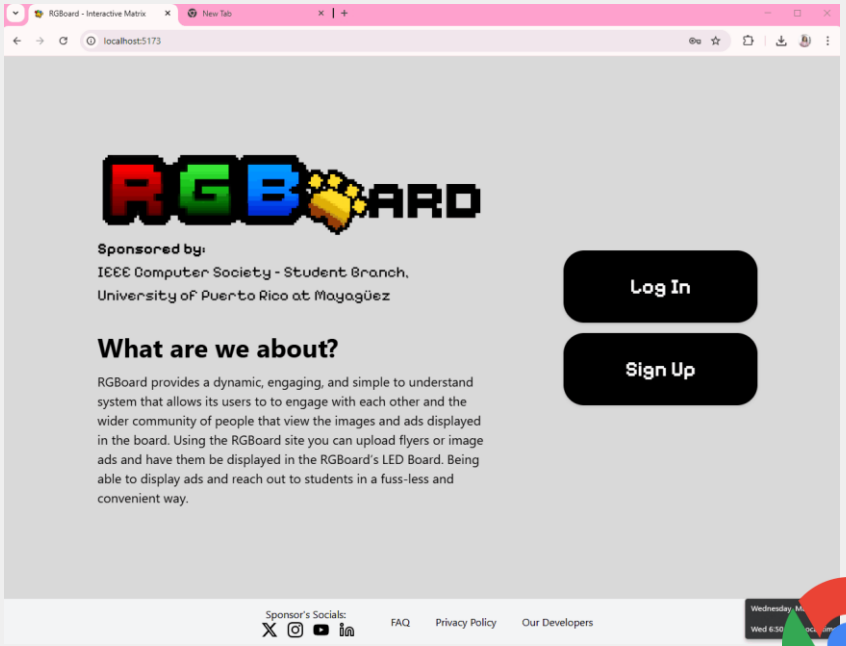
Results: Backend

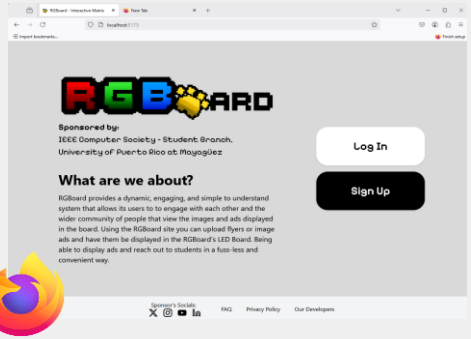


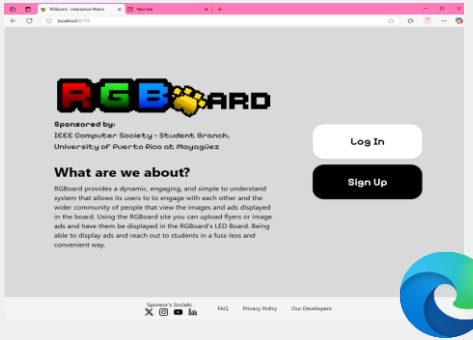
Test Summary

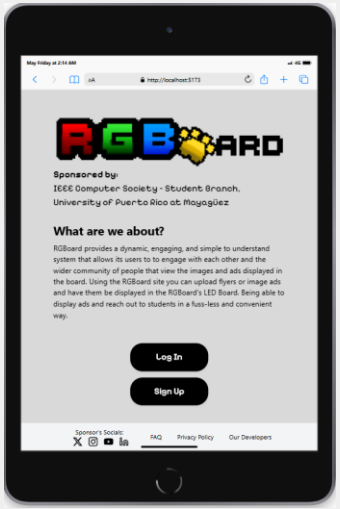
Metric	Value
Total Requests	5462
Total Failures	602
Overall Success Rate	88.98%
Average Response Time	28.90 ms
Test Duration	0 minutes

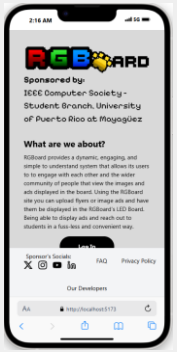
Results: Web Application



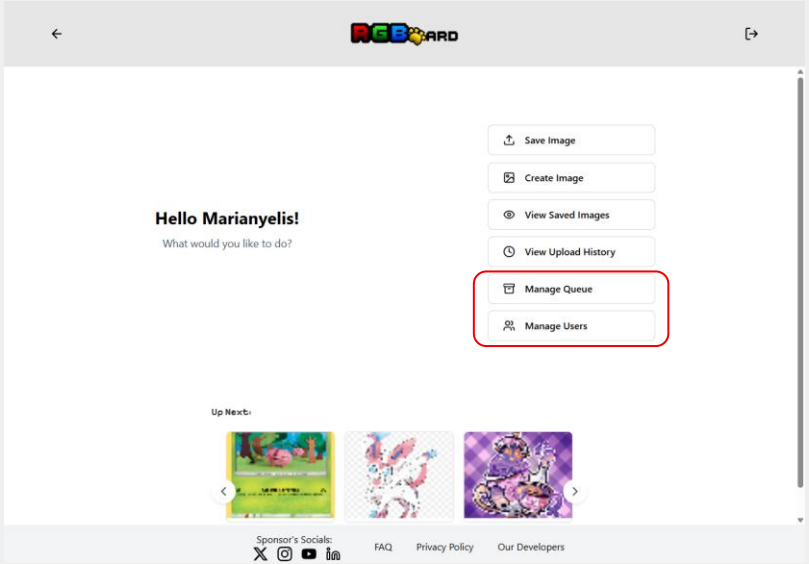


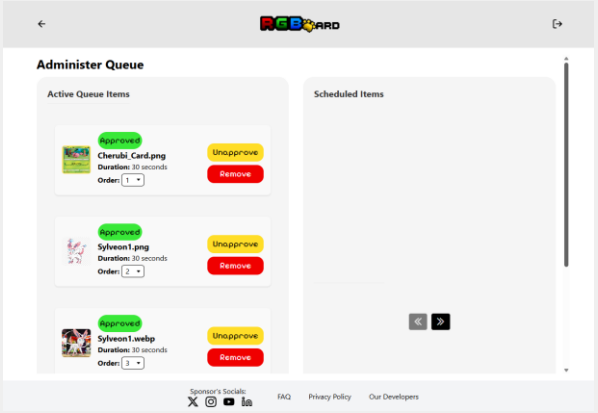


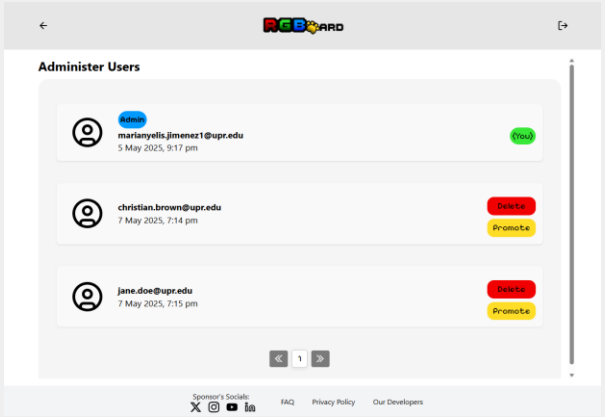




Results: Admin Portal



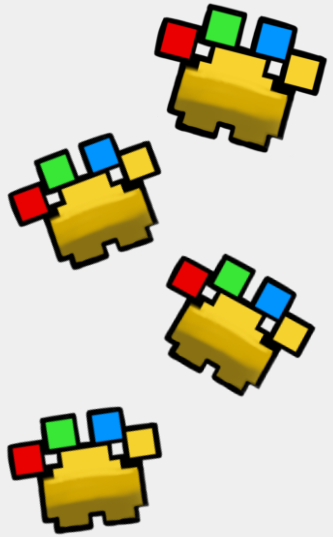




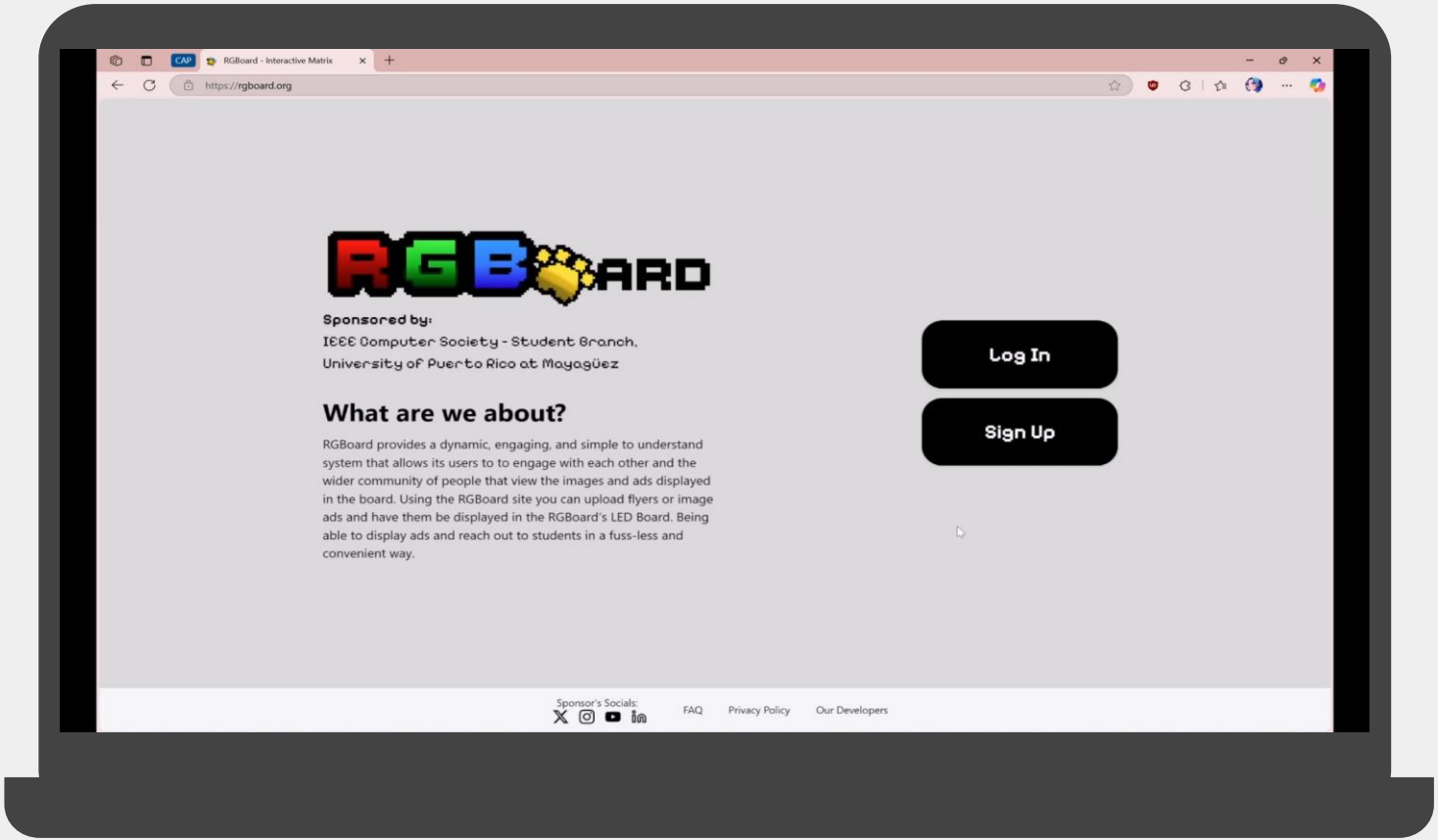
CONCLUSION

- A fully integrated system was achieved that connects a single board computer with an LED board that the user is able to interact with and see change.
- The results prove the stability and engagement of the system

- Future Work:
  - Memory Upgrade
  - Search and/or filter features for images
  - Advanced Image Editor
  - Backup and Recovery System



DEMO


RGBoard - Interactive Matrix
https://rgboard.org
RGBOARD
Sponsored by:
IEEE Computer Society - Student Branch,
University of Puerto Rico at Mayagüez
What are we about?
RGBoard provides a dynamic, engaging, and simple to understand system that allows its users to to engage with each other and the wider community of people that view the images and ads displayed in the board. Using the RGBoard site you can upload flyers or image ads and have them be displayed in the RGBoard's LED Board. Being able to display ads and reach out to students in a fuss-less and convenient way.
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