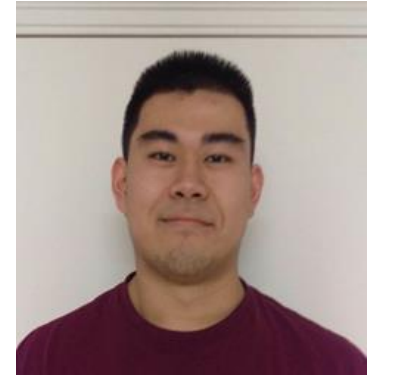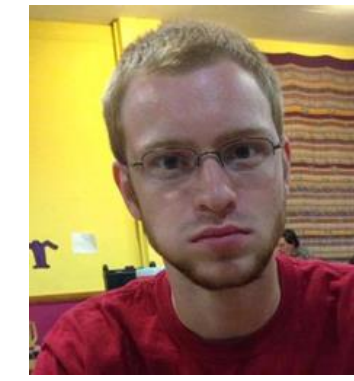# ITS LIT

Patrick Browne, Emma Bryce, Varun Menon,
Michael Polin, Tommy Zhen
Faculty Advisor: Prof. David McLaughlin

Abstract

Current LED displays and televisions are designed for viewing at shorter distances. To achieve discernible imagery from a long distance with this technology, larger resolution and overall size is necessary. This project aimed to create an interactive light display that is designed for viewing from further distances without the need for increasing the size of the overall display. ITS LIT is a display with a specific LED pitch chosen to fulfill our needs. The goal is also to incorporate campus interaction through the use of our iOS app in which people can use to interact with the display.

System Overview

- The entire system incorporates three subsystems and is mounted on a wooden frame.
- The LED display itself is composed of 9 PCBs with 144 LEDs on each board. The layout is designed so that the LEDs are one inch apart from each other.
- We created an iOS app which is used to control the display by sending requests to the server which then directs it to the display.
- The server acts as a medium between the iOS app and the LED display. Requests from app are stored in the server and are sent to the display in real-time.
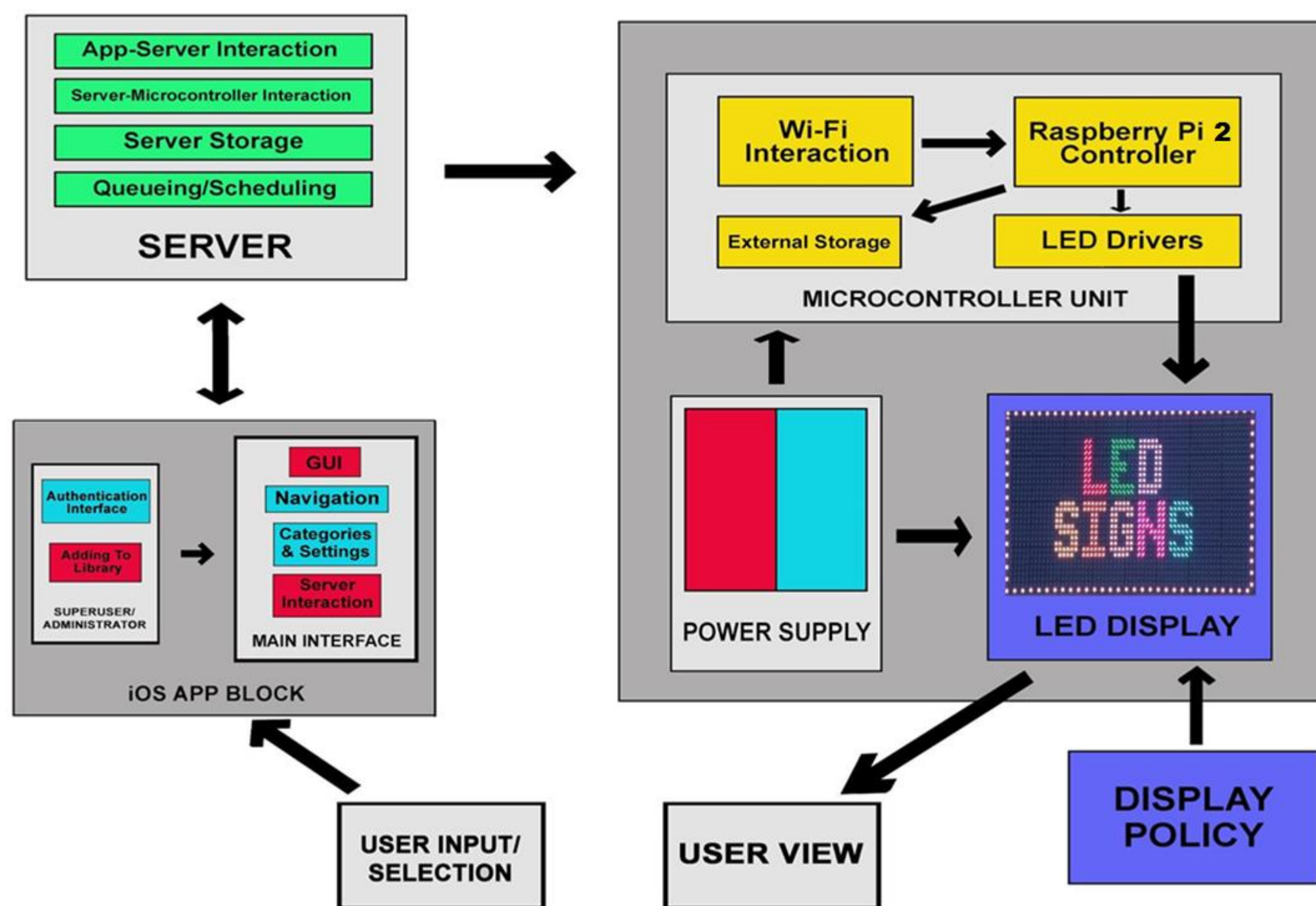
Block Diagram

Figure 1: Block Diagram with subsystems outlined

Results

- Fully functional LED display
- Fully functional app deployed on iPhone 6/6+/7 devices running iOS 10.3 or above
- Users able to select from a host of preset images on the app and Superusers can add custom images to be shown on the display
- Fully functional server that is able to handle app requests and communicate with the microcontroller accordingly
- End-to-end functionality from user input on the app to the image being shown on the display in real time

Acknowledgement

Specifications

Part	Unit
Single LED	60mA x 5V=0.3W
Single PCB	60mA x 144= 8.64A
Single PCB	8.64A x 5V= 43.2W
Total System	43.2W x 9= 388.8W

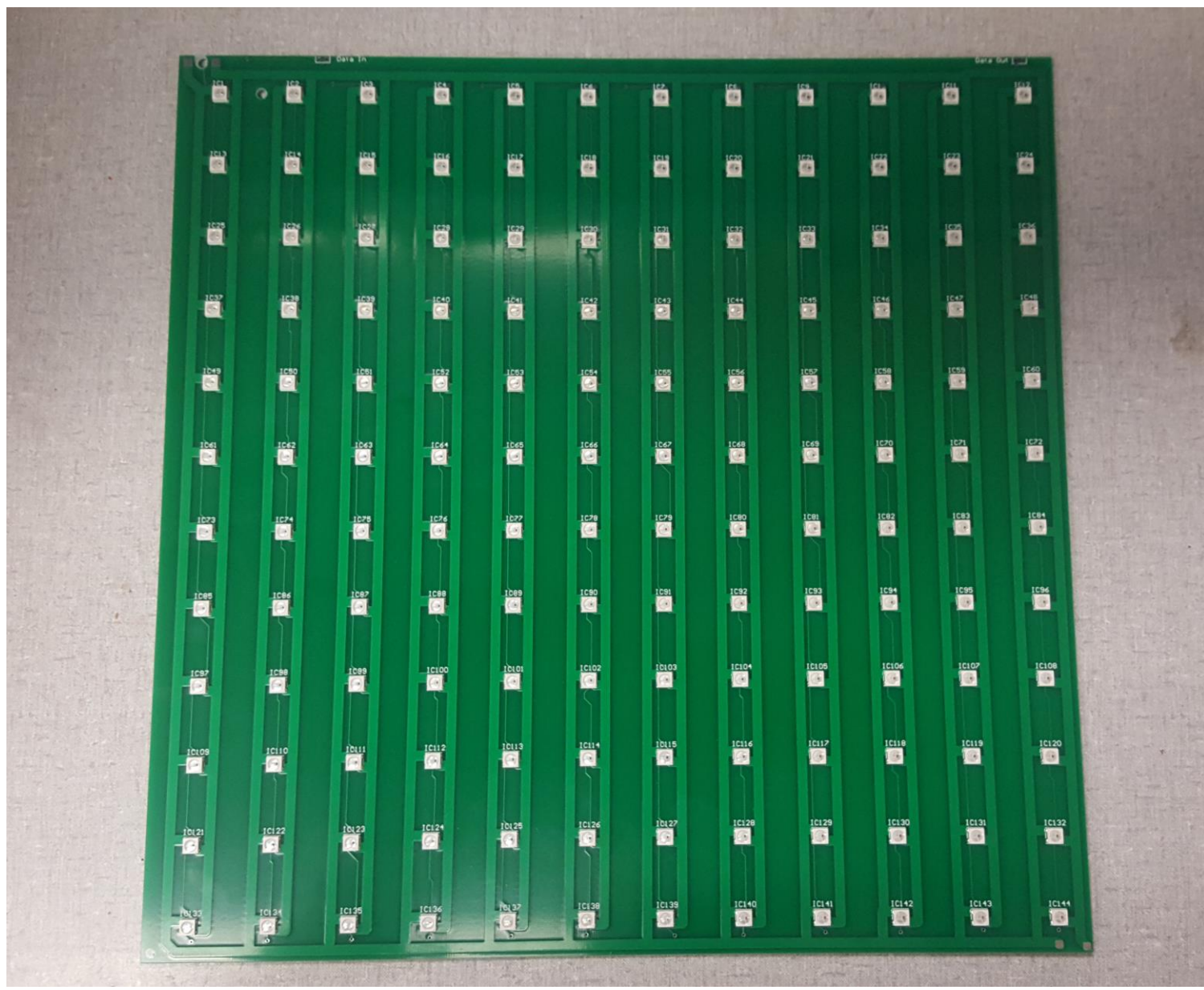| Part	Goal	Actual
9 PCB's	<400W	388.8W at max

LED Display

Figure 2: One of the PCB panels used for LED display

- The LED display consists of 9 PCB's each of which contains 144 LED's
- Each PCB is 1' x 1' making the entire display 3' x 3'
- The PCB's were designed using Altium
- The PCB's were populated with assistance from Worthington Assembly Inc.
- We used WS2812B LEDs and the display is updated through their communication protocol through a pulse width modulation module on the Raspberry Pi.
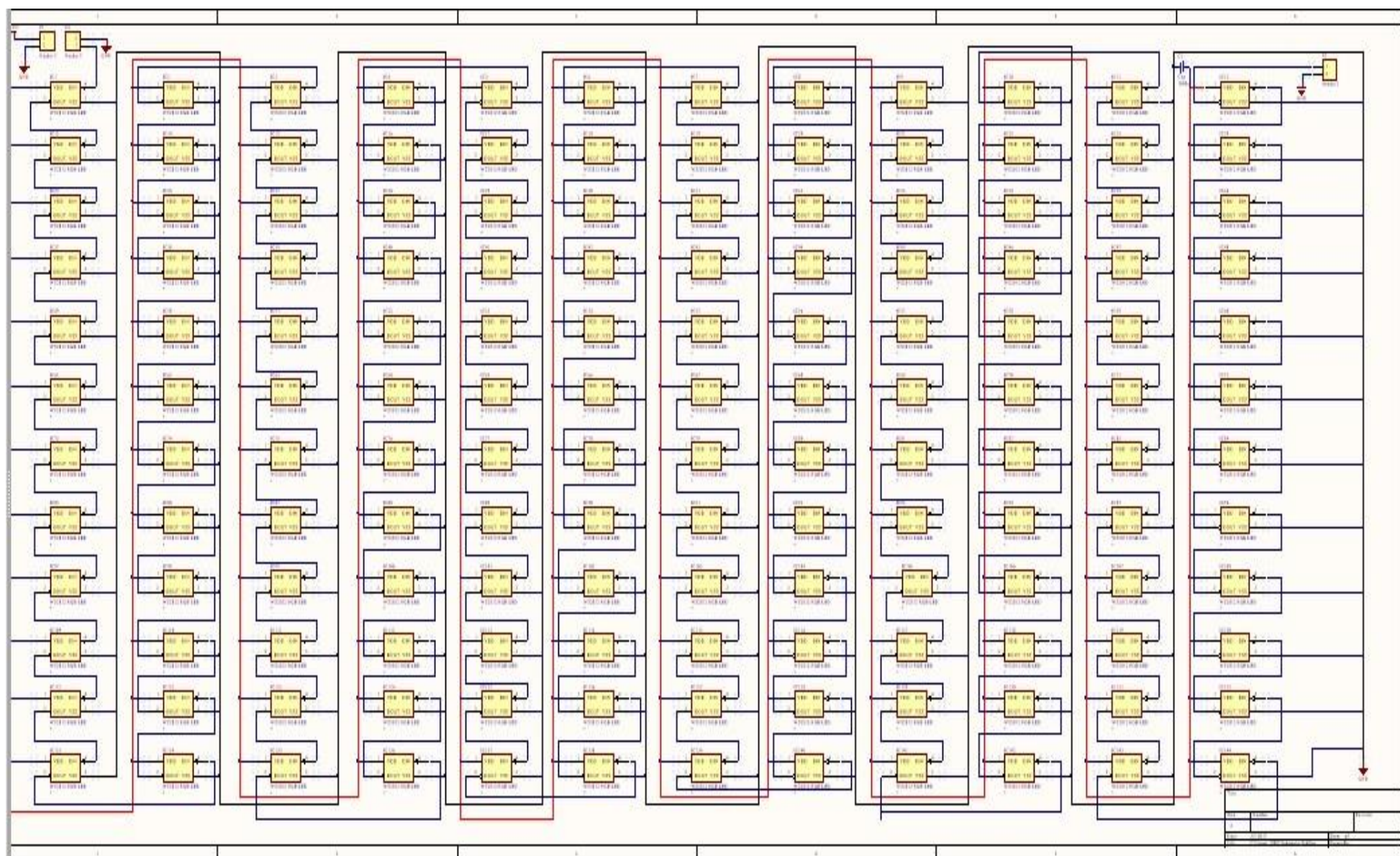- The image is downsampled, converted to RGB, and then sent to the display from the Pi.

Figure 3: Schematic of the PCB design

Server

- We used a MySQL database which receives requests from the iOS app through PHP scripts.
- The database stores requests in a FIFO based queue and are deleted from the database after the corresponding image is sent to LED display.
- The server will recognize if a URL is sent by the Super-user and will download the image from the link.

Cost

Part	Development	Production (1000)
Raspberry Pi	$40	$40
Power Supply	$105	$105
WS2812 LEDs	$145	$100
PCBs	$105	$69.84
Total	$395	$314.84

Application

- The app was designed on XCode v8.3.1 using Swift 3
- Optimized for best performance on iPhone 6/6+/7 devices running on iOS 10.3 or above
- Most of the app features can be accessed by the public, but special privileges can be accessed only by a Super-user.
- The Super-user interface consists of a login authentication/credentials check and privileges to add images that aren't present amongst existing presets
- The general public access library consists of a categories section, from which users can select a specific category of images
- Once in a selected category, users can select from a host of preset images
- Once an image is selected, the app communicates with the server to transmit the required data for the image to be shown on the LED Display
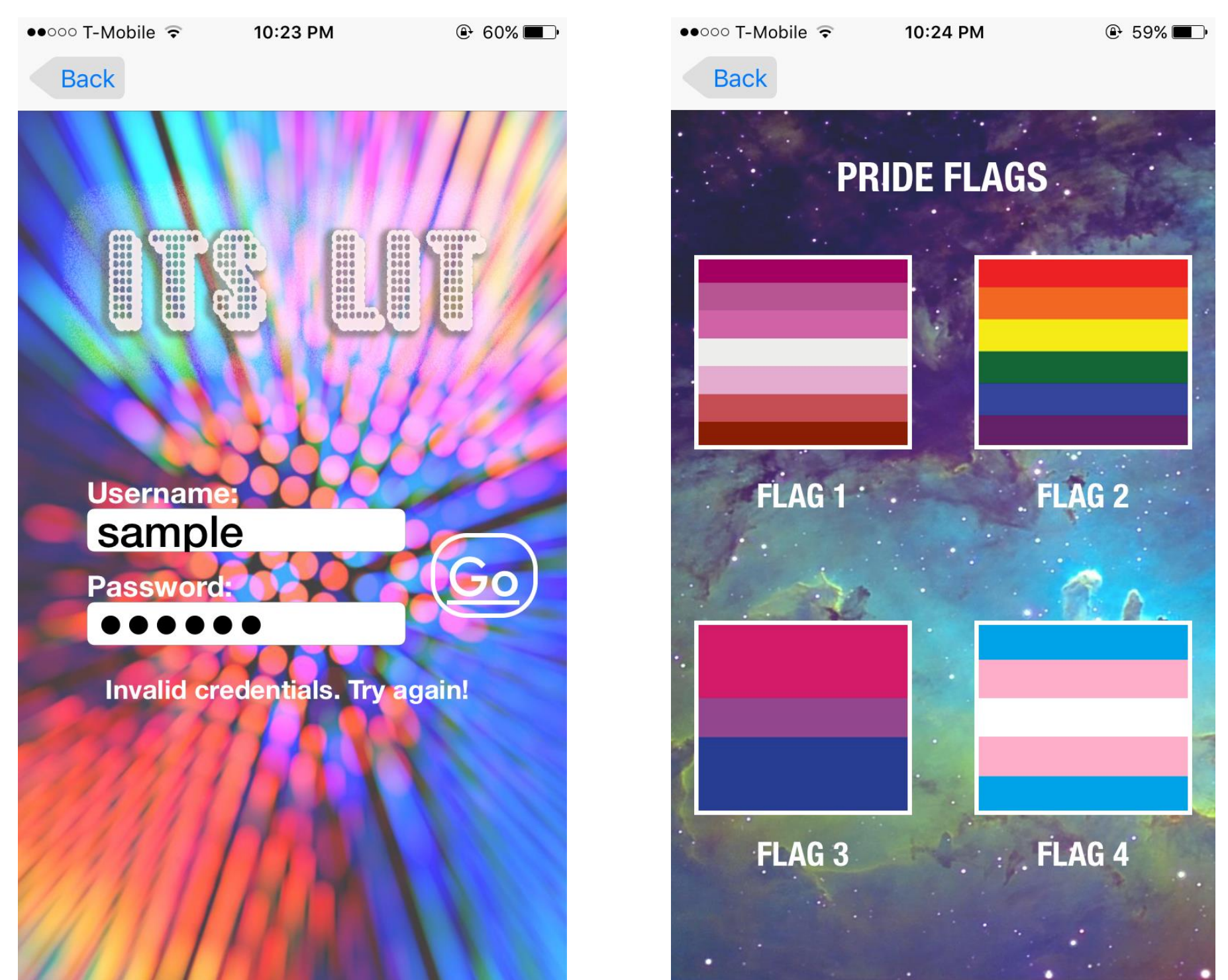

Figure 4: Screenshots of the iOS App

Power Supply

- Two Aiposen 5V/60A/300W LED Power Supplies are used to power the display
- 12-gauge THHN copper wire were used to rig up the power supply to the display
- Each power supply converts 120/220V AC to 5V DC
- Each power supply is capable of handling a maximum current of 60A
- The Raspberry Pi microcontroller is powered by a USB port on power strip

Figure 5: 900 Pixel Prototype