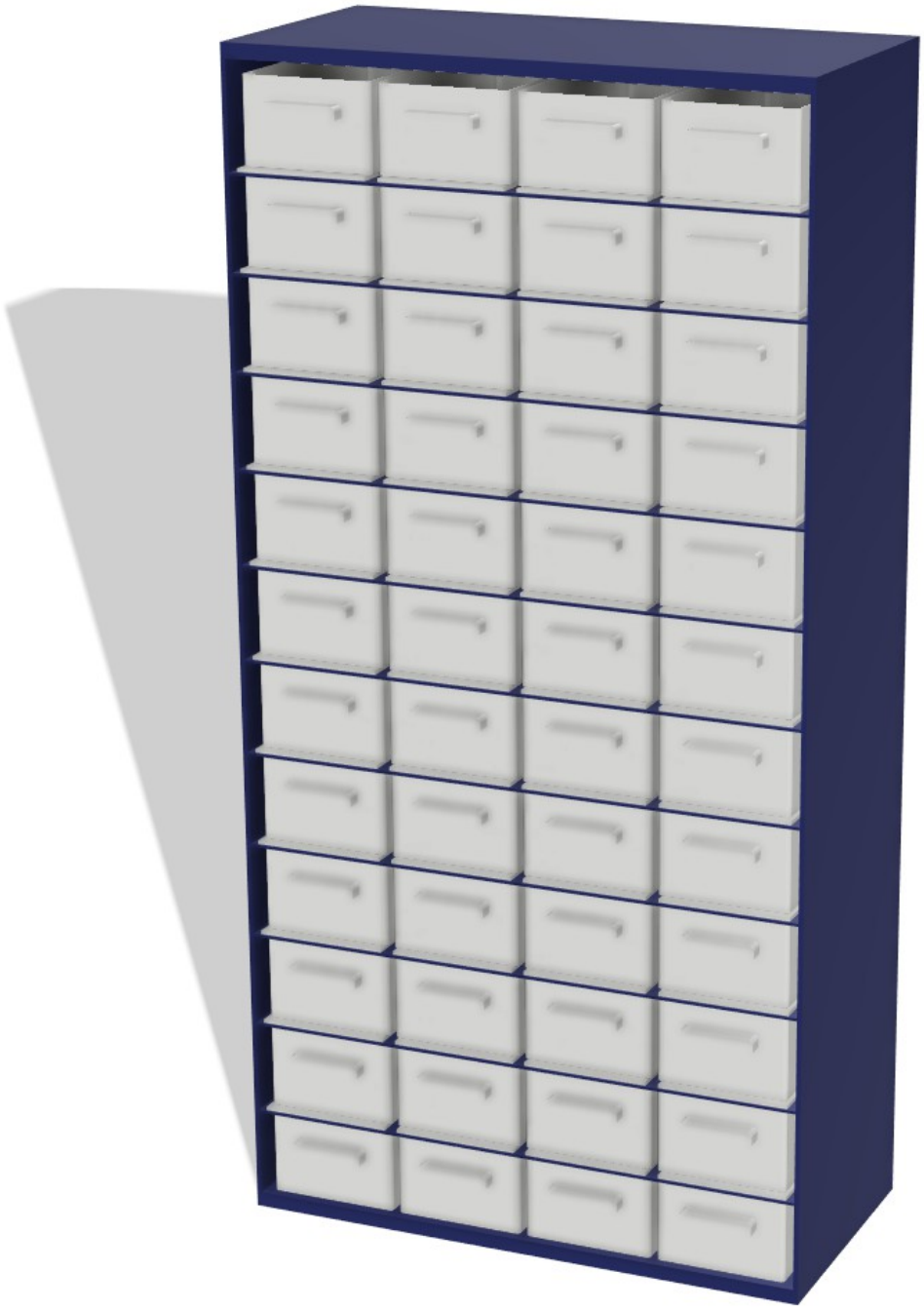
Softwaretechnik Projekt WS21/22, Jakob Czekansky

User Guide Hardware Pick-by-Light



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Introduction

Welcome to the Pick-By-Light system!

The Pick-By-Light System (hereinafter called PBL) is a system to assist you in finding spareparts in multiple rooms and small parts magazin in them. To achieve this the PBL provides a graphical user interface on your smart device or web browser in which you search for a specific sparepart. The compartment, in which the part is stored, will light up.

This project is an open source project and we highly encourage you to build it on your own and modify the hard- or software to your likings. To ensure you are able to do this you will find all relevant information on which parts you need to build it on your own, the technical specifications and an assembly guide in this document.

Some of the parts need to be 3D printed, you can find all necessary 3D printable master files in the git repository.

Parts List

A list of parts needed to build the PBL on your own. This listing is specified for a single sparepartscontainer with 12 rows and 4 compartments per row. 3D printed parts are marked with „(3DP)“.

ItemNr	Description	Qty.	Length (if needed)
1	Sparepartscontainer	1	
2	ESP32 Microcontroller	1	
3	Adafruit Flora Smart NeoPixel (or similar)	48	
4	(3DP) LED Holding Mechanism	12	
5	(3DP) LED Wedges	48	
6	(3DP) LED Holding Mechanism Connector	22	
7	(3DP) ESP Box	1	
8	(3DP) ESP Box Lid	1	
9	10mm x 3mm Neodym Magnets	60	
10	Acrylic glass sheets 1,5mm thickness (7cm x 14cm) *	24	
11	Acrylic glass sheets wedged 1,5mm thickness (7cm x 14cm front, 3cm x 14cm back) *	24	
12	Cable 1mm diameter (between LEDs)	108	8cm
13	Cable 1mm diameter (connectors end of row)	72	3cm
14	Cable 1mm diameter (connector between rows)	36	30cm
15	JST Male 3 pole	23	
16	JST Female 3 pole	24	
17	JST Crimpcontacts	72	
18	Jumpercable Male (ESP32 connector)	3	10cm

*specific measurements depend on your sparepartscontainer, the acrylic glass sheets need to lay flat underneath each drawer.

Technical Specifications

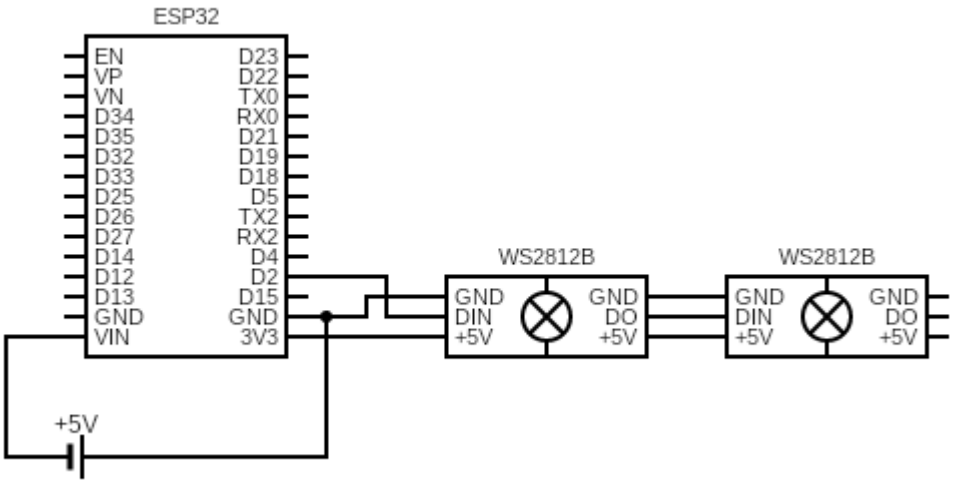
The PBL is powered by an ESP32 microcontroller to which the LEDs are connected. One ESP32 corresponds to one sparepartscontainer, multiple ESP32s are connected via WIFI to a single Raspberry Pi which holds the Frontend and Backend software structures.

In the following datasheet only the hardware components of one sparepartscontainer will be discussed.

Used hardware

Microcontroller: ESP32
LEDs: Adafruit Flora Smart NeoPixel RGB LED v2 (WS2812B controller)

Wiring Diagram



Power Consumption

One NeoPixel draws a maximum of 60mA if all color values are at 100%.
One sparepartscontainer with 48 compartments and so 48 LEDs draws a total of 2,9A at 3,3V.

Depending on how many compartments and LEDs you have per sparepartscontainer you can either power the whole system via the ESP32's pins (as shown in the above wiring diagram) or via a seperate powersupply. If you use the latter option make sure the ESP32 and the LEDs are connected to the same GROUND.

To find a suitable powersupply you can calculate the maximum power consumption of your sparepartscontainer with following formula:

60mA x (NumberOfLEDs) = Powerdrawage

The PBL system can only be powered by a maximum of 5V DC.

For further explanation of power consumption consult the adafruit website:
https://learn.adafruit.com/adafruit-neopixel-uberguide/powering-neopixels

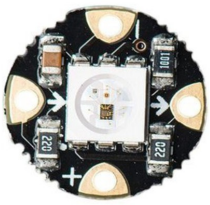
Assembly Guide

Soldering the LEDs

The PBL is designed row wise. Each row contains 4 LEDs, which are imbedded into the holding mechanism, hold in place by a clamp.

Solder one row after another, so 4 LEDs each and put JST connection pins on each end of a row. Through this you can ensure firstly scalability and secondly if any LEDs get damaged they are easy to switch.

All LEDs need to be soldered in parallel, make sure the data-in-pin of each LED is connected to the data-out-pin of the previous LED (indicated on the Flora Smart NeoPixel by the little arrows as seen on the right picture).



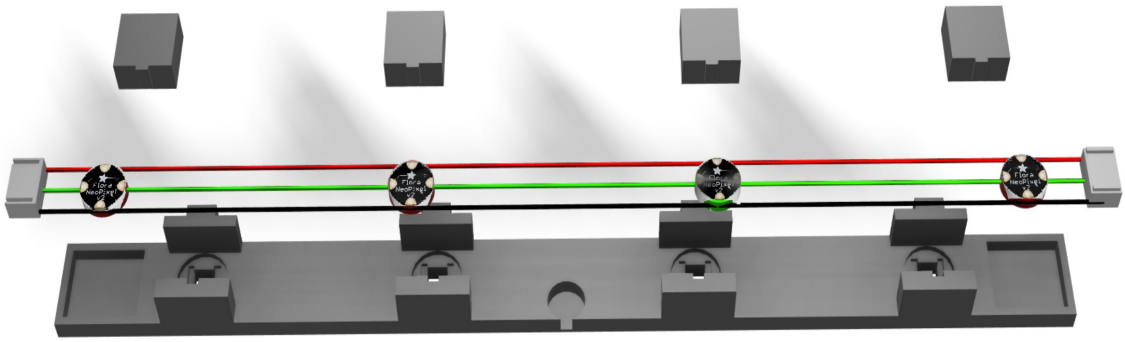
Adafruit Flora Smart NeoPixel v2

All ground-pins need to be connected together and all voltage pins need to be connected together (as shown below).

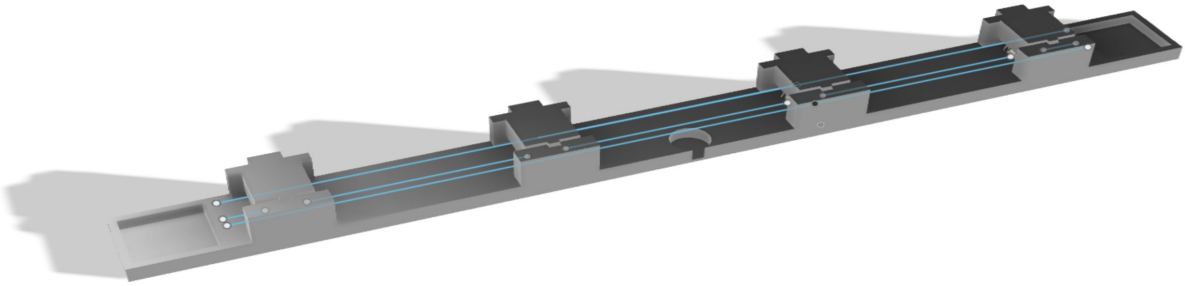
Adafruit Flora Smart NeoPixel v2, connected in parallel

Installation of LEDs to holding mechanisms

To install each row of LEDs into the holding mechanism just lay each LED into its corresponding slot. If you are using Flora Smart NeoPixel each LED should fit snuggly as the holding mechanisms are designed for them.
Make sure the LEDs lay flat and push a LED clamp behind each LED. These are pressfitted and will hold the LEDs in their place.

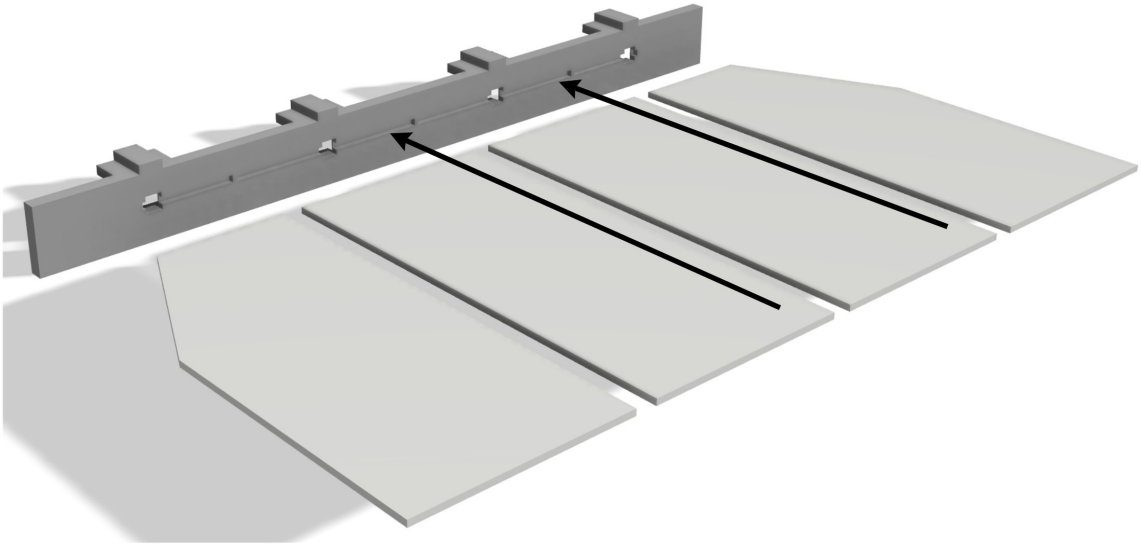


If all LEDs are laying in their corresponding slots with clamps behind them the whole setup should look like this.

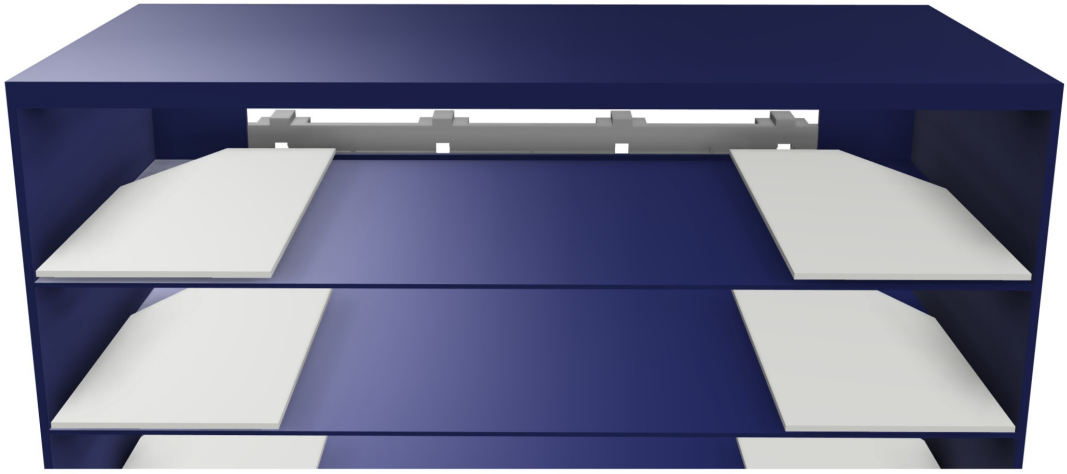


Assembly and attachment of acrylsheets and installing the holding mechanisms to the sparepartscontainer

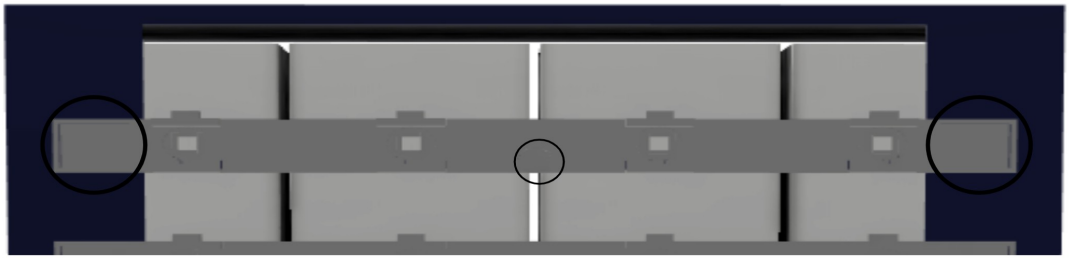
Push the center acrylic sheets into the holding mechanism, they are quite hard fitting and will hold themselves in place.



Leave the wedged sheets, lay them for now into the sparepartscontainer.



Push all holding mechanisms with LEDs, clamps and the acrylic sheets attached from behind into the sparepartscontainer.
Put in every indent on the back of the holding mechanisms a 10mm neodym magnet to secure them more in place.



After this you can hook up all LEDs together and connect them to the ESP32 via the jumper cables.

Testing

LEDs tested:

RGB Smart NeoPixel
Flora NeoPixel
"in house" LEDs

Best luminoscity/color purity: Flora NeoPixel

Cablelength tested: 10m before first LED, LEDs still working.

Nearly noticable difference between single and double LEDs per compartment.

Further information on the LEDs luminoscity can be found in the git repository.