LAPTOP LENDING STATUS SYSTEM

sddec20_02

Advisor: Md Maruf Ahamed

Client: Eric Schares, David Harborth, Lisa Smith and Mitch Steimel of the Parks Library Tech Lending Center

Team: Farouk Al-Obaidi, Camden Thomas, Aaron Thune, Ryan Ray, Zoe Sanders, John Wagner.

Website: http://sddec20-02.sd.ece.iastate.edu/






Acknowledgements

Clients

- Eric Schares (Engineering Librarian)
- Lisa Smith (Parks Library Head of IT)
- David Harborth (Tech Lending Lead)
- Mitch Steimel (Parks Library Web Developer)
- The entire Tech Lending Department!

Faculty

- Faculty Advisor: Md Maruf Ahamed
- Senior Design I Instructors: Dr. Daji Qiao, Dr. Lotfi Ben Othmane
- Senior Design II Instructor: Dr. Thomas Daniels.

Thank you all for your insight and guidance!

Project Overview & Problem Statement

- Parks Library Tech Lending Center lends over 200 different devices to the ISU student body.
- The larger devices the Tech Center lends out (e.g., Laptops and Tablets) are displayed on racks (See Figure 1) while smaller devices (Chargers, Headphone, etc) are hung in bags on bars (Figure 2).
- To maintain information about device statuses (e.g., Overdue, Checked Out), employees currently place color-coded stickers next to associated devices (Figure 3). While this system is simple, it is tedious to maintain as statuses will change.
- Tech Lending proposed a new idea to set up a color-coded LED system that changes color automatically to reflect a status update on of the device.

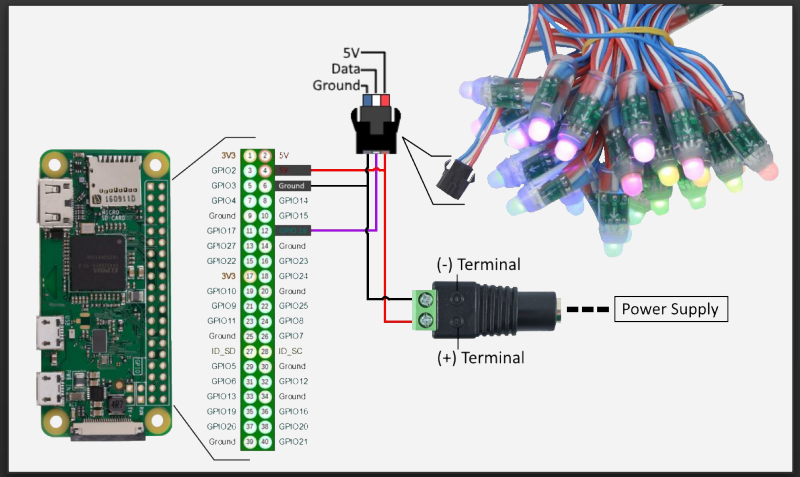
Figure 1) Devices placed on racks at the Tech Lending Center

Figure 2) (Above) Smaller devices hung in bags on bars.

Figure 3) Colored stickers on each rack.

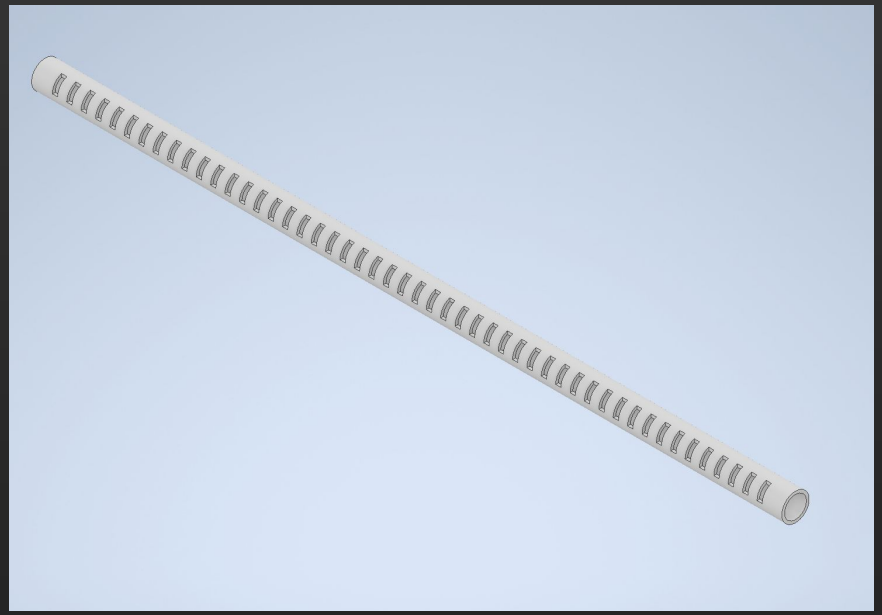
Hardware Architecture

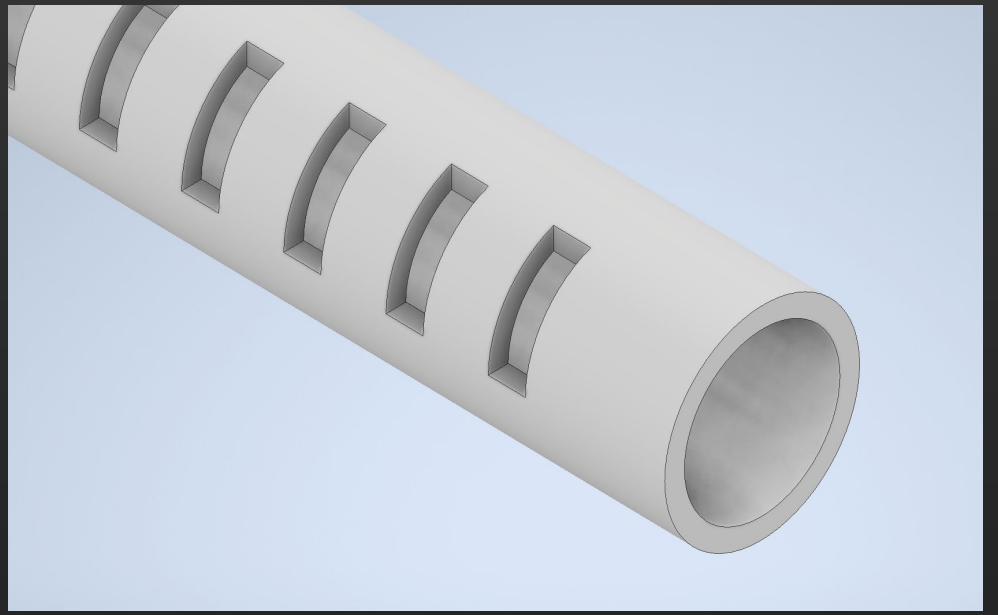
- Goal of designing convenient-to-assemble hardware modules controlling a range of individually addressable RGB LEDs used to indicate the status of a given item in the lending system
- Hardware aims to be versatile enough to support the varied mounting configurations within the tech lending system
- Each module is controlled by a Raspberry Pi Zero W, which continually retrieves information about lending items in its purview and updates the corresponding LEDs
- LEDs are an off-the-shelf strand of WS2811 LEDs, chosen due to ubiquity and ease of assembly



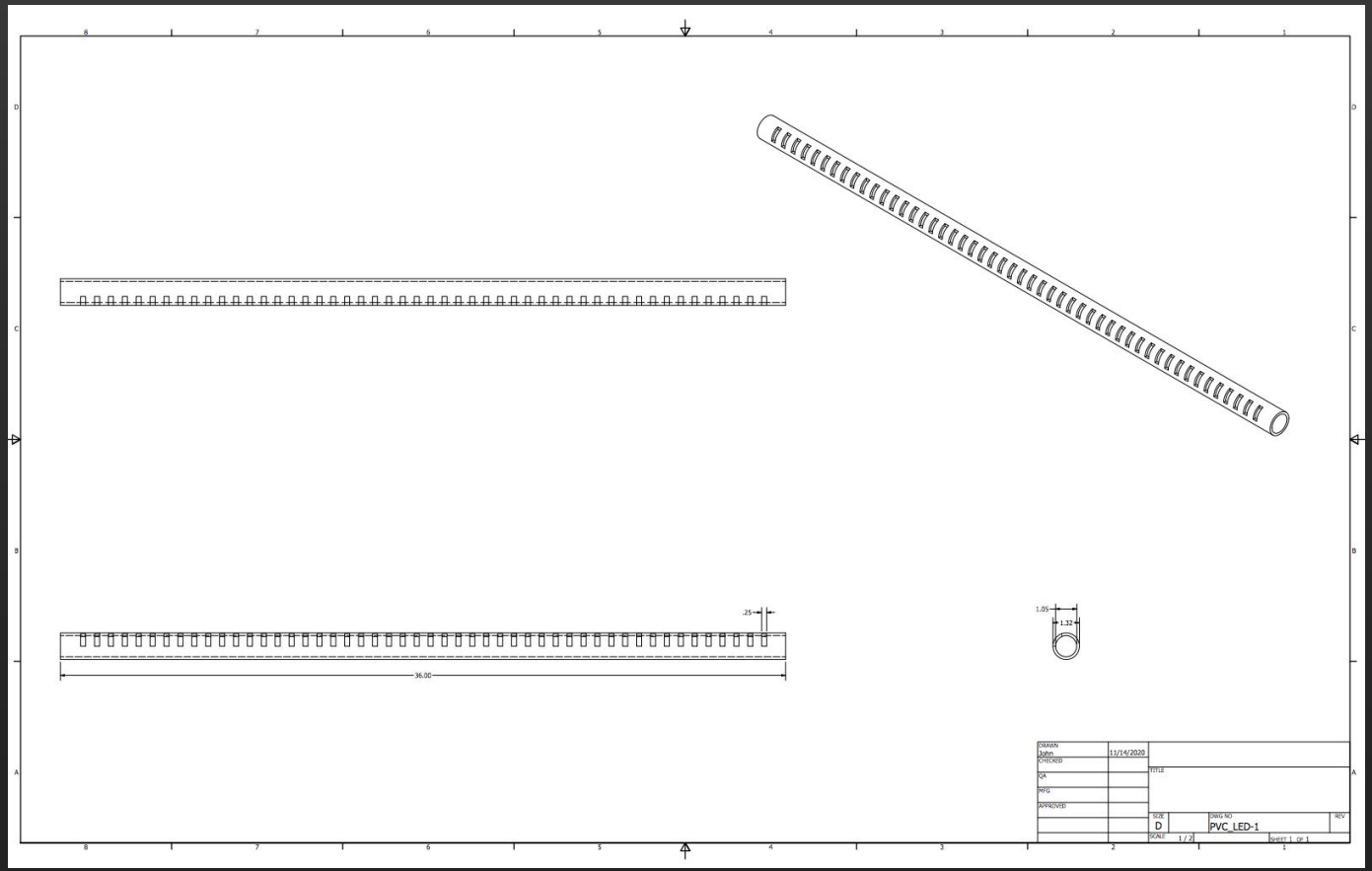
- Combined 5 volt, 5 amp power supply for Pi and LED strip, sufficient to handle the worst-case power consumption of both components
- Hardware cost of $63.50 per module

LED Enclosures for Bagged Devices - CAD Model

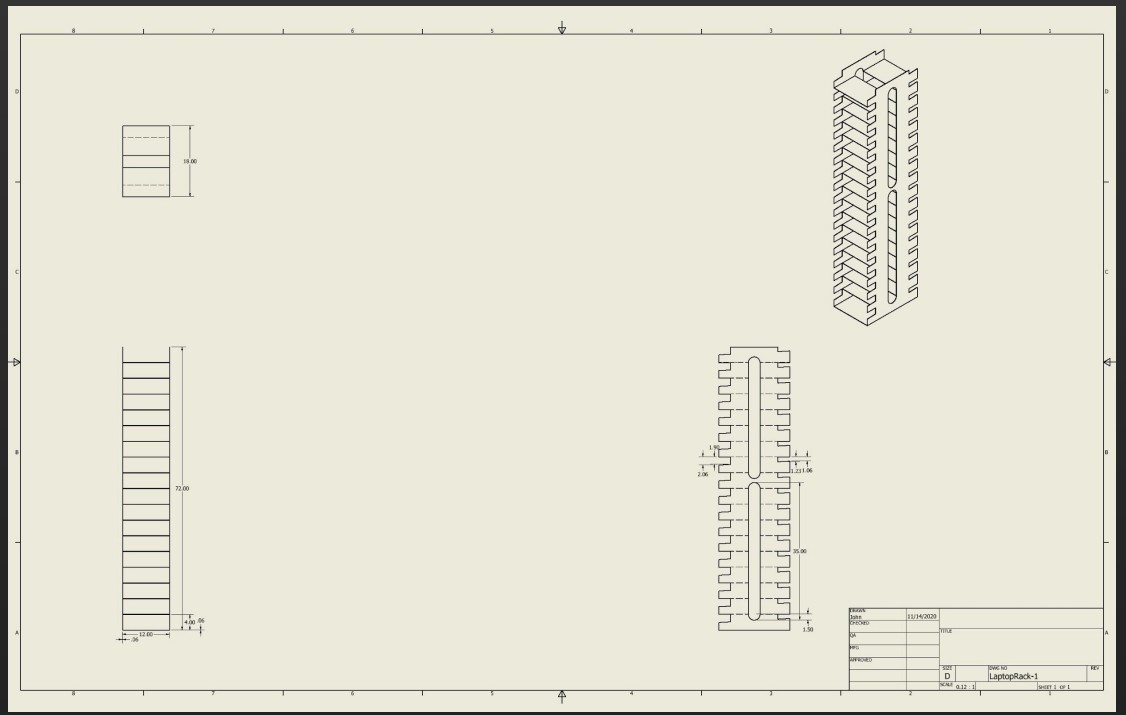


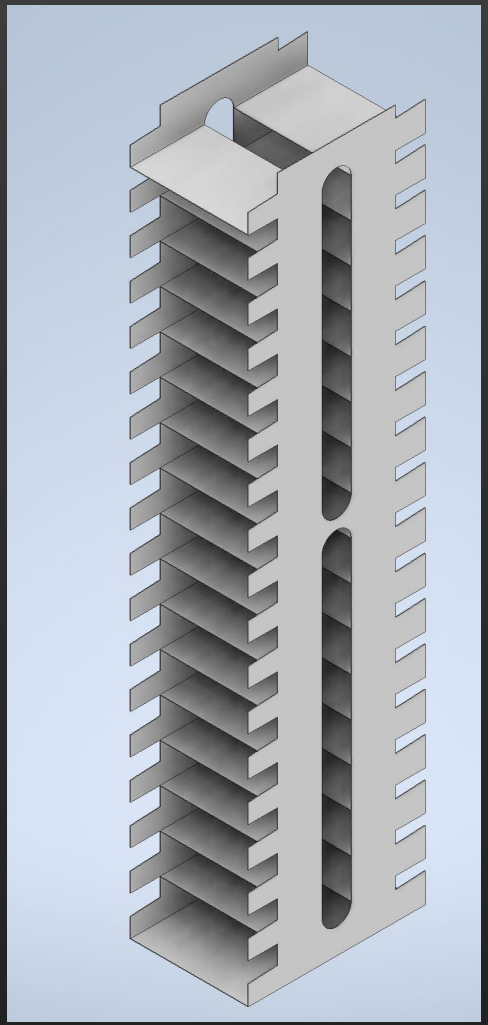


LED Enclosures for Bagged Devices - Schematic View



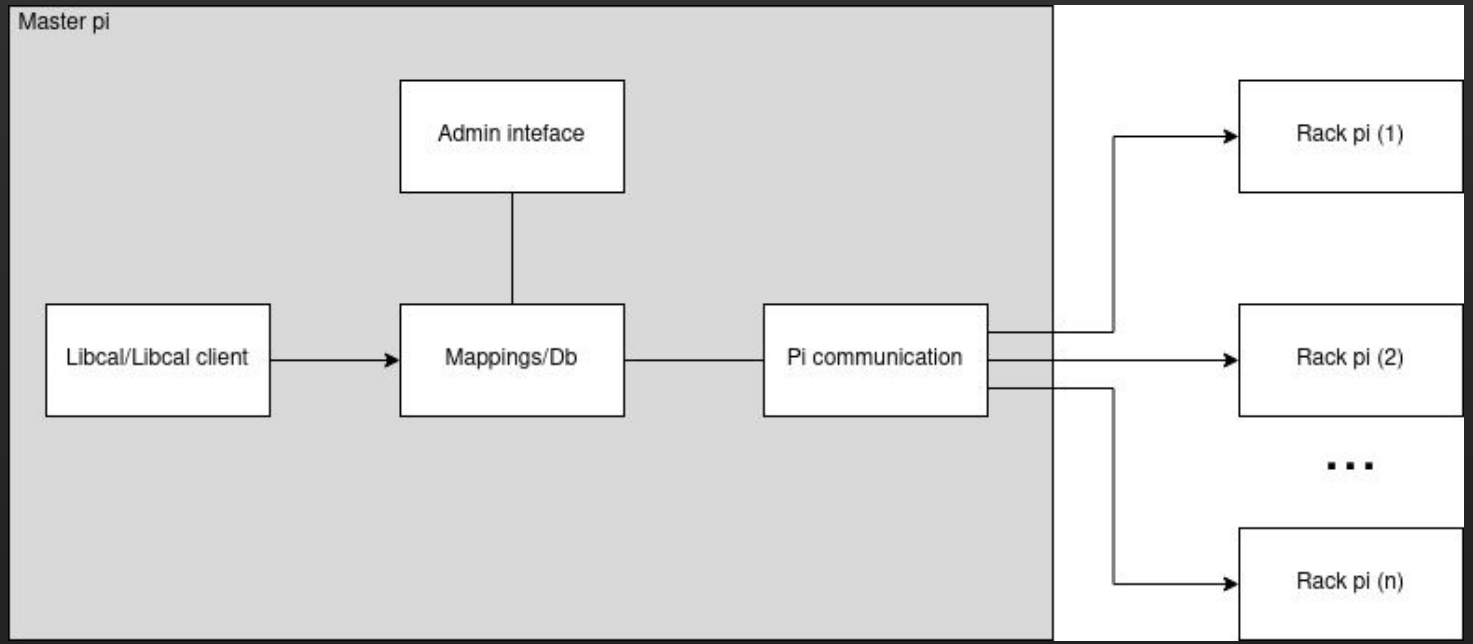
Shelf CAD Model



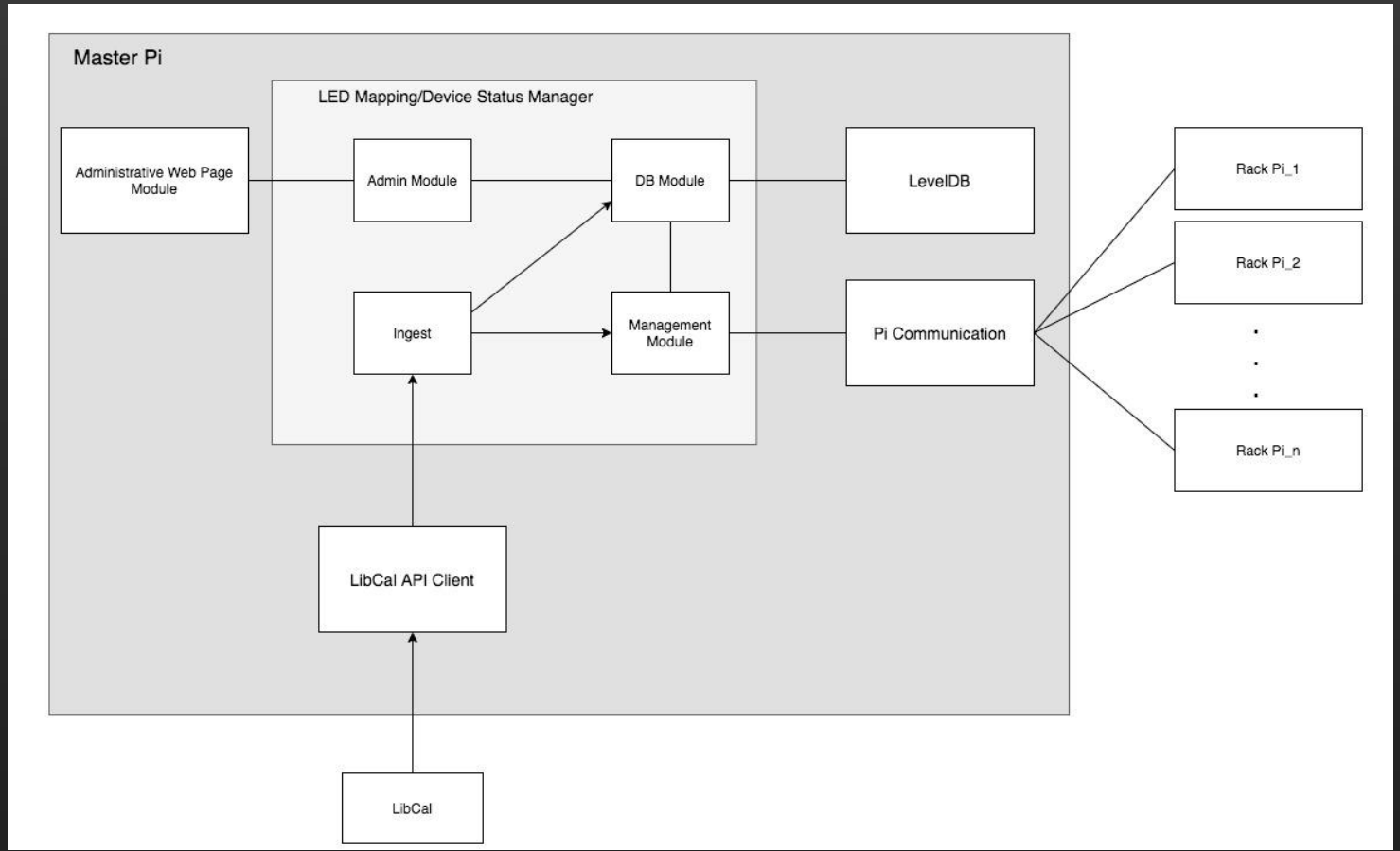


Software Architecture

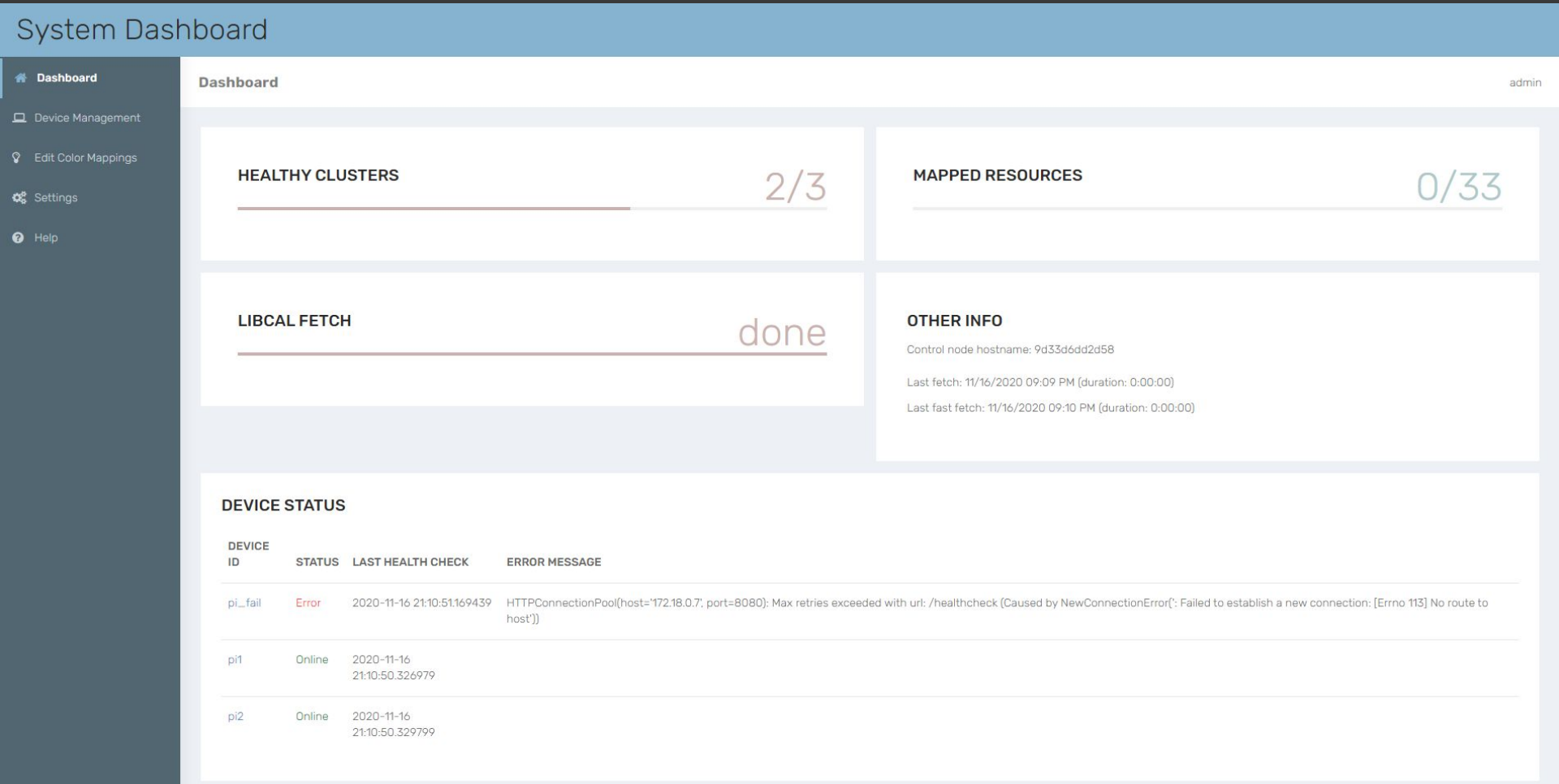
- Master/Follower Architecture
- Each device rack or bar has a Raspberry Pi controlling a set of LEDs.
  - Each LED corresponds to a device on the rack of its controlling Pi.
- Each Rack Pi registers itself with a Master Raspberry Pi. The Master Pi then sends device status updates from the LibCal library management system.



Software Architecture - Closer Look



Admin Web Portal - Dashboard



Admin Web Portal - Dashboard Continued

UNMAPPED RESOURCES

RESOURCE ID	STATE
LC001	Available
LC002	Overdue
LC003	Checked Out
LC004	Available
LC005	Available
LC006	Available
LC007	Overdue
LC008	Checked Out

RESOURCE MAPPINGS

DEVICE ID	MAPPINGS
pi1	LED: 0 --> none LED: 1 --> none LED: 2 --> none LED: 3 --> none LED: 4 --> none LED: 5 --> none LED: 6 --> none
pi2	LED: 0 --> none LED: 1 --> none LED: 2 --> none
pi_fail	LED: 0 --> none LED: 1 --> none LED: 2 --> none

Pi id

pi1

Number of leds on pi

7

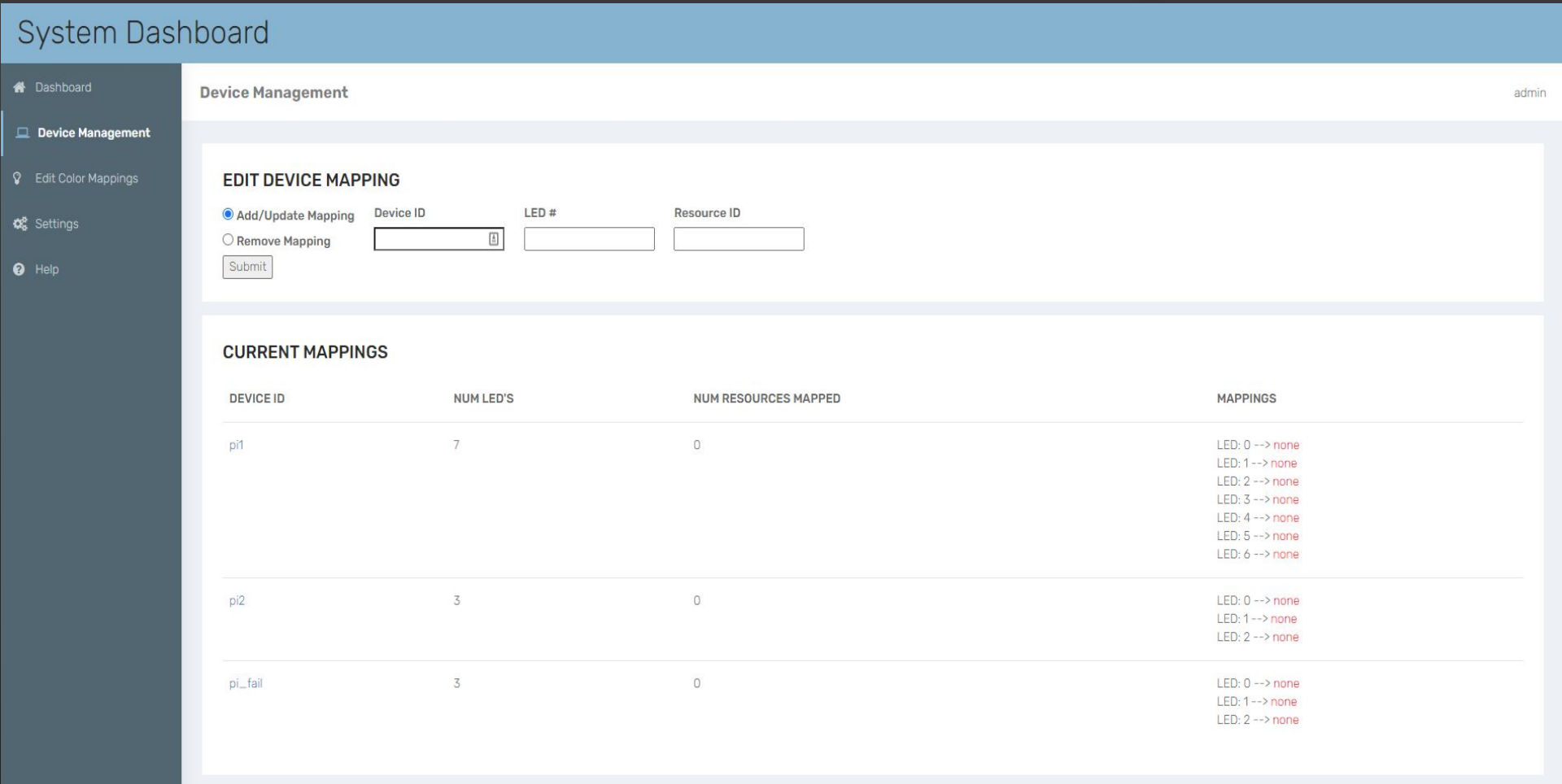
Delete Save

CURRENT STATUS

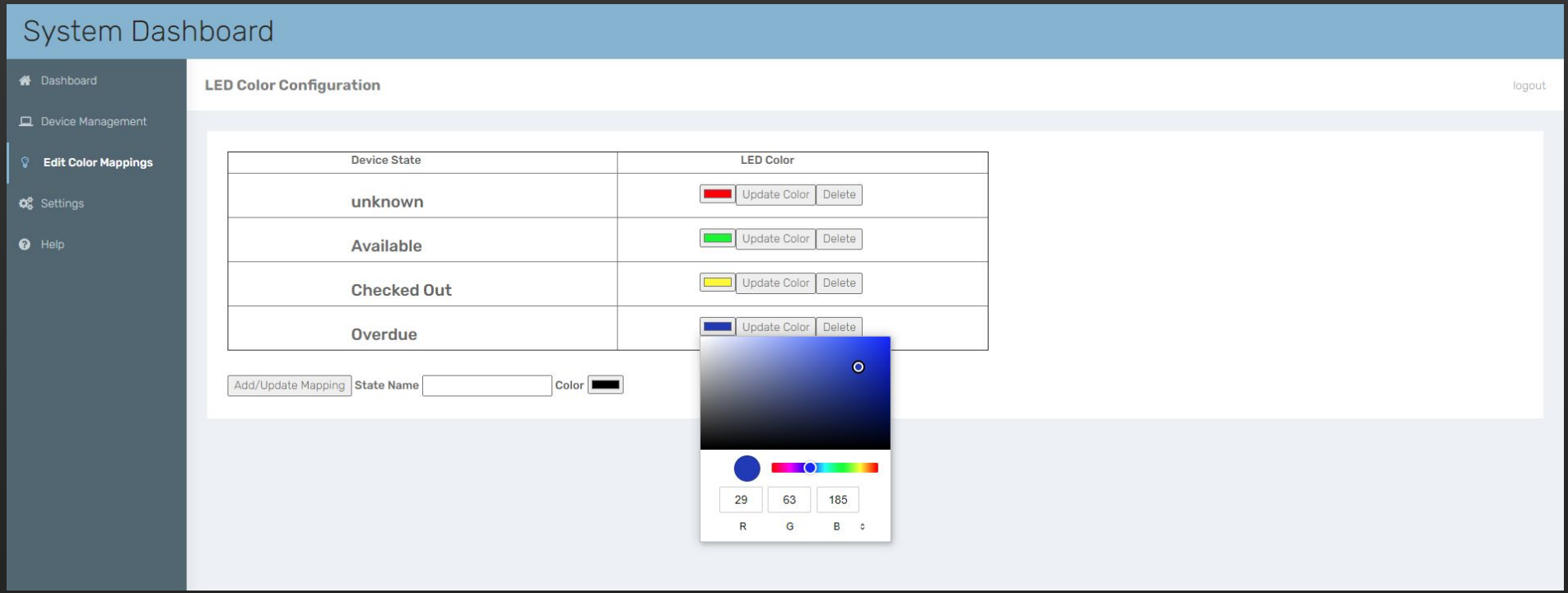
```
Health: Online (last successful check in at 2020-11-16 21:12:54.593957)
Ip: 172.18.0.4

LED: 0 --> none
LED: 1 --> none
LED: 2 --> none
LED: 3 --> none
LED: 4 --> none
LED: 5 --> none
LED: 6 --> none
```

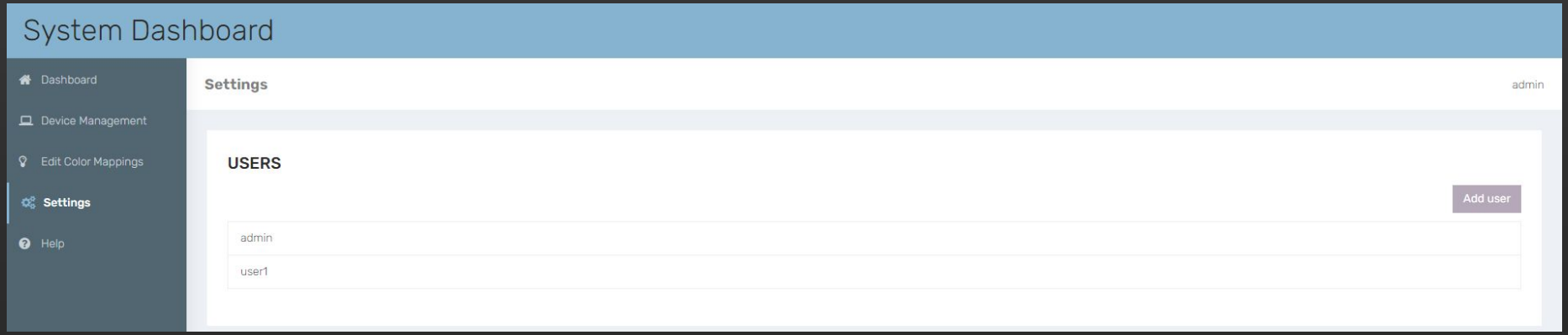
Admin Web Portal - Device Management

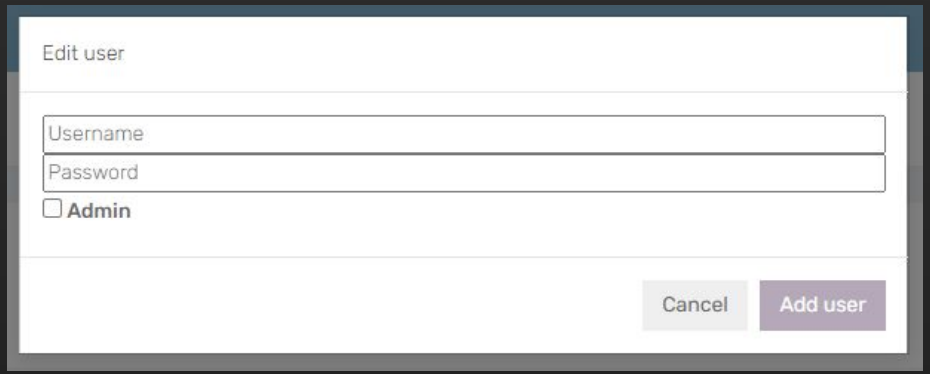


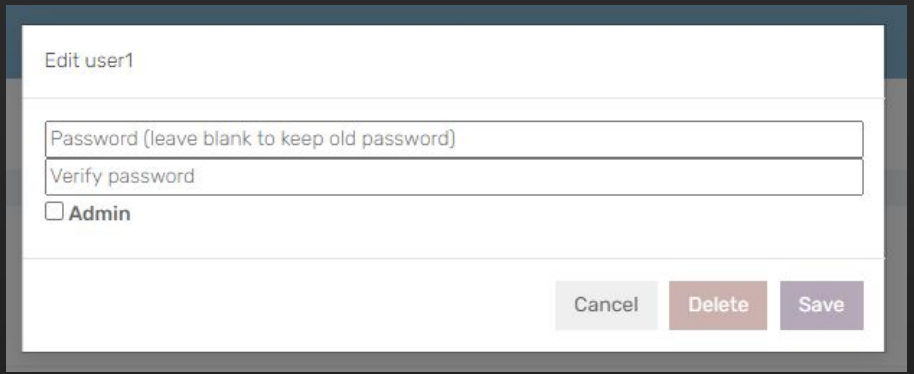
Admin Web Portal - Edit Color Mappings



Admin Web Portal - Settings



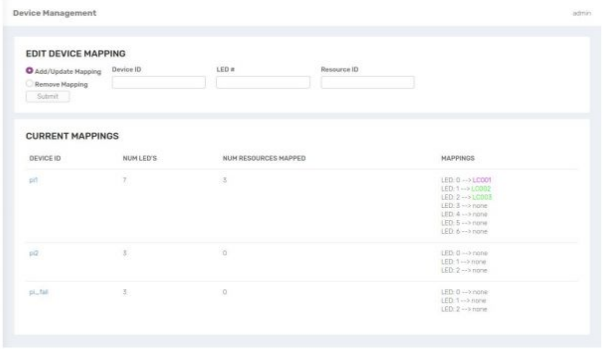




Admin Web Portal - Help

System Dashboard

- Dashboard
- Device Management
- Edit Color Mappings
- Settings
- **Help**



To rename a raspberry pi or change the number of leds attached to it click on the name in the admin interface to get to the pi page. Then just change the appropriate field and click save.

To delete a pi click the delete button. If the pi is still running it will register itself again in a few minutes.

To assign a color to a libcal state go to the color mappings page select the color with the color picker and click the save button next to it. As the libcal api detects new states they will be added to this page.

The unknown state is a fallback any unmapped led or color that has not been set will default to the unknown color.

System Dashboard | Device Management | Color Mappings

Not secure | 192.168.173.246/color-mapping.html

Facebook | Twitter | LinkedIn | Canvas | 3DPrinting | Hy-Vee | Reddit | Gmail | The Des Moines Re... | Hacker News | Youtube | Netflix | Calendar | Scratchapixel | Github

LED Color Mappings

- Dashboard
- Device Management
- Edit Color Mappings
- Settings
- Help

LED Color Configuration

Device State	LED Color
unknown	Update Color | Delete
Available	Update Color | Delete
Checked Out	Update Color | Delete
Overdue	Update Color | Delete
Mediated Denied	Update Color | Delete
Cancelled by Admin	Update Color | Delete

Add/Update Mapping | State Name | Color

footer

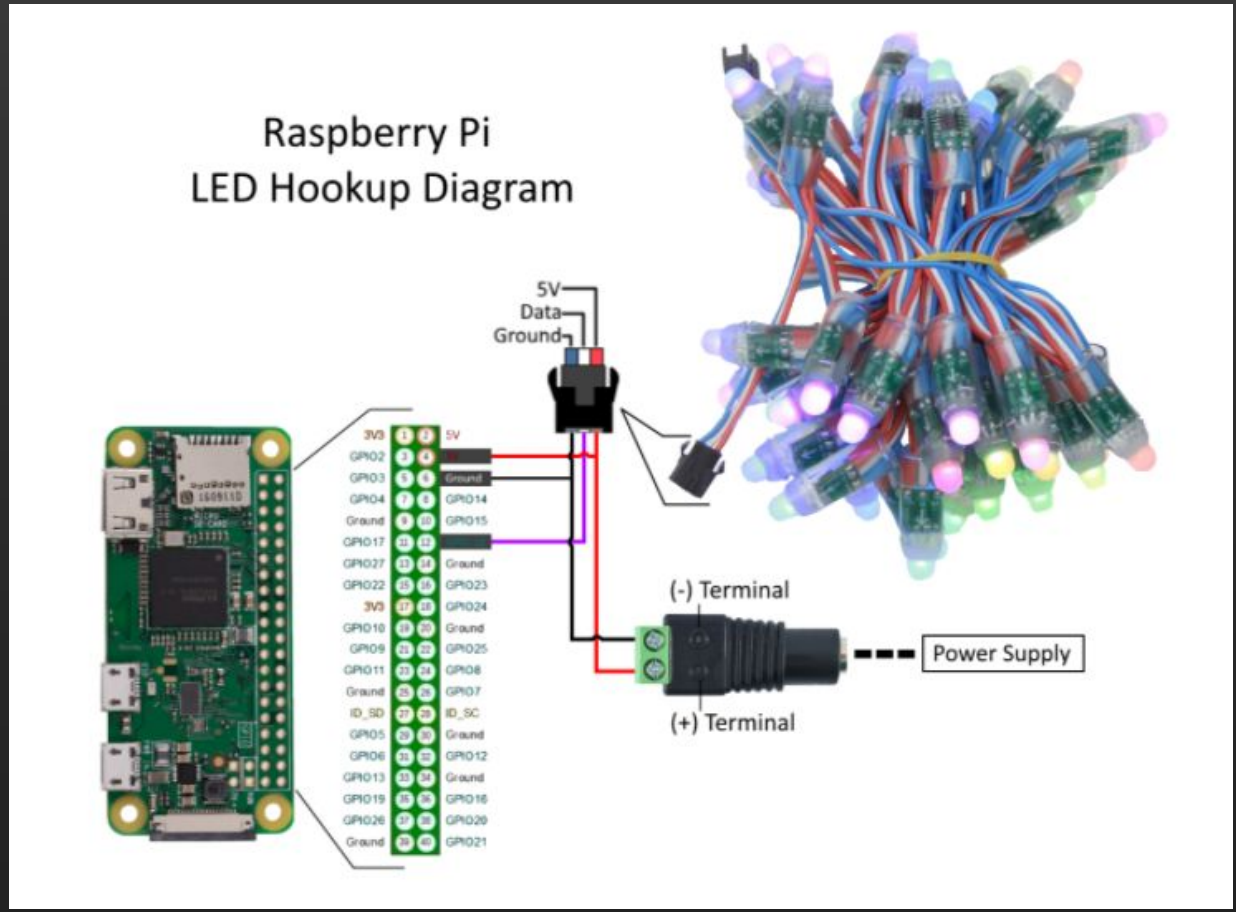
Installation Process

- Required Parts
- Assembling RackPi Hardware
- Installing RackPi
- Configuring the RackPi

Required Parts

Raspberry Pi Zero W
Raspberry Pi GPIO Headers
WS2811 RGB LED Strip (5 Volt)
5 Volt, 5 Amp AC to DC Power Supply with Female DC Barrel Connector
Breadboard Jumper cables (Male to Female)
RECOMMENDED (Single Purchase Items)
Mini-HDMI to HDMI cable (for connecting Pi to monitor)
Micro-USB to USB OTG cable (for connecting peripherals to Pi)

Assembling the RackPi



Installing the RackPi - Part 1

1. Go to: https://git.ece.iastate.edu/sd/sddec20-02/-/tree/rackpi-image

2. Make sure that rack-pi image is selected in the drop down

3. Click the either of the two download buttons

Image 1

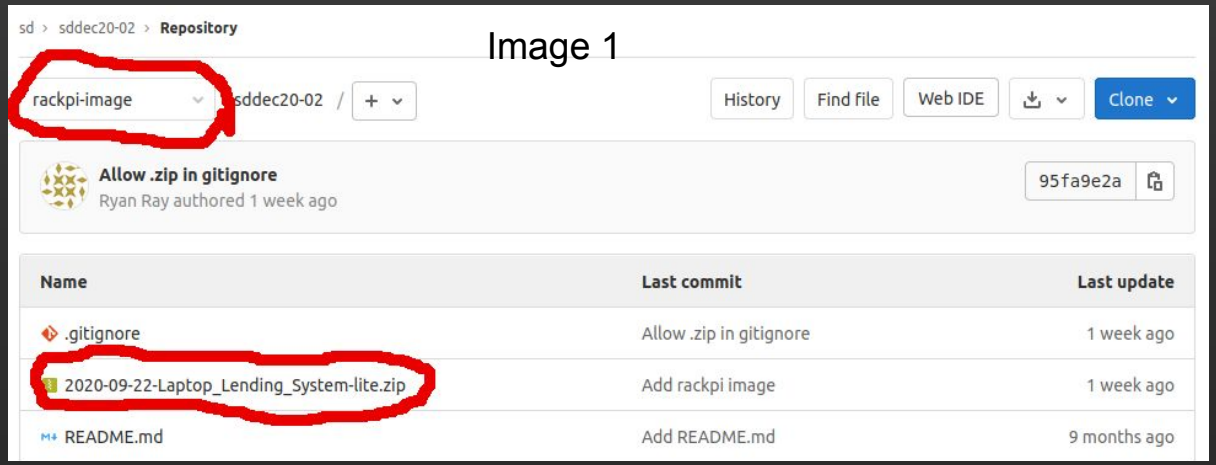
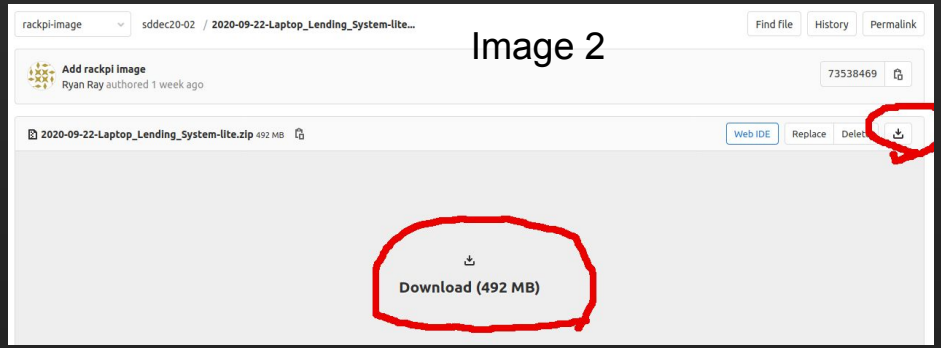


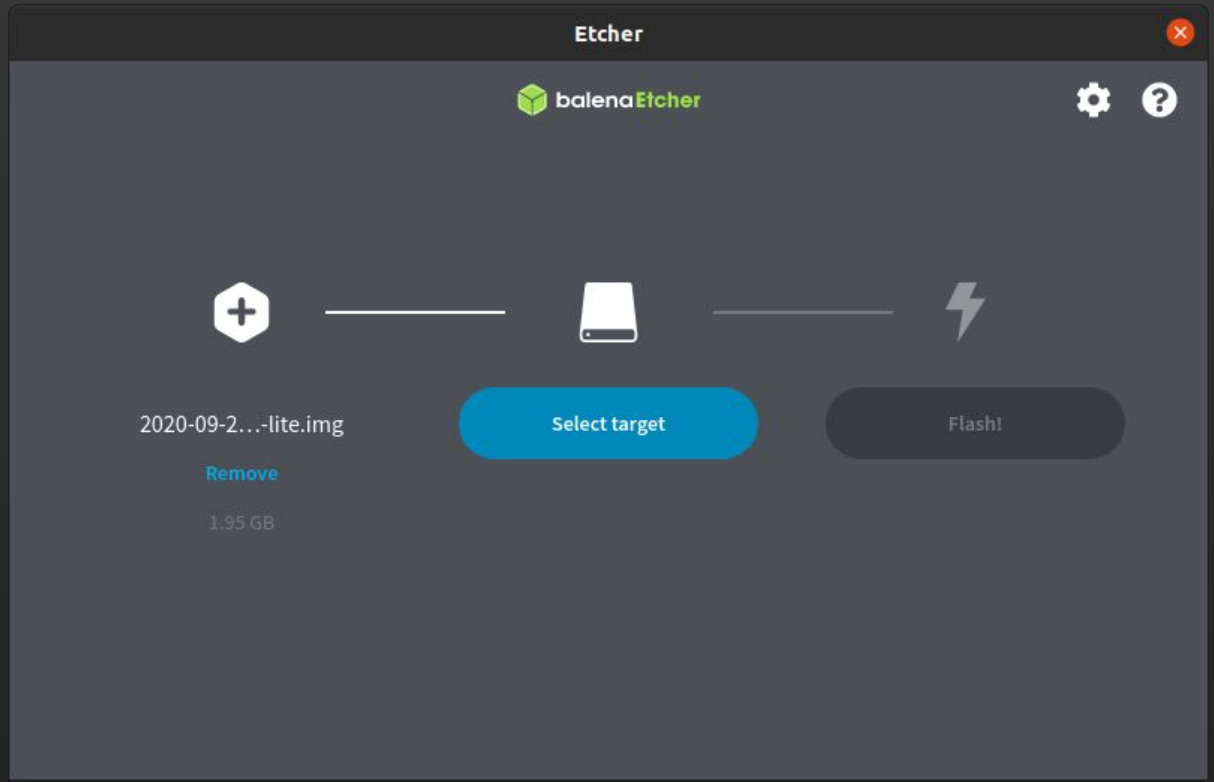
Image 2



Installing the RackPi - Part 2

1. Unzip the raspberry pi image file

2. Download Etcher, insert the SD card for your Pi into your computer and select the extracted raspberry pi image



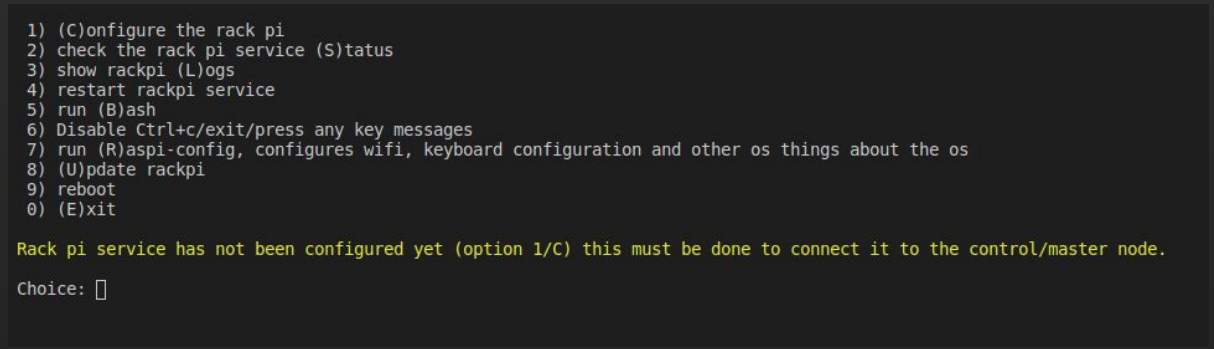
Configuring the RackPi - Part 1

1. Boot the RackPi.

2. Unplug the RackPi. Register it with netreg using its mac address

3. Plug the RackPi back when you see the image menu.
4. Type ‘C’
5. Enter the number of leds attached to the raspberry pi.

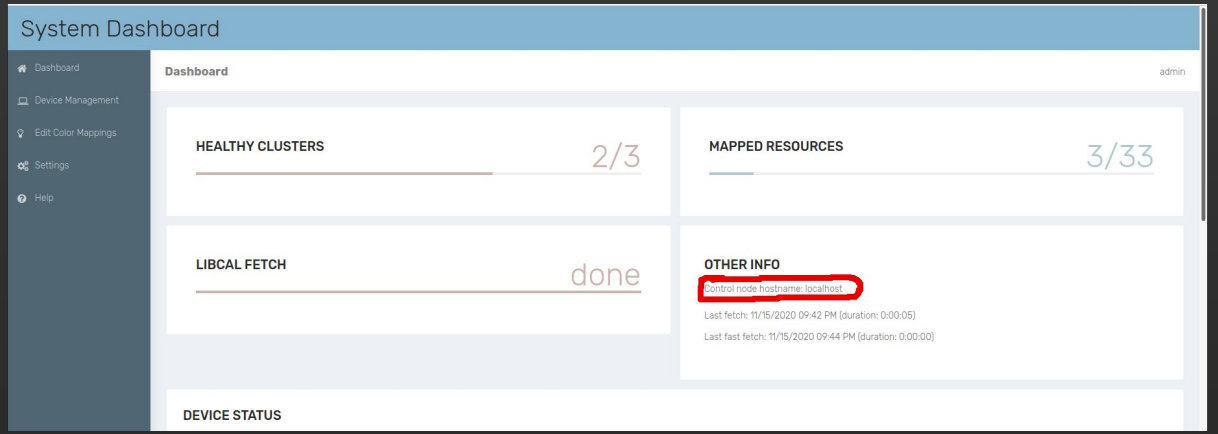
image menu



Configuring the RackPi - Part 2

1. Enter the control node hostname.
2. The RackPi will install the latest rackpi module and start it
3. You are all set.

Admin Interface




That's all Folks!