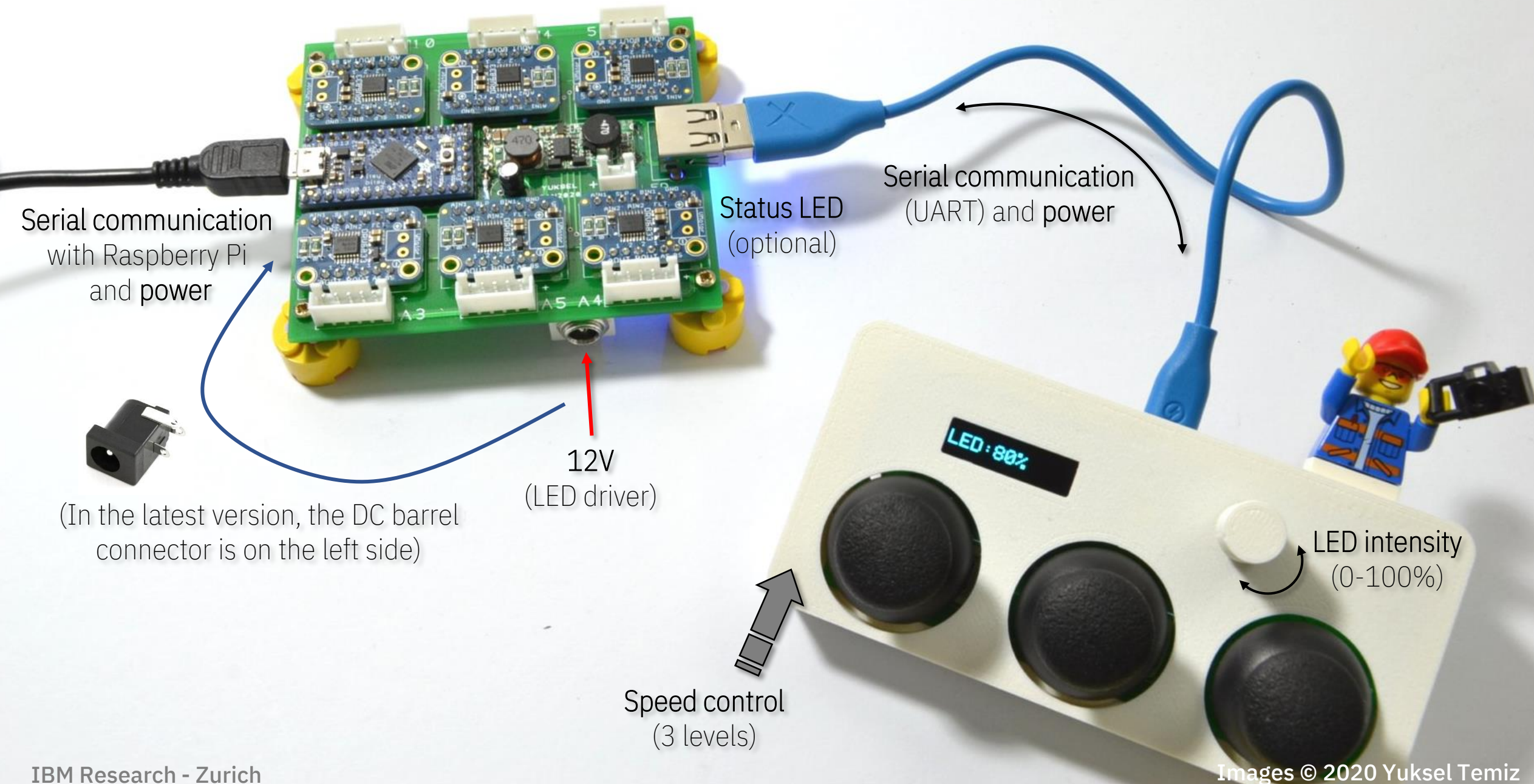**Circuit assembly**

Electronics

Serial communication
with Raspberry Pi
and **power**

Status LED
(optional)

Serial communication
(UART) and **power**

12V
(LED driver)

(In the latest version, the DC barrel
connector is on the left side)

LED : 80%

LED intensity
(0-100%)

Speed control
(3 levels)

IBM Research - Zurich

Images © 2020 Yuksel Temiz

Mainboard

Arduino

Stepper signals

Driver enable signals

Controller — RX / TX

Raspberry Pi — USB

PWM

12V — LED driver — LED

NeoPixel status LED (optional)

Stepper motor drivers

EN — X — 5V
EN — Y
EN — Z
EN — C
EN — R
EN — T

Raspberry Pi (USB)

Arduino microcontroller (Adafruit 3677)

6x stepper motor driver (Adafruit 3297)

6x 5pin JST-XH connectors (Stepper motors)

LED driver (RECOM RCD-24-0.70/PL/B)

86mm

4x 92947

2pin JST-XH connector (LED)

Controller (UART)

NeoPixel LED (Adafruit 1655)

Mainboard

Mainboard
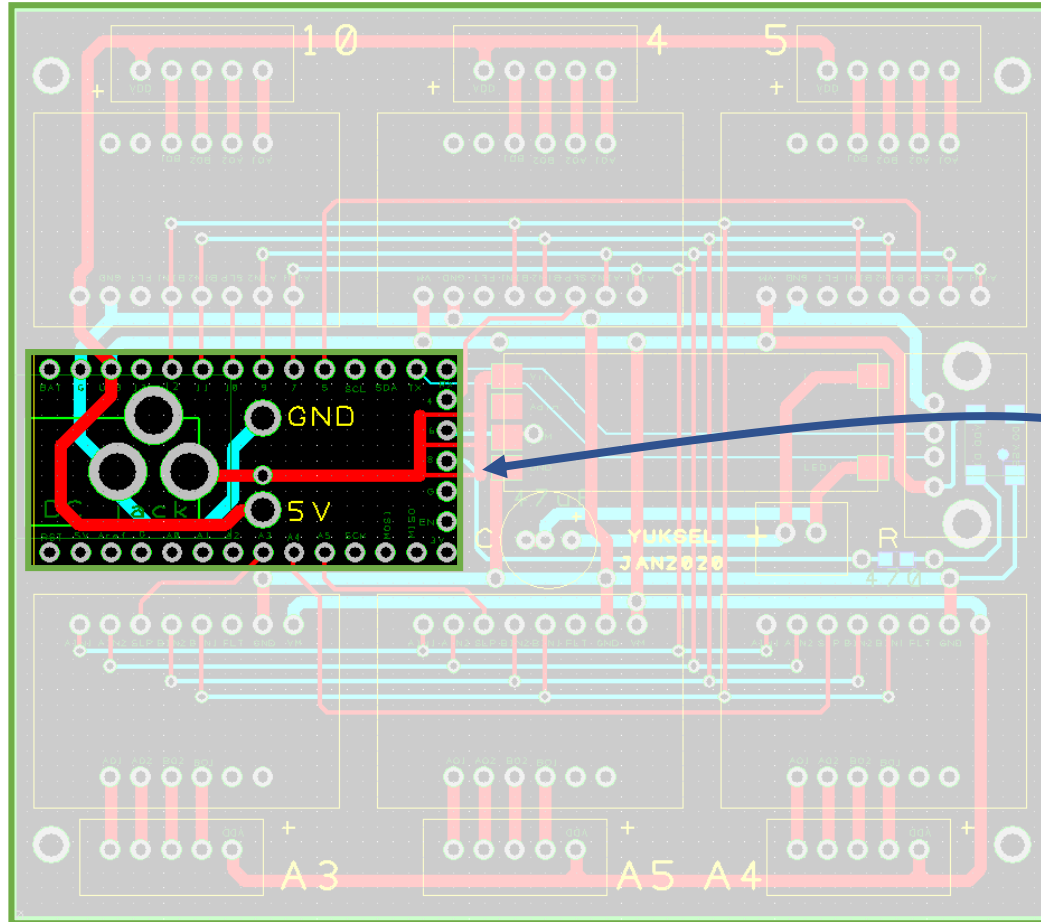

USB (Type A) connector

(Used for the communication between the mainboard and the controller)

DC barrel connector

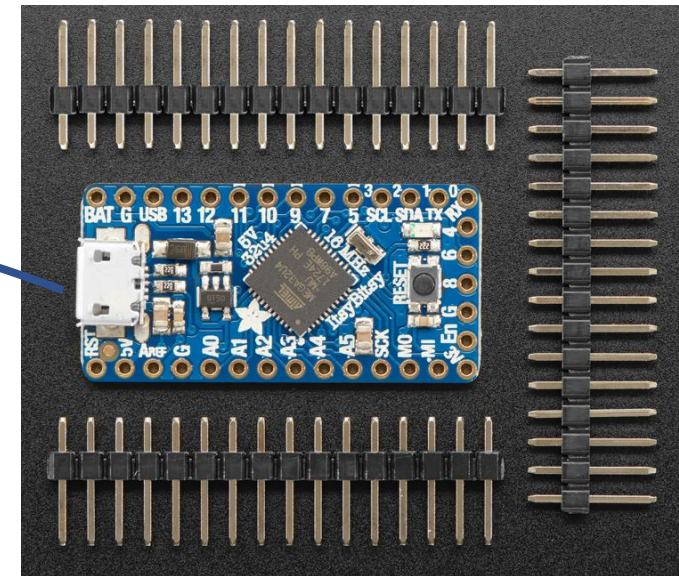(Soldered to the bottom side. Needed to supply >5V to the LED driver)
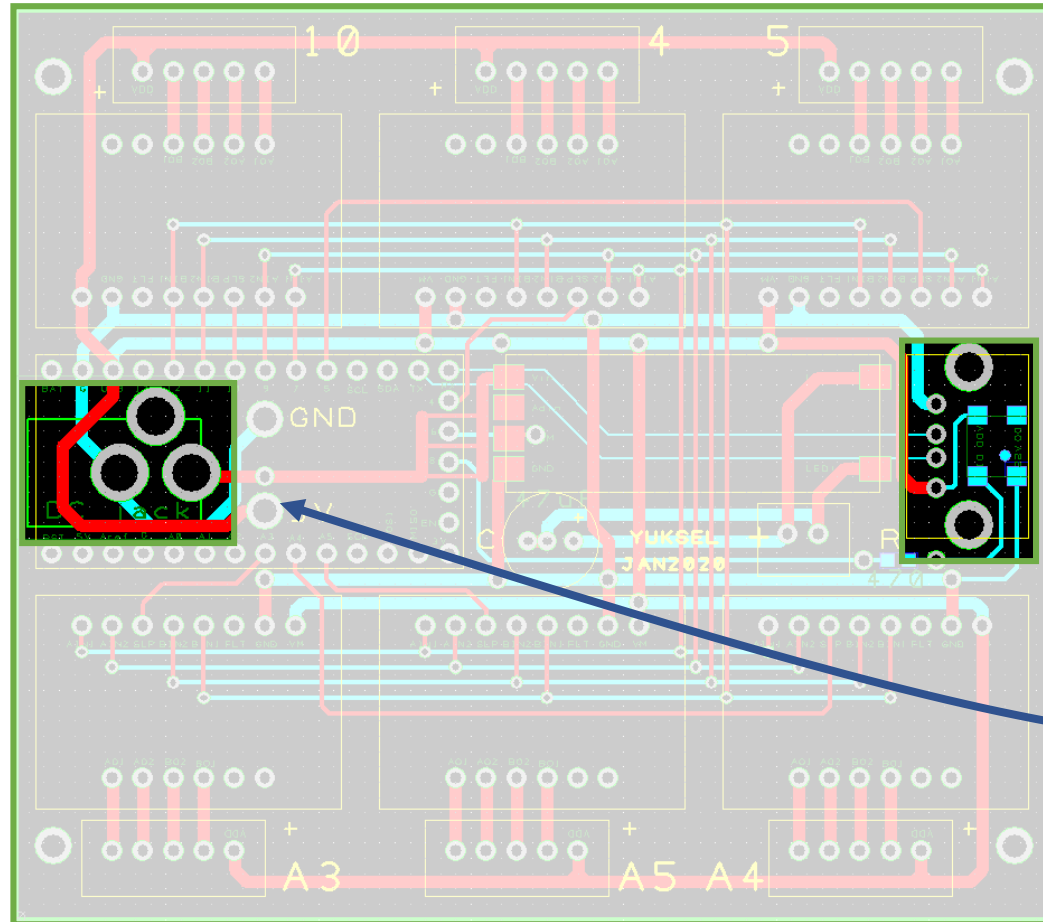
⚠ Solder the connector before the Arduino

Images © 2020 Yuksel Temiz

Mainboard
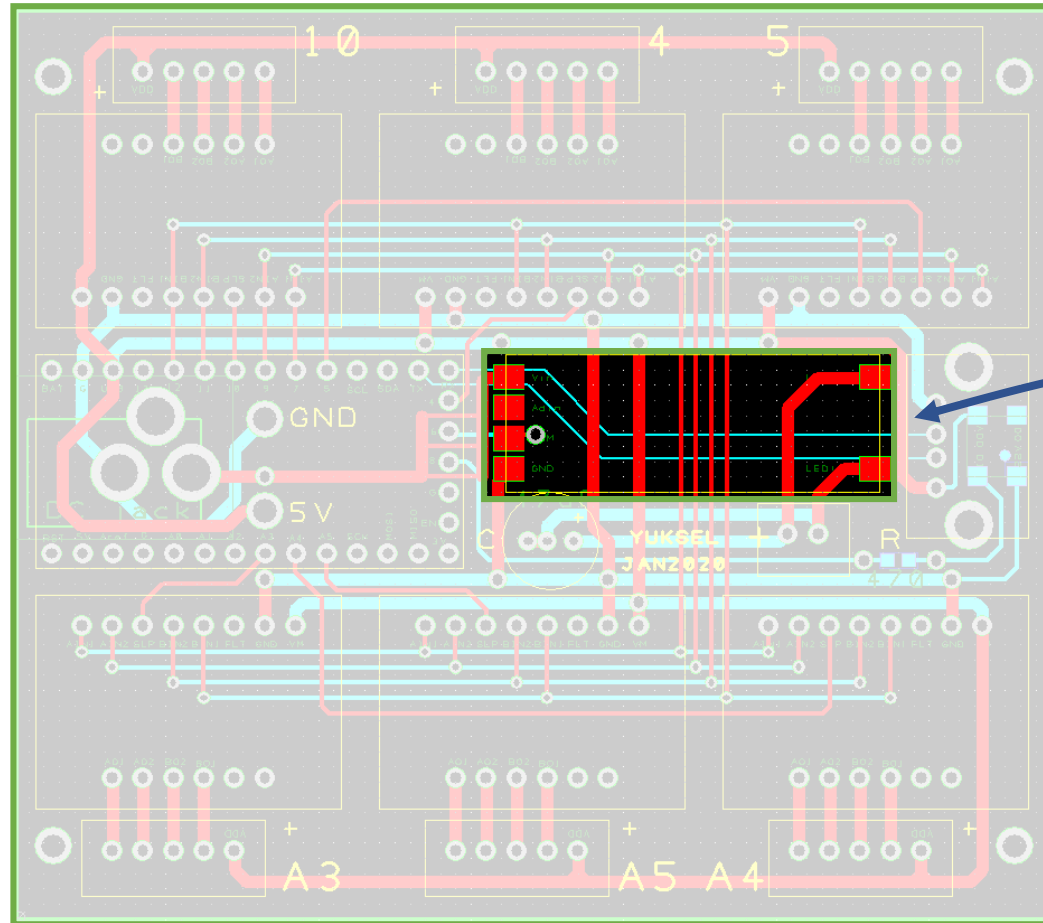
Adafruit ItsyBitsy 32u4 5V

(Use the headers for a reliable connection
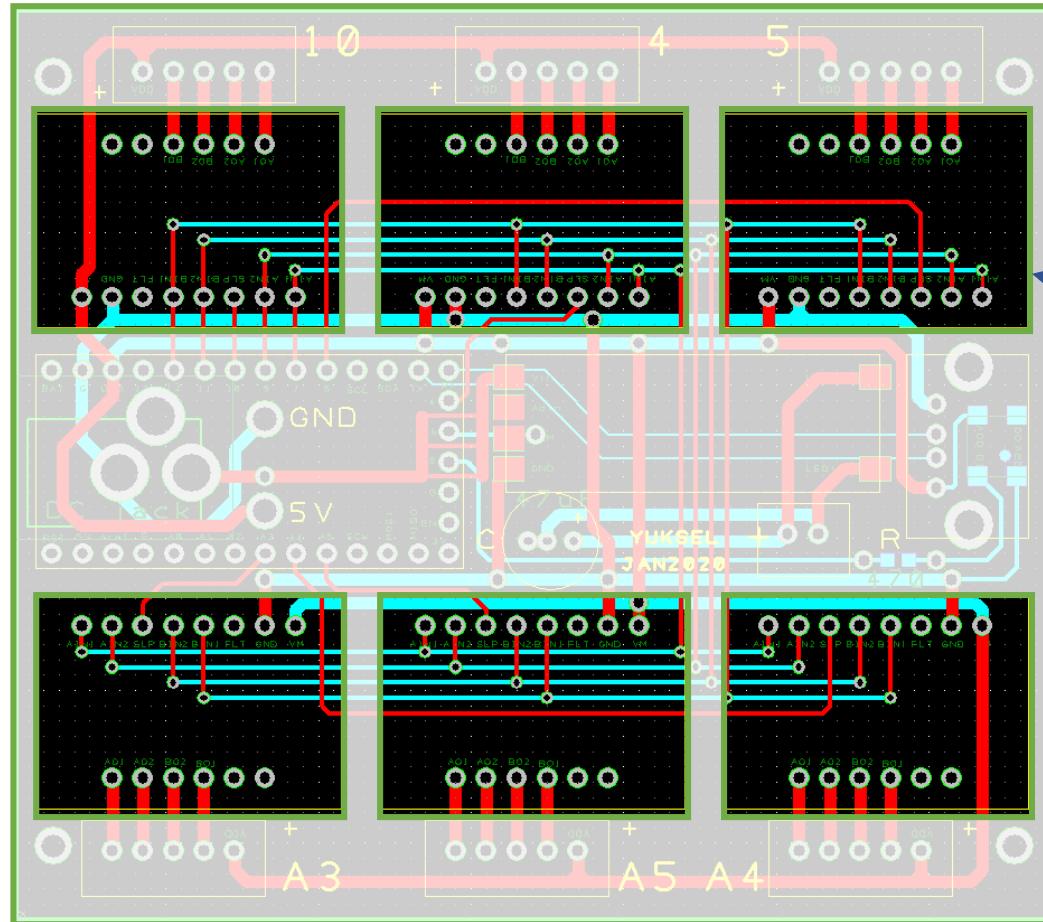between the Arduino board and the PCB)
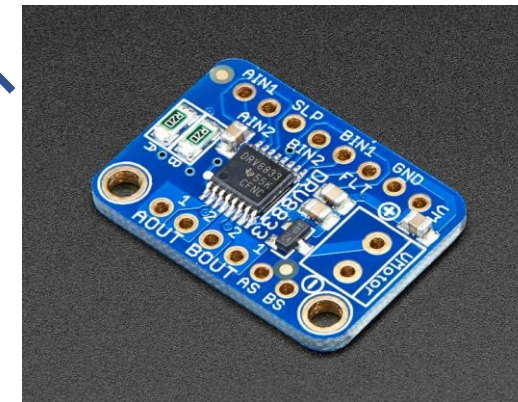
Mainboard

RCD-24-0.70/PL/B LED driver

Mainboard
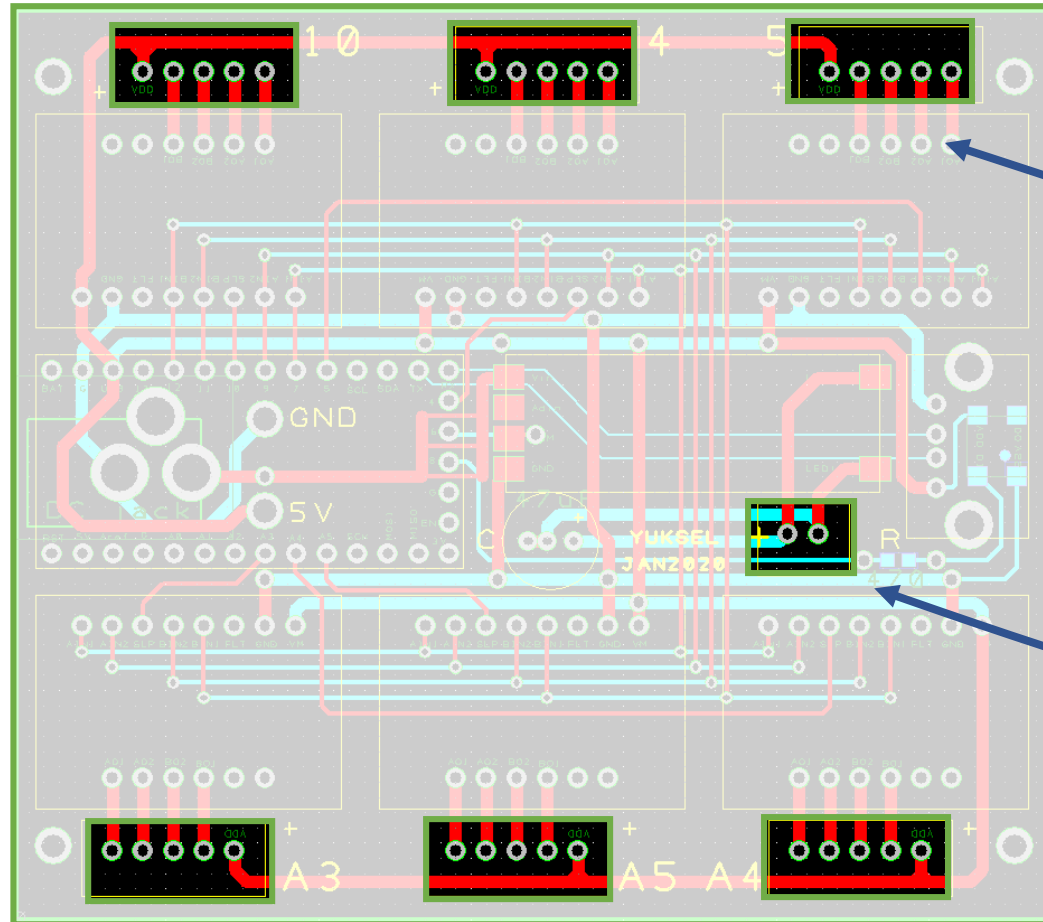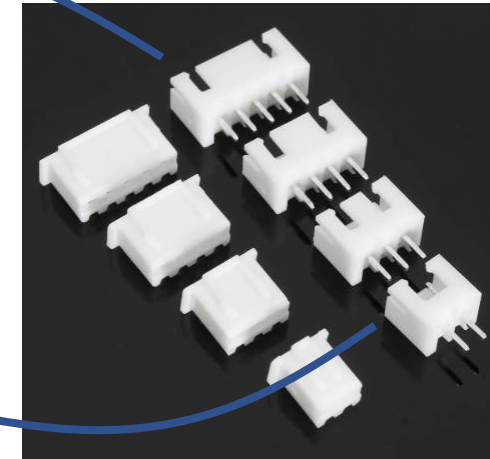

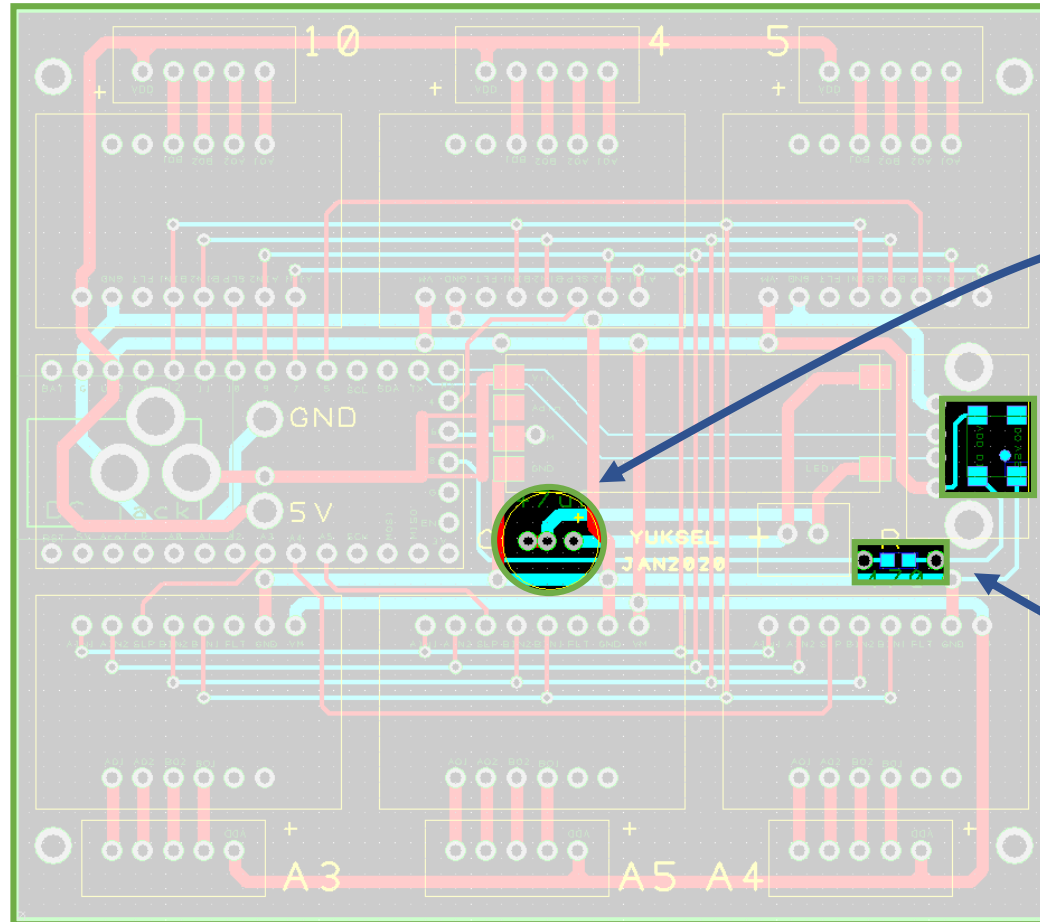Adafruit DRV8833 motor driver

6x

Mainboard

[JST XH connector set](#)

5pin
(stepper
motors)

2pin (LED)

Mainboard

47µF / 16V capacitor
(Required for the PWM
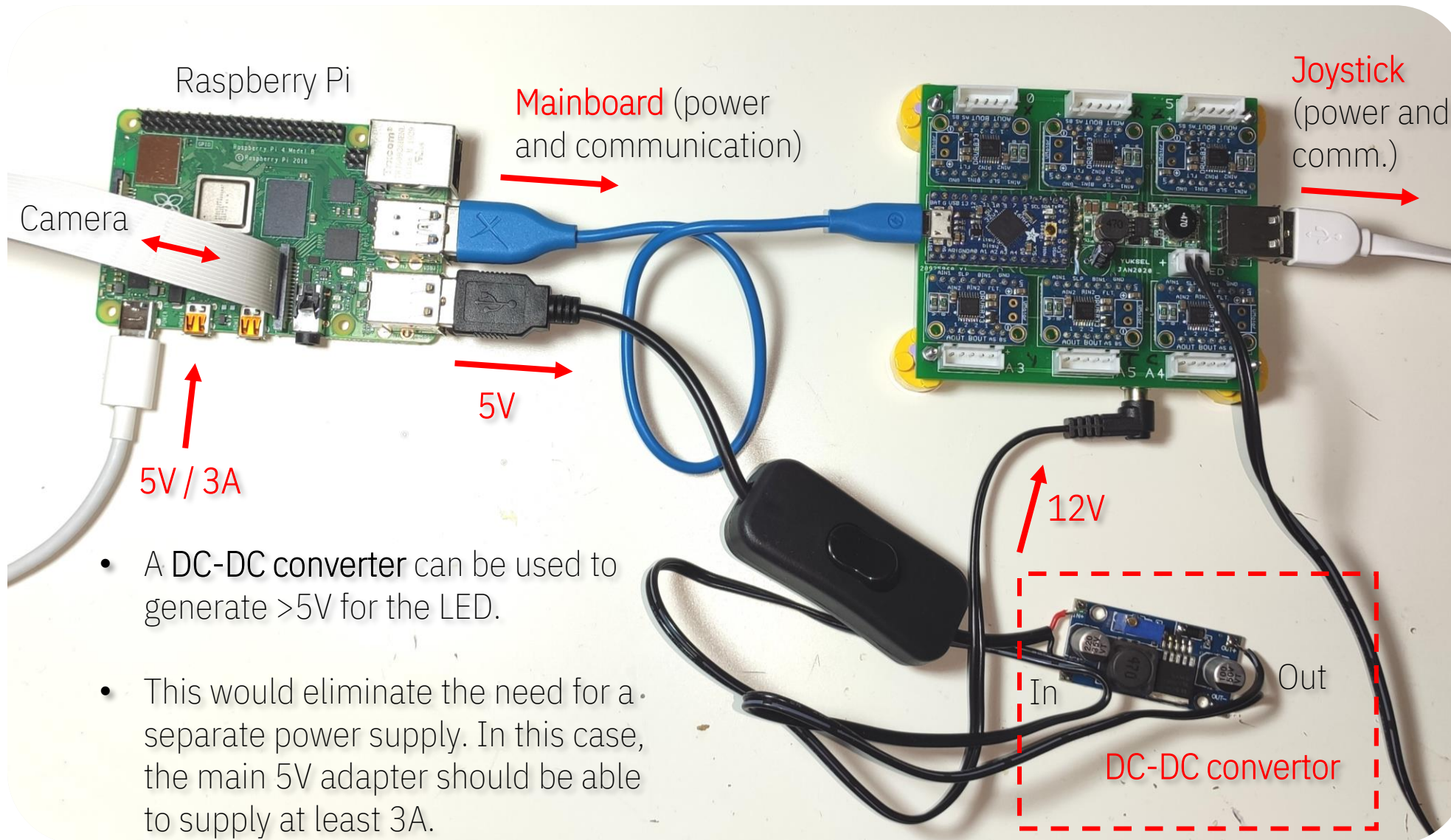function of the LED driver)

NeoPixel (optional)

Resistor (300 – 500 ohm)

(Precaution for the NeoPixel data input.
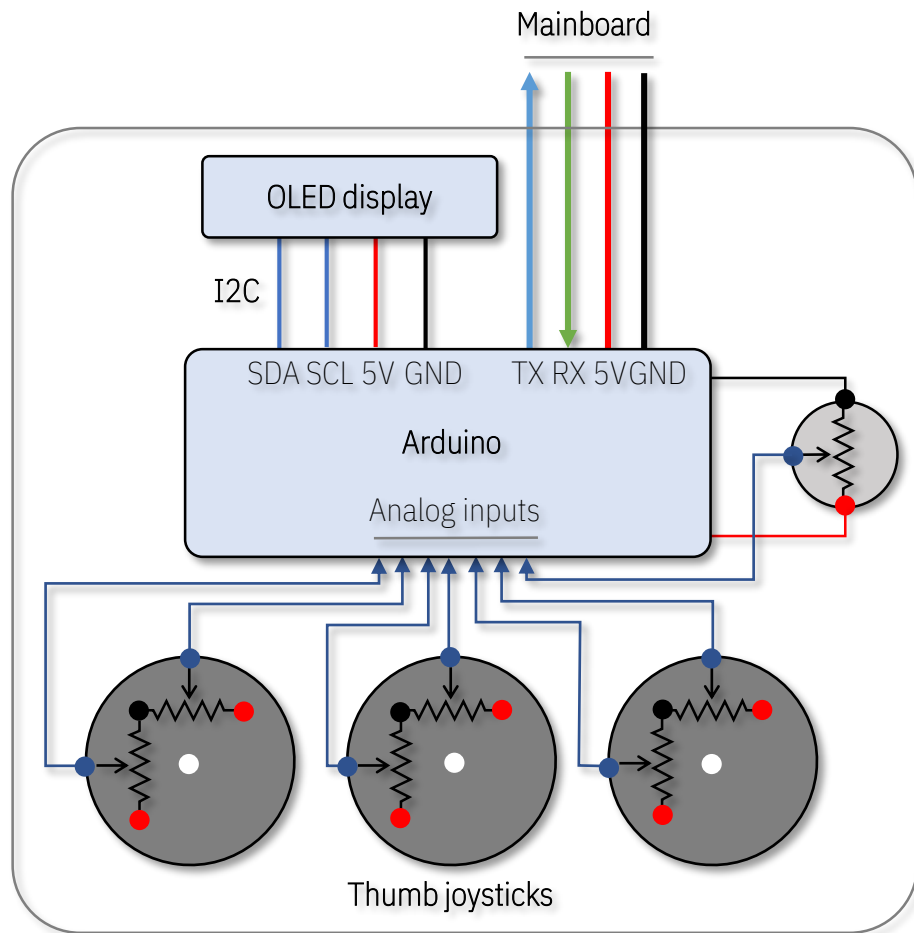SMD or a regular resistor can be used.)

Mainboard

Raspberry Pi

Camera

Mainboard (power and communication)

Joystick (power and comm.)

5V

5V / 3A

12V

Step-up DC-DC converter

In

Out

DC-DC convertor

- A **DC-DC converter** can be used to generate >5V for the LED.

- This would eliminate the need for a separate power supply. In this case, the main 5V adapter should be able to supply at least 3A.

Controller

OLED display

I2C

SDA SCL 5V GND   TX RX 5V GND

Mainboard

Arduino

Analog inputs

Thumb joysticks

128x32
OLED display

Mainboard
(UART, power)

Arduino microcontroller
(Adafruit 3677)

10Kohm Potentiometer
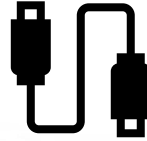(Adafruit 4133)

43mm

3x thumb joysticks
(Sparkfun COM-09032)

This joystick controller is fun to use but it is optional, the microscope can also be controlled directly from a keyboard connected to Raspberry Pi using the Python code.
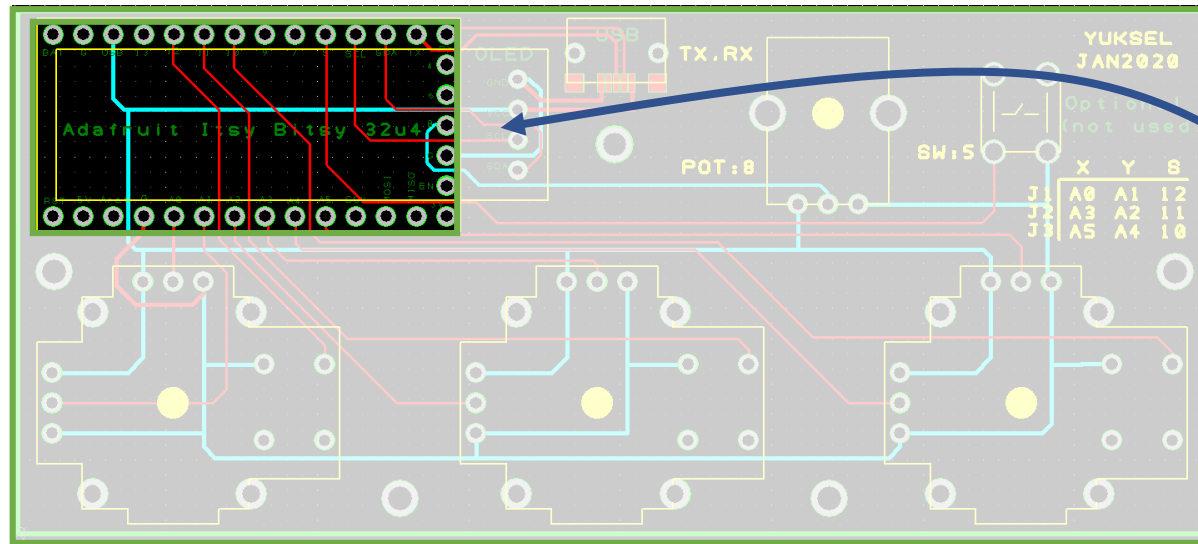
Controller

Used to communicate with the mainboard,
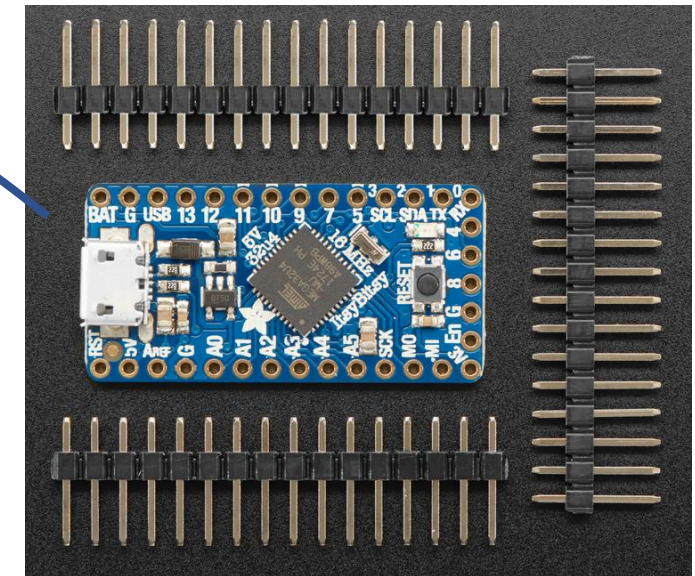which also supplies the power

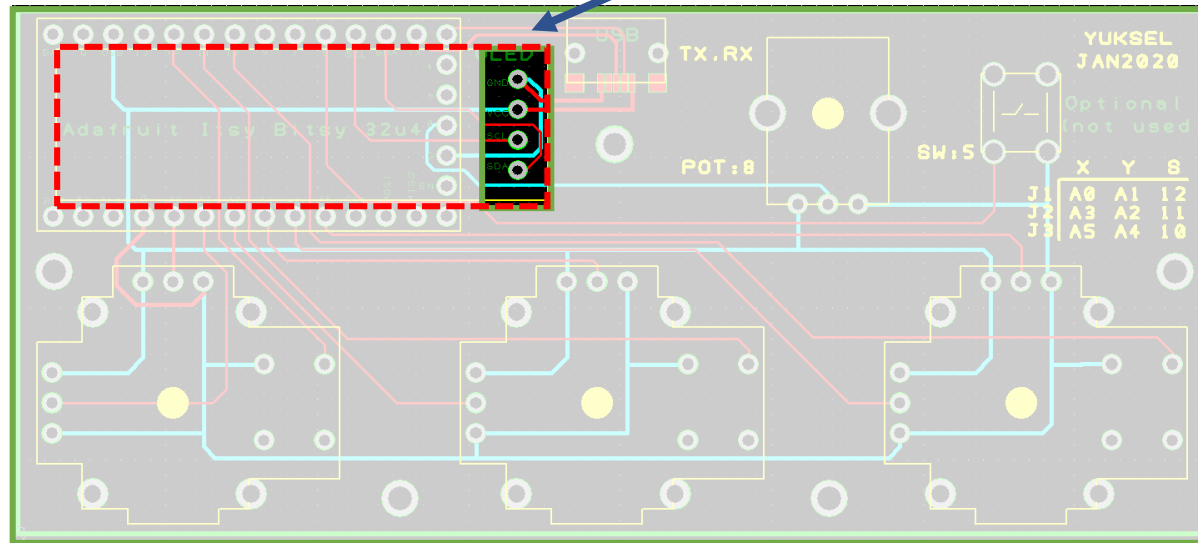Used to upload the
Arduino code, not
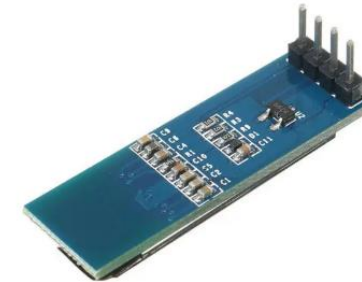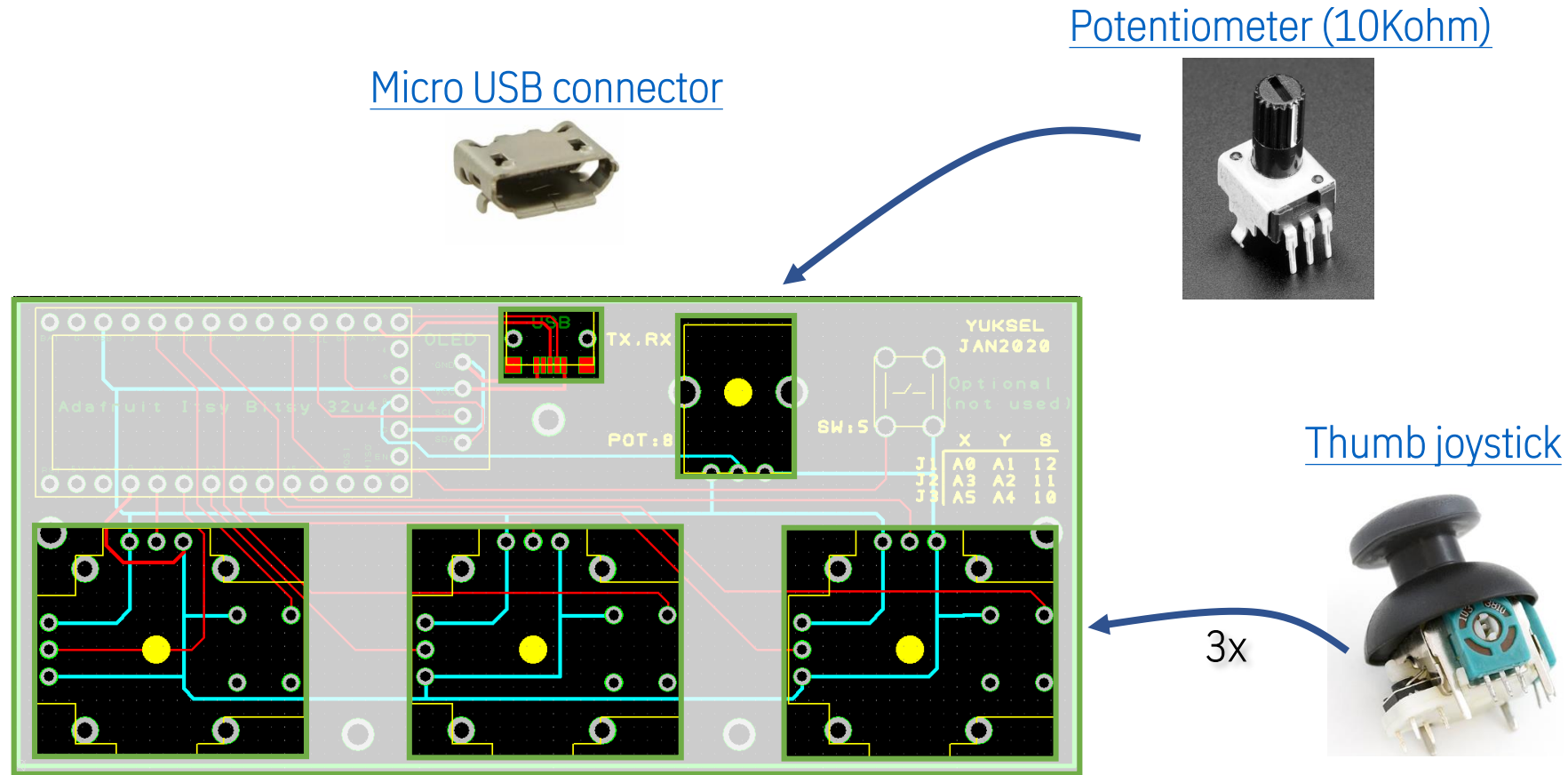needed afterwards
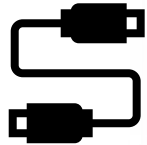
Controller

Adafruit ItsyBitsy 32u4 5V

Controller

⚠️ The OLED display sits on top of the Arduino microcontroller

128 × 32 OLED display

Controller

Micro USB connector

Potentiometer (10Kohm)

Thumb joystick

3x

⚠️ Soldering the micro USB connector can be difficult. I recommend putting a large amount of solder to all pins, short-circuiting them, and carefully taking out the excess using a solder wick.