

# LAPTOP LENDING STATUS SYSTEM

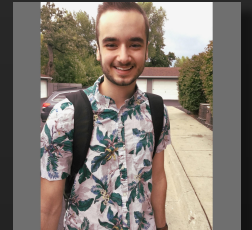
sddec20\_02

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**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

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## 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



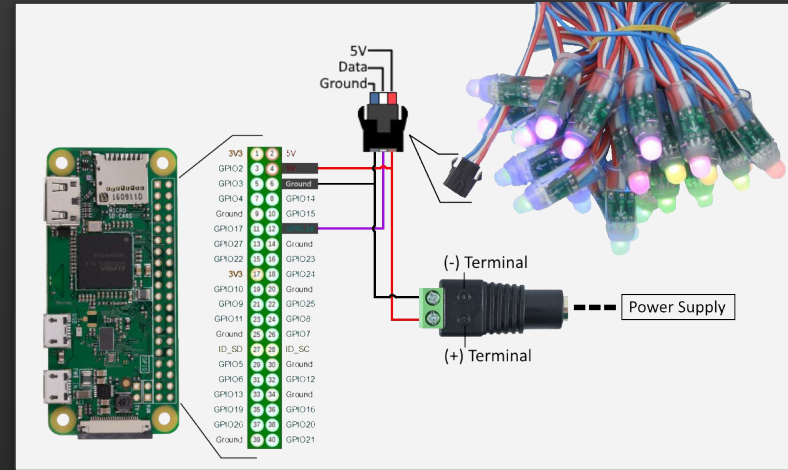
Figure 2) (Above) Smaller devices hung in bags on bars.



Figure 3) Colored stickers on each rack.

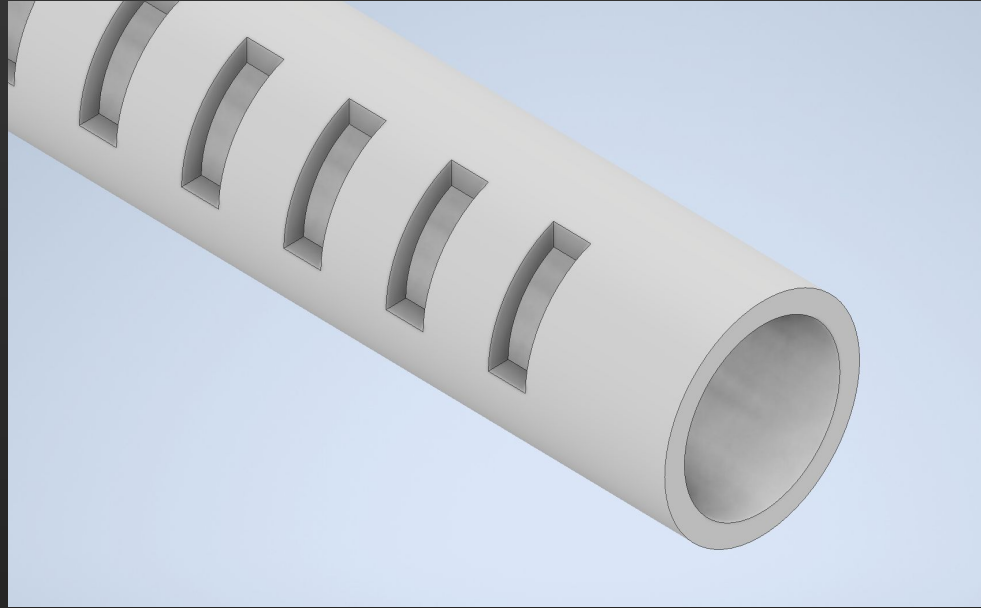
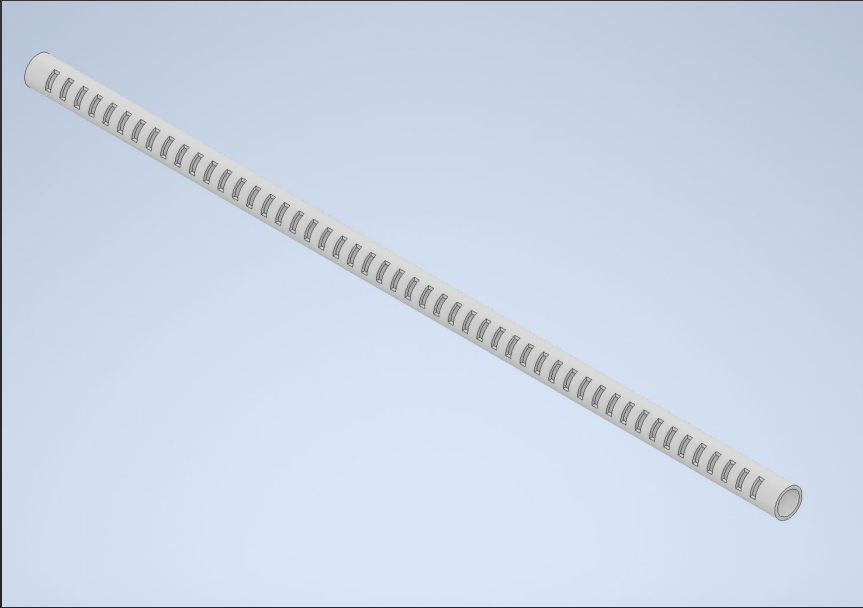
# Hardware Architecture

- 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

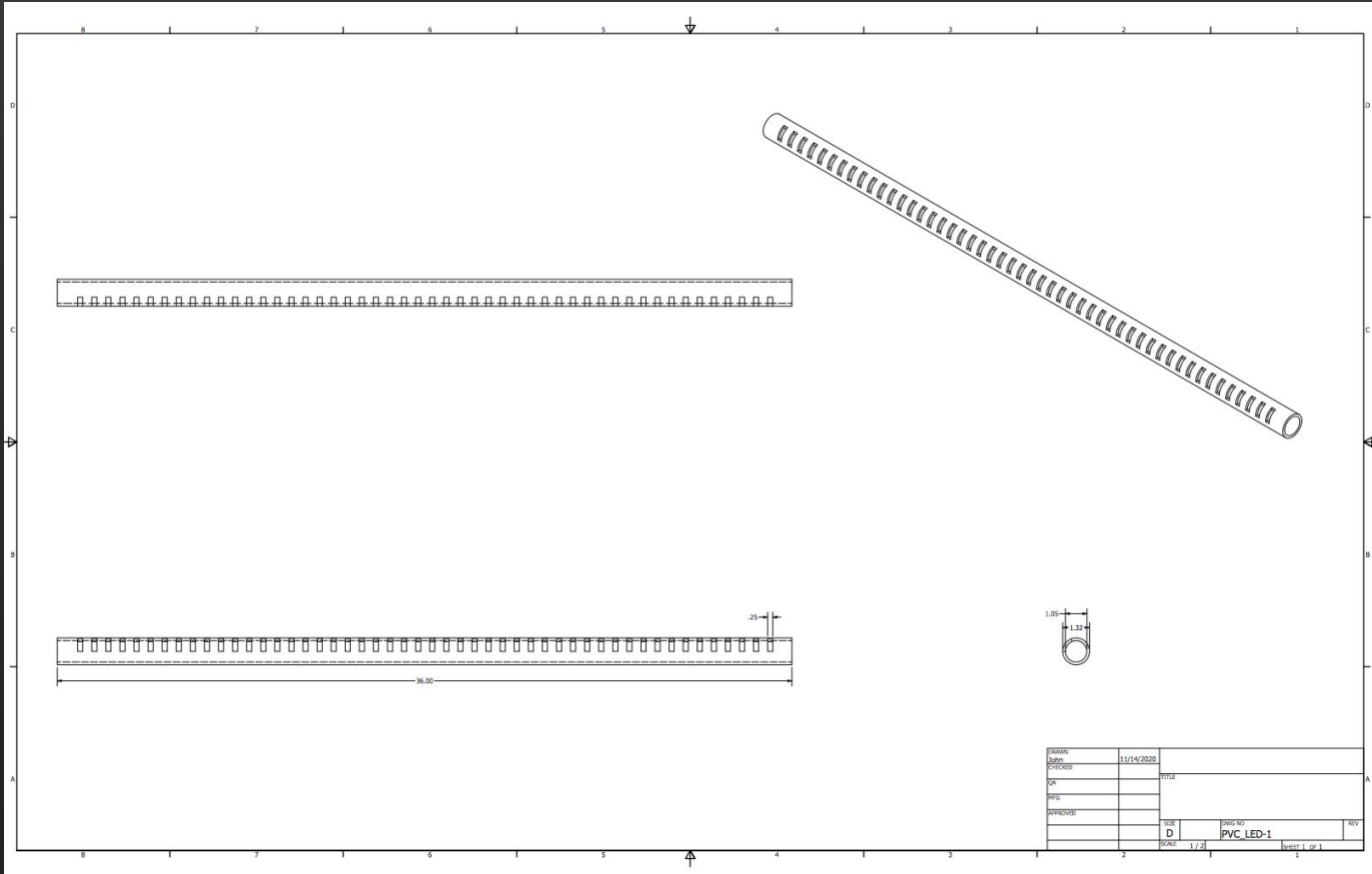


- Combined 5 volt, 5 amp power supply for Pi and LED strip, sufficient to handle the worst-case power consumption of both components
- Hardware cost of \$63.50 per module

# LED Enclosures for Bagged Devices - CAD Model

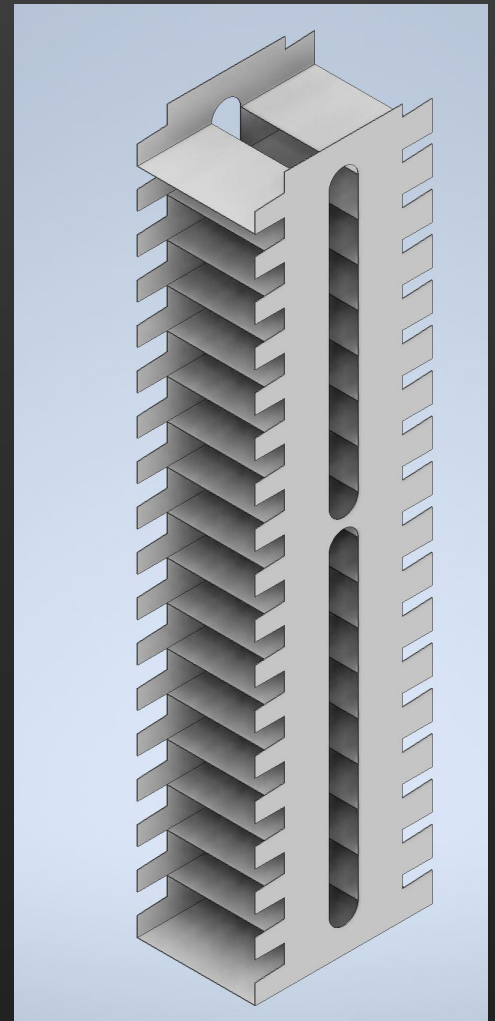
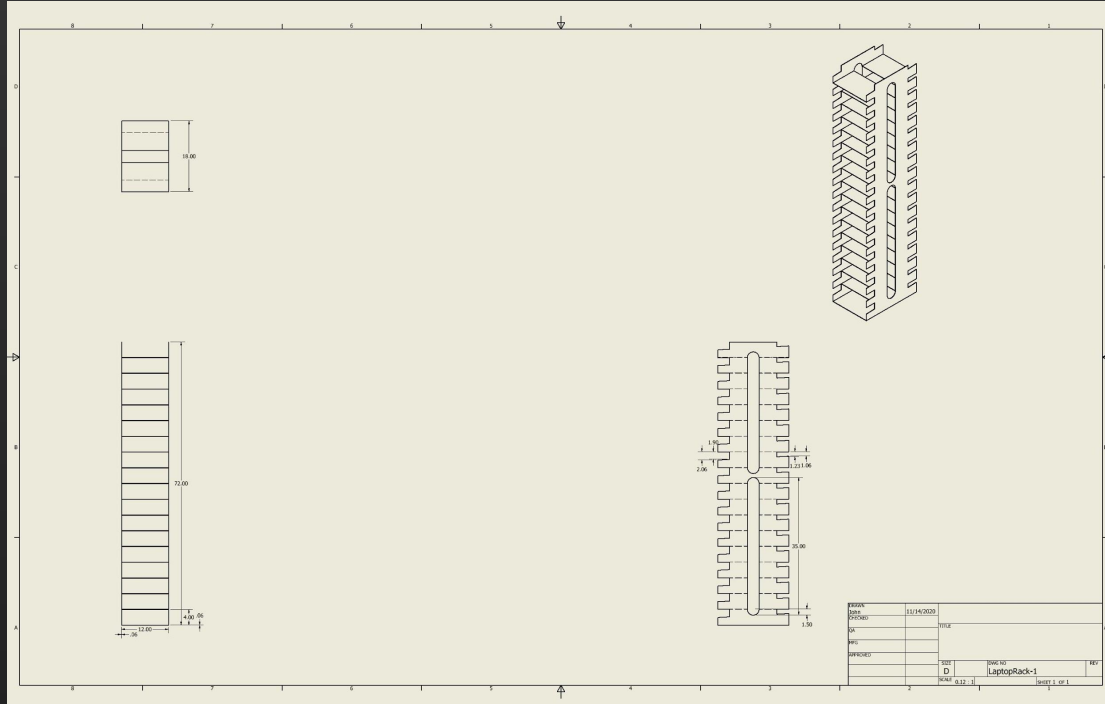


# LED Enclosures for Bagged Devices - Schematic View



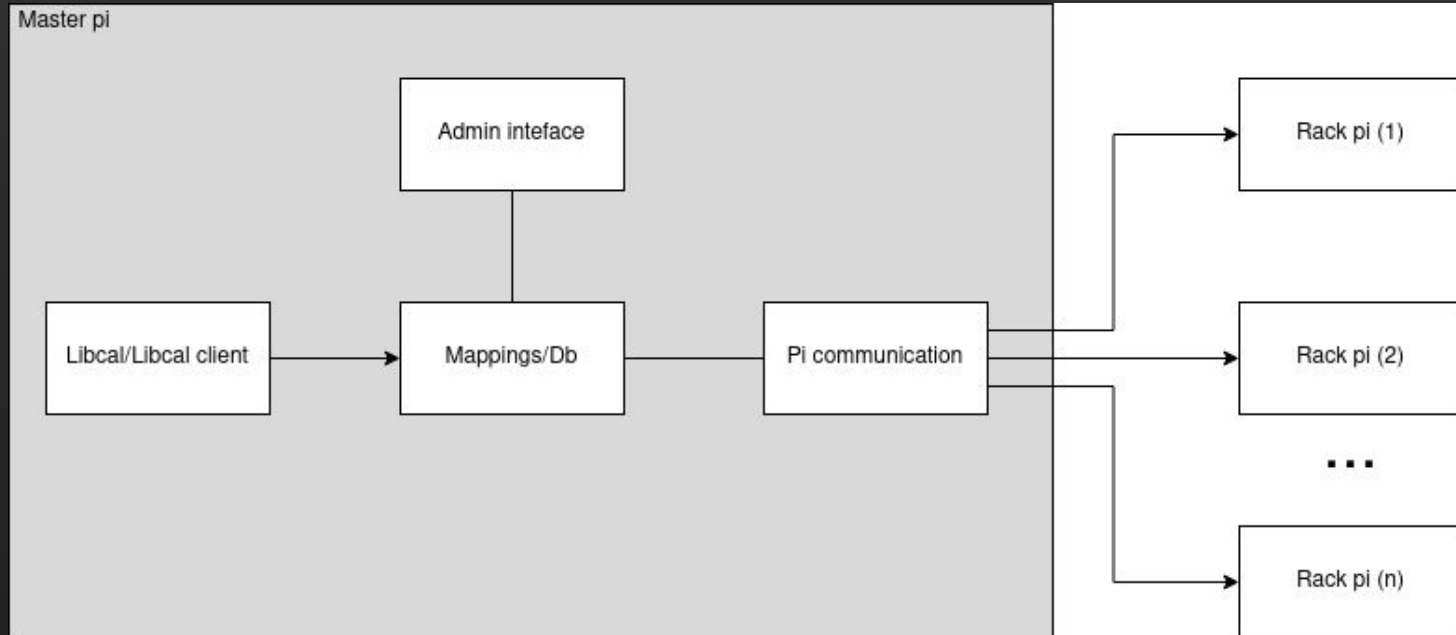
DESIGN	DATE	11/14/2020	TITLE	
DRAWN				
CHECKED				
APPROVED				
SCALE	1/2		Sheet 1 of 1	

# Shelf CAD Model



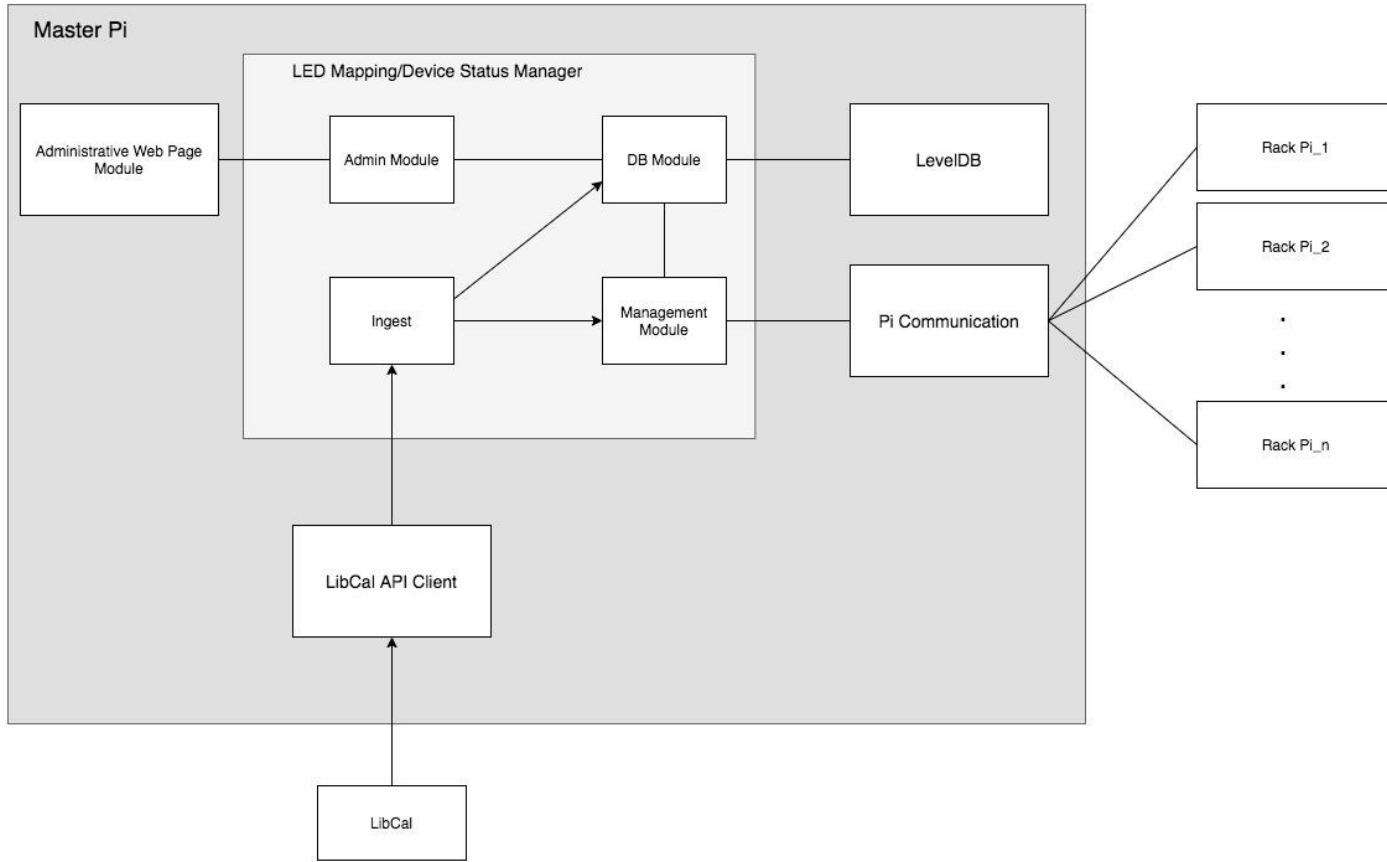
# Software Architecture

- 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

## System Dashboard

Dashboard

Device Management

Edit Color Mappings

Settings

Help

admin

### Dashboard

HEALTHY CLUSTERS

2/3

MAPPED RESOURCES

0/33

LIBCAL FETCH

done

OTHER INFO

Control node hostname: 9d33d6dd2d58

Last fetch: 11/16/2020 09:09 PM (duration: 0:00:00)

Last fast fetch: 11/16/2020 09:10 PM (duration: 0:00:00)

### DEVICE STATUS

DEVICE

DEVICE ID	STATUS	LAST HEALTH CHECK	ERROR MESSAGE
pi_fail	Error	2020-11-16 21:10:51.169439	HTTPConnectionPool(host='172.18.0.7', port=8080): Max retries exceeded with url: /healthcheck (Caused by NewConnectionError(': Failed to establish a new connection: [Errno 113] No route to host'))
pi1	Online	2020-11-16 21:10:50.326979	
pi2	Online	2020-11-16 21:10:50.329799	

# 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

Number of leds on pi

## 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

## System Dashboard

Dashboard

Device Management

Edit Color Mappings

Settings

Help

### Device Management

admin

#### EDIT DEVICE MAPPING

Add/Update Mapping

Device ID

LED #

Resource ID

Remove Mapping

Submit

#### CURRENT MAPPINGS

DEVICE ID	NUM LED'S	NUM RESOURCES MAPPED	MAPPINGS
pi1	7	0	LED: 0 --> none LED: 1 --> none LED: 2 --> none LED: 3 --> none LED: 4 --> none LED: 5 --> none LED: 6 --> none
pi2	3	0	LED: 0 --> none LED: 1 --> none LED: 2 --> none
pi_fail	3	0	LED: 0 --> none LED: 1 --> none LED: 2 --> none

# Admin Web Portal - Edit Color Mappings

## System Dashboard


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

### LED Color Configuration

logout

Device State	LED Color
unknown	 <input type="button" value="Update Color"/> <input type="button" value="Delete"/>
Available	 <input type="button" value="Update Color"/> <input type="button" value="Delete"/>
Checked Out	 <input type="button" value="Update Color"/> <input type="button" value="Delete"/>
Overdue	 <input type="button" value="Update Color"/> <input type="button" value="Delete"/>

State Name  Color



Color picker dialog showing a blue color selection. The RGB values are R: 29, G: 63, B: 185.

# Admin Web Portal - Settings

## System Dashboard

Dashboard

Device Management

Edit Color Mappings

**Settings**

Help

### Settings

admin

#### USERS

Add user

admin

user1

#### Edit user

Username

Password

Admin

Cancel

Add user

#### Edit user1

Password (leave blank to keep old password)

Verify password

Admin

Cancel

Delete

Save

# Admin Web Portal - Help

## System Dashboard

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

Device Management admin

**EDIT DEVICE MAPPING**

Add/Update Mapping    Device ID:     LED #:     Resource ID:

Remove Mapping

**CURRENT MAPPINGS**

DEVICE ID	NUM LED'S	NUM RESOURCES MAPPED	MAPPINGS
pi1	7	3	LED 0 ->LED001 LED 1 ->LED002 LED 2 ->LED003 LED 3 ->none LED 4 ->none LED 5 ->none LED 6 ->none
pi2	3	0	LED 0 ->none LED 1 ->none LED 2 ->none
pi_tst	3	0	LED 0 ->none LED 1 ->none LED 2 ->none

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.

Pi id

Number of leds on pi

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.

# LED Color Mappings

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

## LED Color Configuration

Device State	LED Color
unknown	 <a href="#">Update Color</a> <a href="#">Delete</a>
Available	 <a href="#">Update Color</a> <a href="#">Delete</a>
Checked Out	 <a href="#">Update Color</a> <a href="#">Delete</a>
Overdue	 <a href="#">Update Color</a> <a href="#">Delete</a>
Mediated Denied	 <a href="#">Update Color</a> <a href="#">Delete</a>
Cancelled by Admin	 <a href="#">Update Color</a> <a href="#">Delete</a>

Add/Update Mapping State Name  Color





# Installation Process

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- 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)

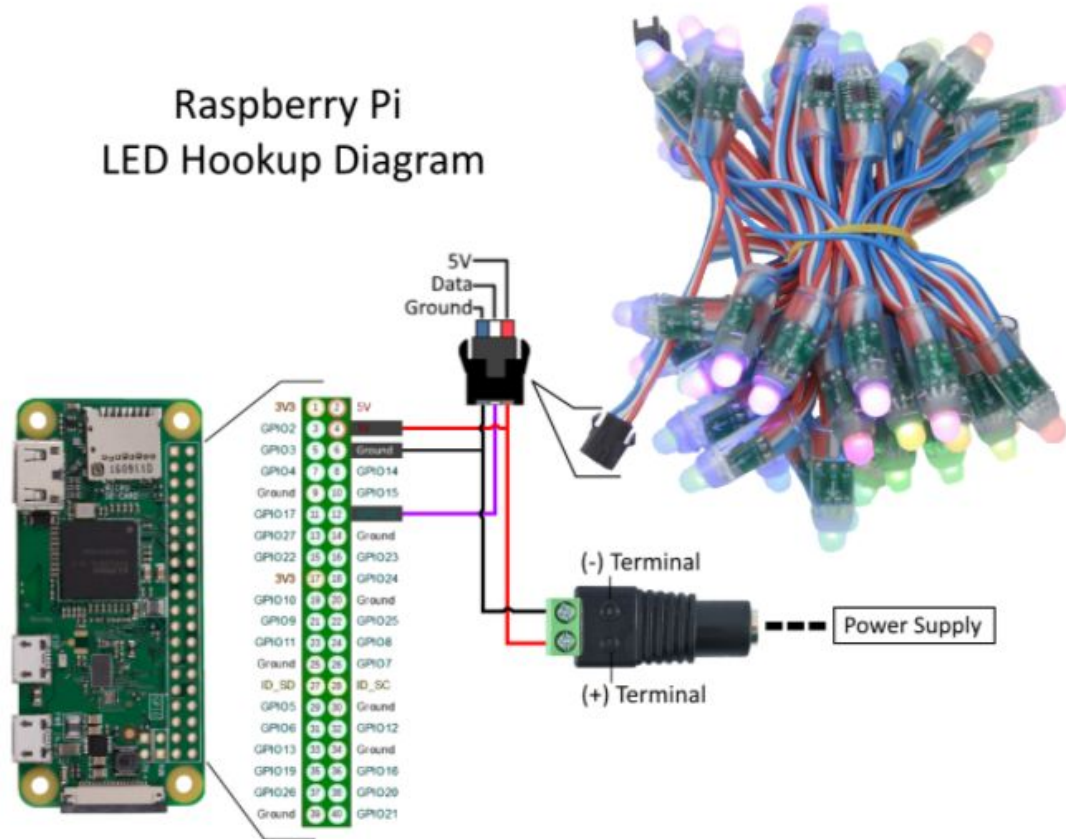
**RECOMMENDED (Single Purchase Items)**

Mini-HDMI to HDMI cable (for connecting Pi to monitor)

Micro-USB to USB OTG cable (for connecting peripherals to Pi)

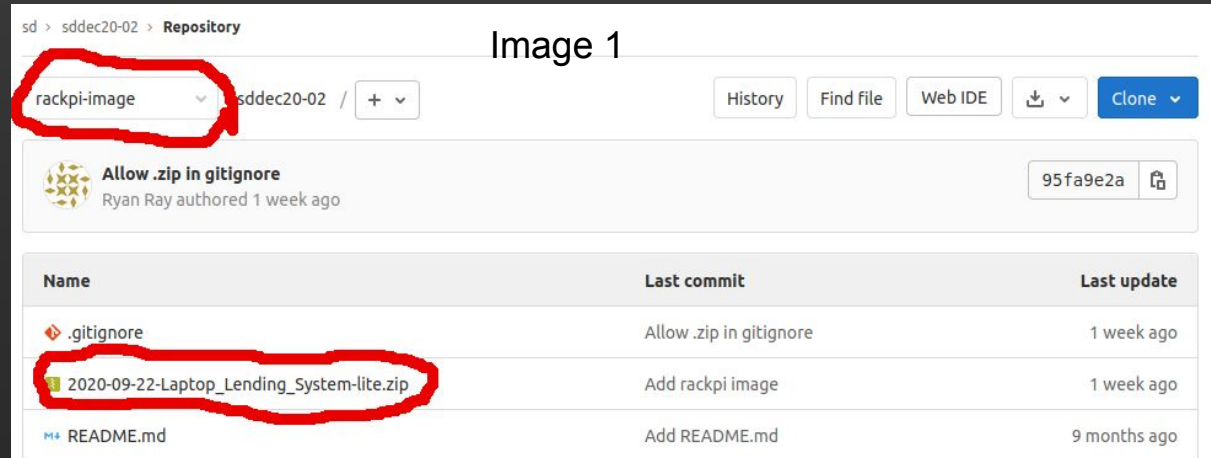
# Assembling the RackPi

Raspberry Pi  
LED Hookup Diagram



# 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



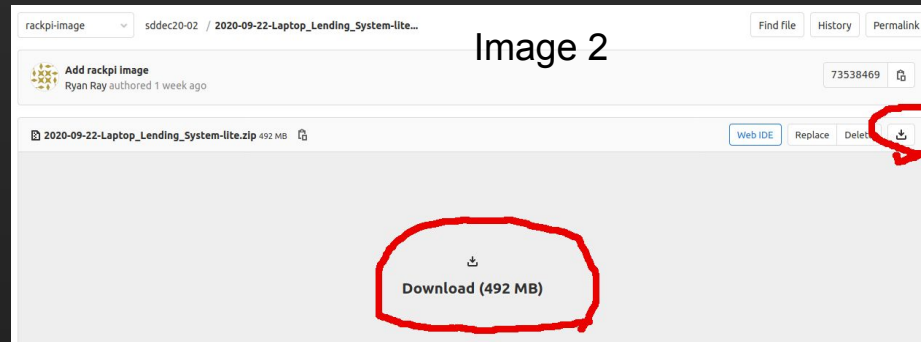
sd > sddec20-02 > Repository Image 1

rackpi-image sddec20-02 / +

History Find file Web IDE 95fa9e2a Clone

Allow .zip in gitignore  
Ryan Ray authored 1 week ago

Name	Last commit	Last update
.gitignore	Allow .zip in gitignore	1 week ago
2020-09-22-Laptop_Lending_System-lite.zip	Add rackpi image	1 week ago
README.md	Add README.md	9 months ago



rackpi-image sddec20-02 / 2020-09-22-Laptop\_Lending\_System-lite... Find file History Permalink

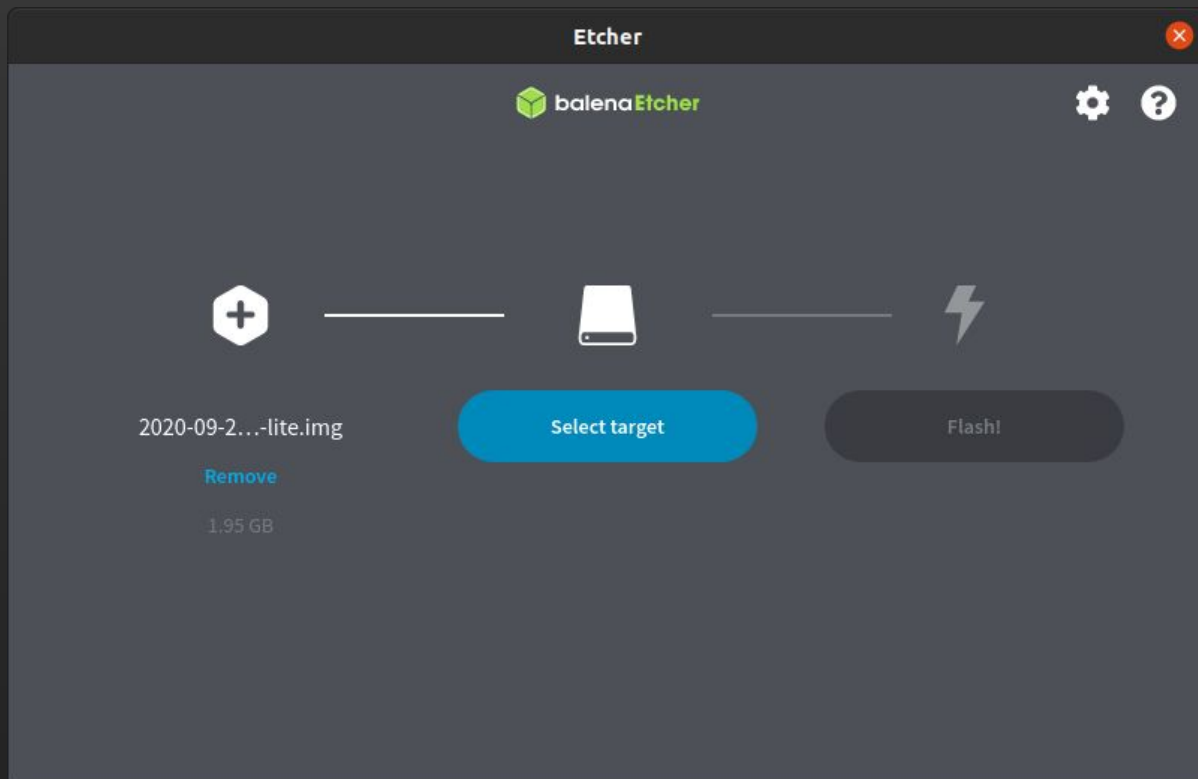
Add rackpi image  
Ryan Ray authored 1 week ago 73538469

2020-09-22-Laptop\_Lending\_System-lite.zip 492 MB

Web IDE Replace Delete Download (492 MB)

# 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

```
1) (C)onfigure the rack pi
2) check the rack pi service (S)tatus
3) show rackpi (L)ogs
4) restart rackpi service
5) run (B)ash
6) Disable Ctrl+c/exit/press any key messages
7) run (R)aspi-config, configures wifi, keyboard configuration and other os things about the os
8) (U)pdate rackpi
9) reboot
0) (E)xit
```

Rack pi service has not been configured yet (option 1/C) this must be done to connect it to the control/master node.

Choice:

# 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

The screenshot shows the 'System Dashboard' of the RackPi Admin Interface. The dashboard is titled 'Dashboard' and is accessed by the user 'admin'. It features a sidebar with navigation options: Dashboard, Device Management, Edit Color Mappings, Settings, and Help. The main content area is divided into several sections:

- HEALTHY CLUSTERS**: A progress bar showing 2/3 clusters are healthy.
- MAPPED RESOURCES**: A progress bar showing 3/33 resources are mapped.
- LIBCAL FETCH**: A progress bar showing the process is 'done'.
- OTHER INFO**: A section containing the text 'Control node hostname: localhost', which is highlighted with a red circle. Below this, it shows 'Last fetch: 11/15/2020 09:42 PM (duration: 0:00:05)' and 'Last fast fetch: 11/15/2020 09:44 PM (duration: 0:00:00)'. At the bottom of the dashboard, there is a section for 'DEVICE STATUS'.

The image features a dark, starry night sky as a background. The stars are scattered across the frame, with some appearing as bright yellow and orange points, while others are smaller and bluer. The overall color palette is dominated by deep blues and blacks, with the white text providing a sharp contrast. The text is written in a classic, elegant cursive script, slanted slightly upwards from left to right. The phrase "That's all Folks!" is centered in the middle of the image, with the exclamation point at the end of the second line.

*That's all Folks!*