

If .NET Brewed Beer



Shaun Lawrence

@bijington

“Give a person a beer and they drink for a day. Teach them to brew and you give them a hangover for life.”



Shaun Lawrence

@bijington

My first brew



+



>



Shaun Lawrence

@bijington

Brewing process

- Clean and Sanitize
- Wort
- Mix
- Fermentation
- Carbonate
- Cold crash



Shaun Lawrence

@bijington

Top 5 priorities for brewing great beer

Quoting John Palmer

1. Sanitation
2. Fermentation
3. Proper yeast management
4. The boil
5. The recipe



Shaun Lawrence

@bijington

Top 5 priorities for brewing great beer

Quoting John Palmer

1. Sanitation
2. Fermentation
3. Proper yeast management
4. The boil
5. The recipe

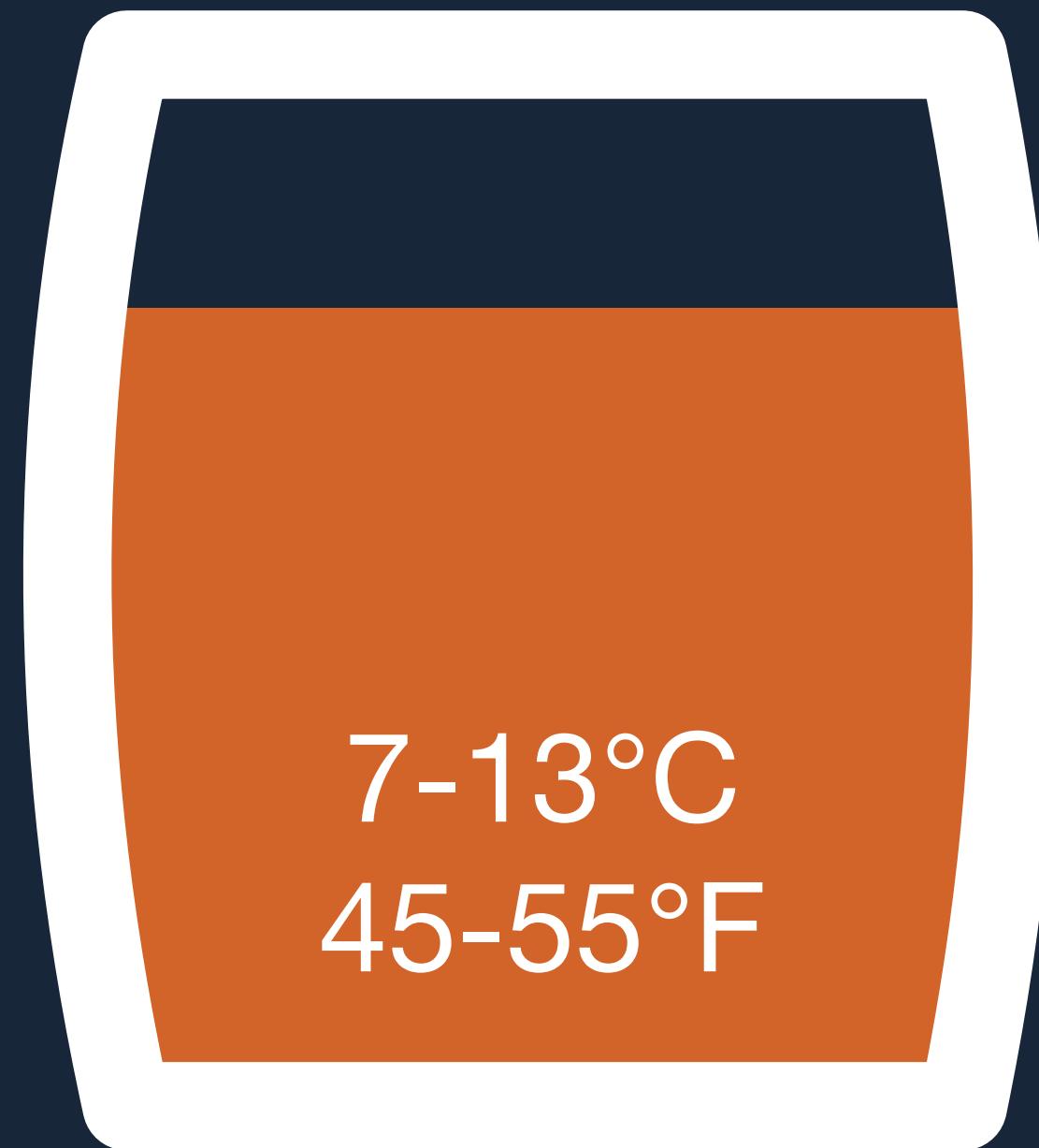


Shaun Lawrence

@bijington

Fermentation - Temperature control

Lager



Ale



Fermentation - Temperature control



Wi-Fi Enabled
(2.4 G Hz band)



Remote Control



Voice Control



Schedule and Timer



Away Mode



Share to Family



No Hub Required



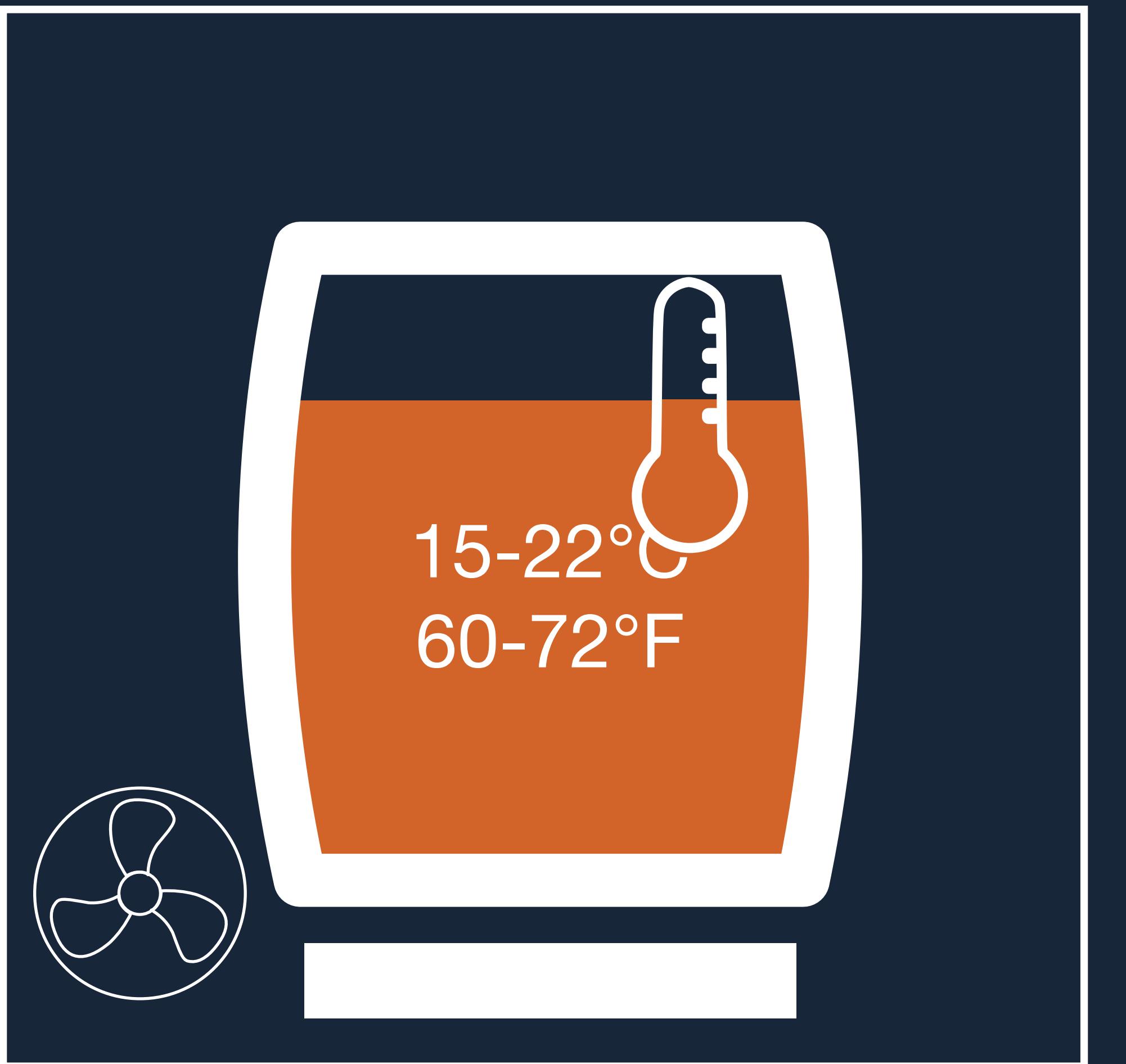
Easy Use with Free APP



Shaun Lawrence

@bijington

Fermentation chamber



My fermentation chamber



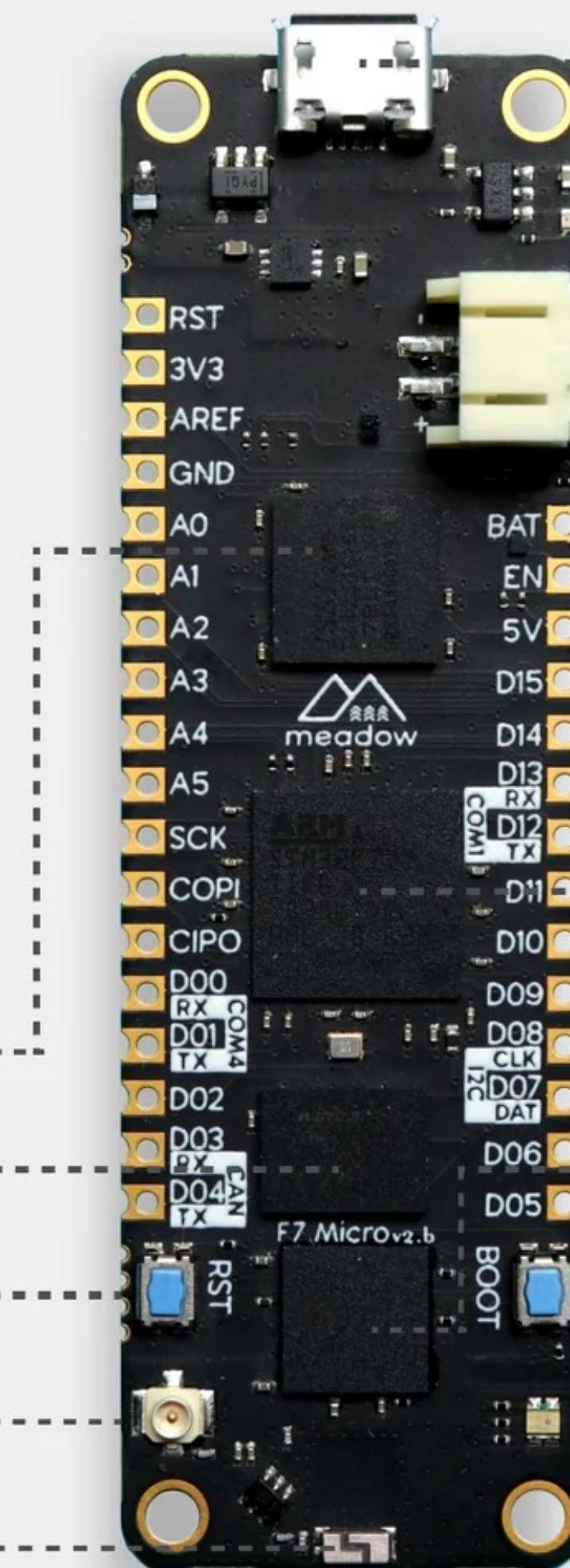
Shaun Lawrence

@bijington

Meadow F7v2 Dev Module

25 GPIO (12 PWM)
6 Analog In
I2C, I2S, SPI, UART, CAN
AES Crypto Acceleration
JPEG Image Hardware Codec
Fully SMT-Compatible

32MB RAM
64MB Flash
Reset Button
Ext. µFL Antenna
Onboard Antenna



Micro USB

LiPo/LiIon
BatteryCharger



STM32F7
Microcontroller

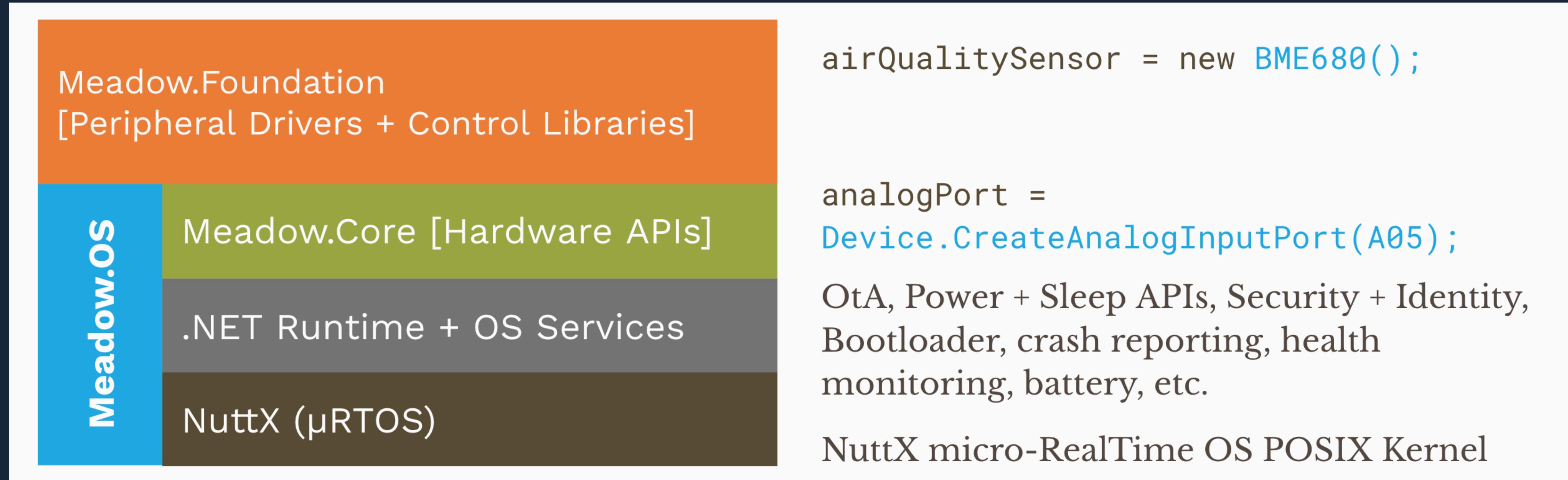
ESP32 BLE & WiFi

DFU Boot Button

RGB LED



Meadow



Shaun Lawrence

@bijington

Meadow - Getting Started

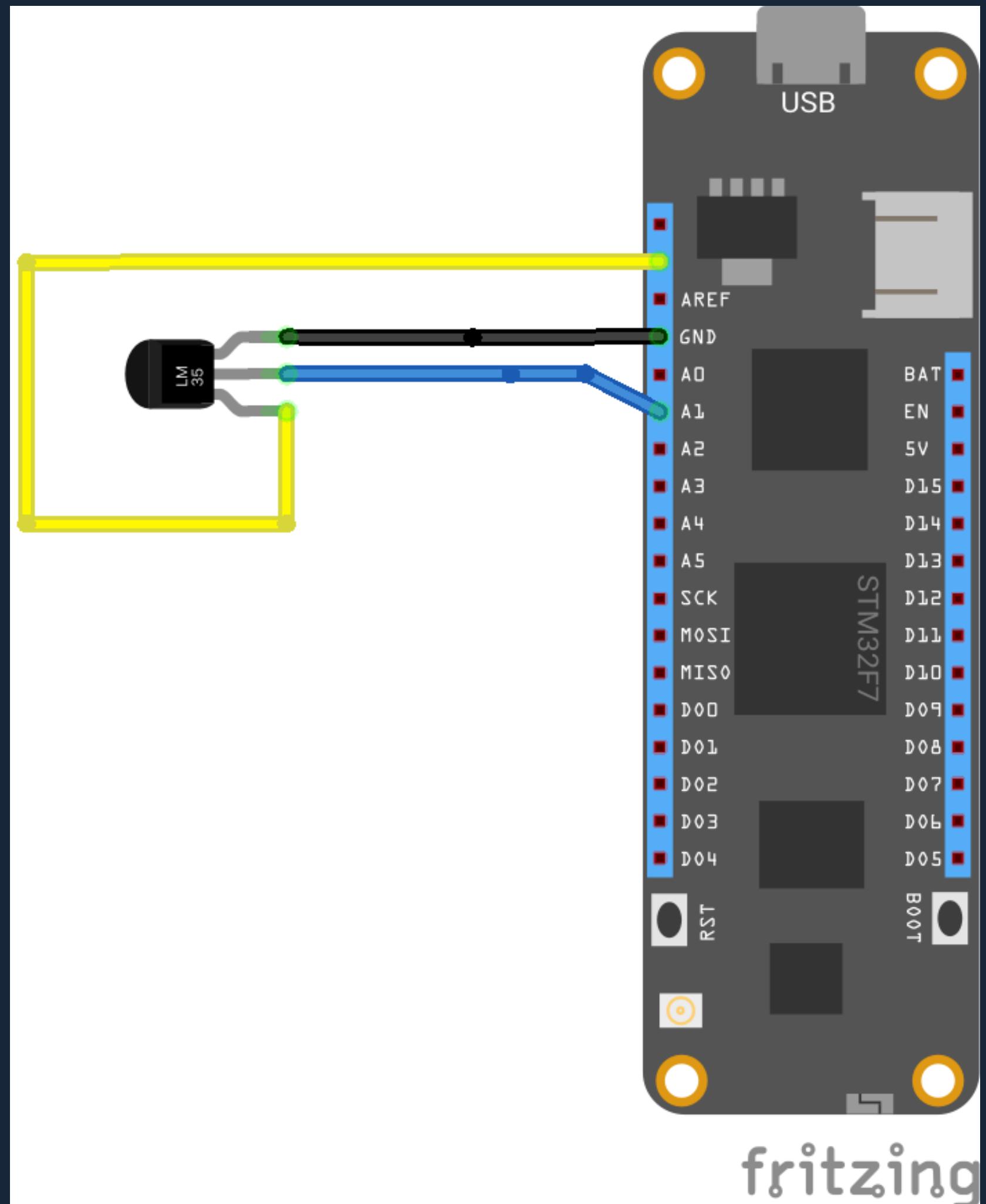
- https://developer.wildernesslabs.co/Getting_Started/
- Visual Studio
- Visual Studio Code
- Command Line Interface



Shaun Lawrence

@bijington

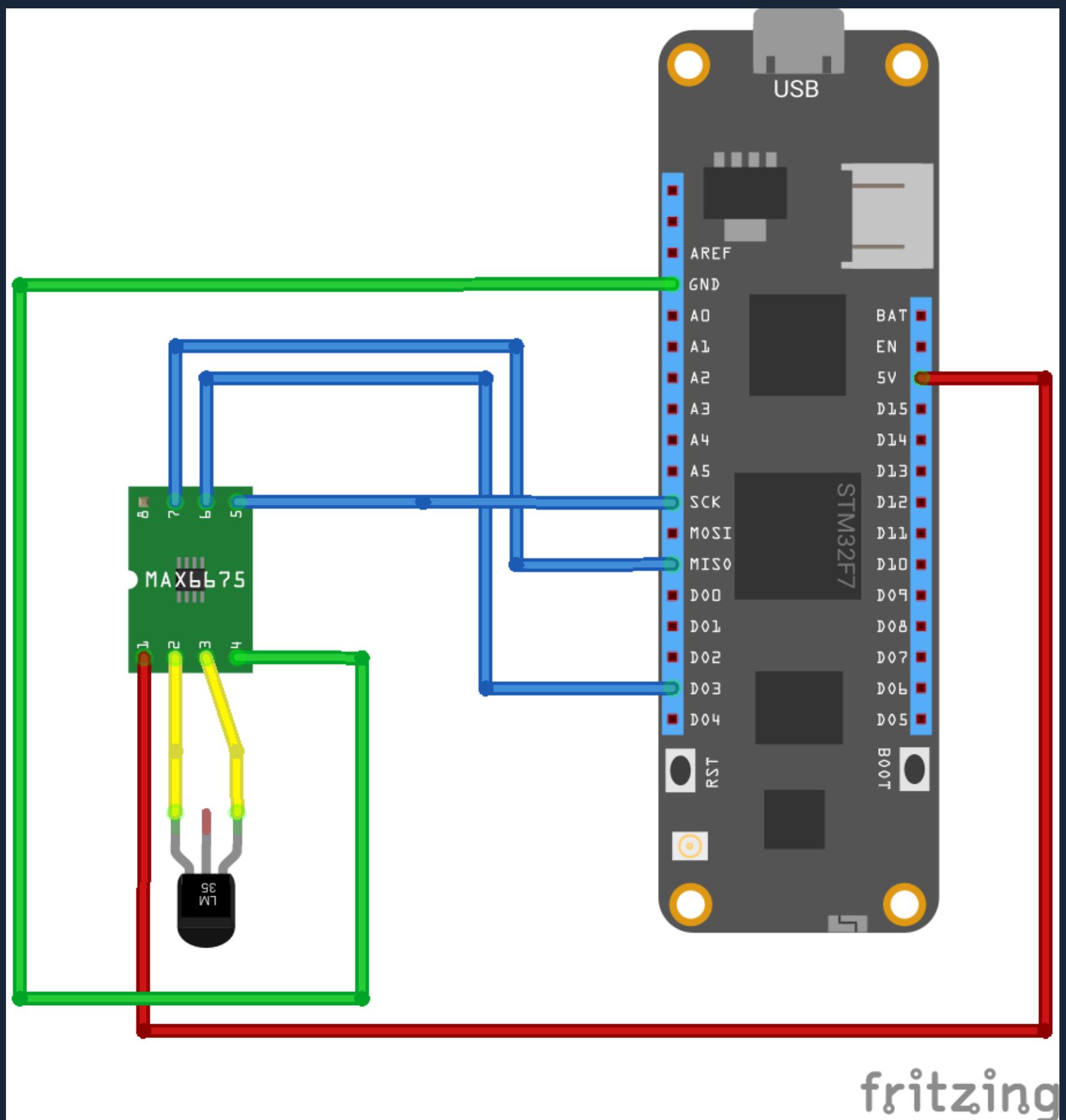
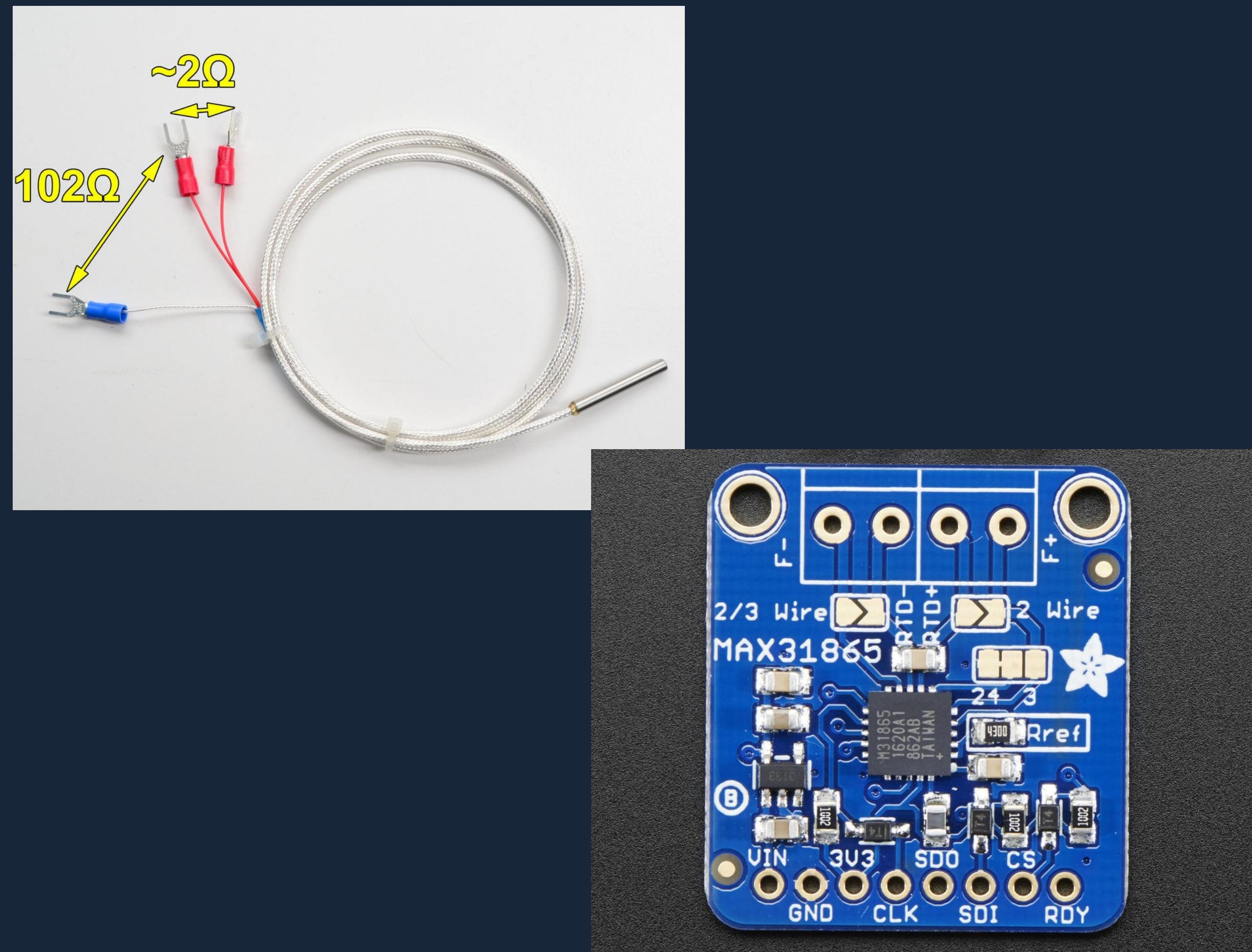
Ambient temperature sensor



Shaun Lawrence

@bijington

Liquid temperature sensor



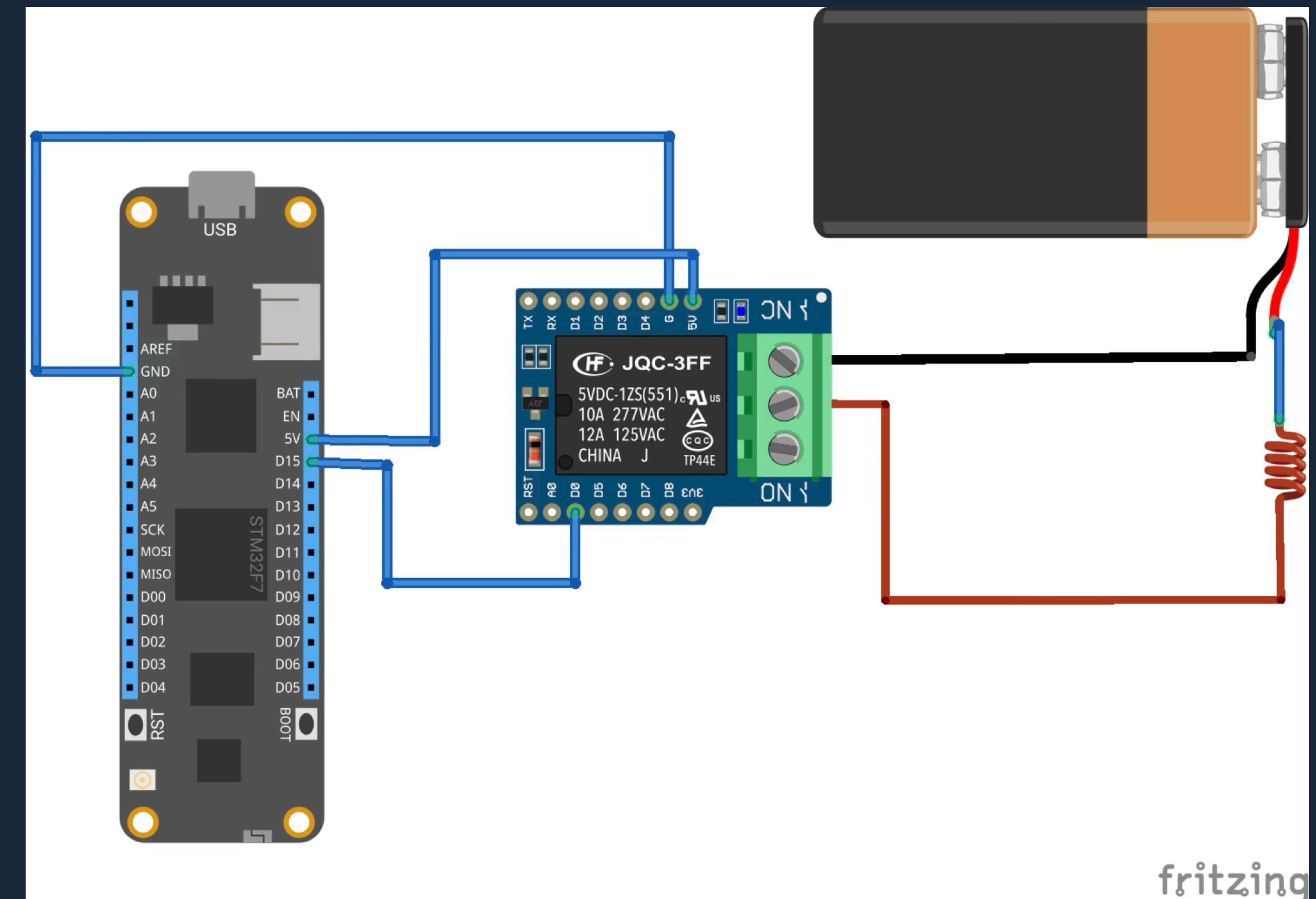
fritzing



Shaun Lawrence

@bijington

Heating/cooling element



Shaun Lawrence

@bijington

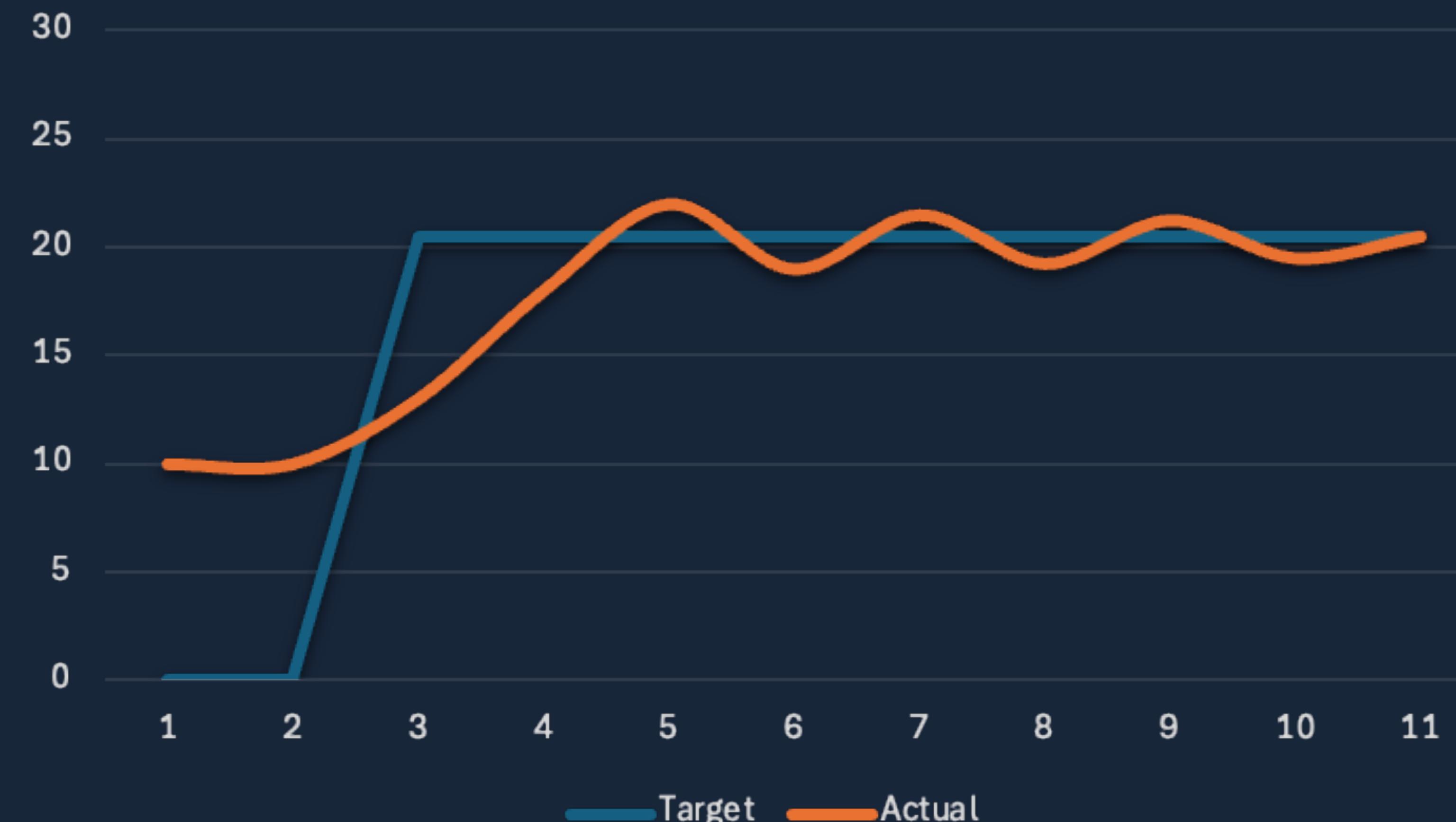
Job done?!



Shaun Lawrence

@bijington

Fermentation - Temperature control



Shaun Lawrence

@bijington

Proportional, Integral, Derivative (PID)

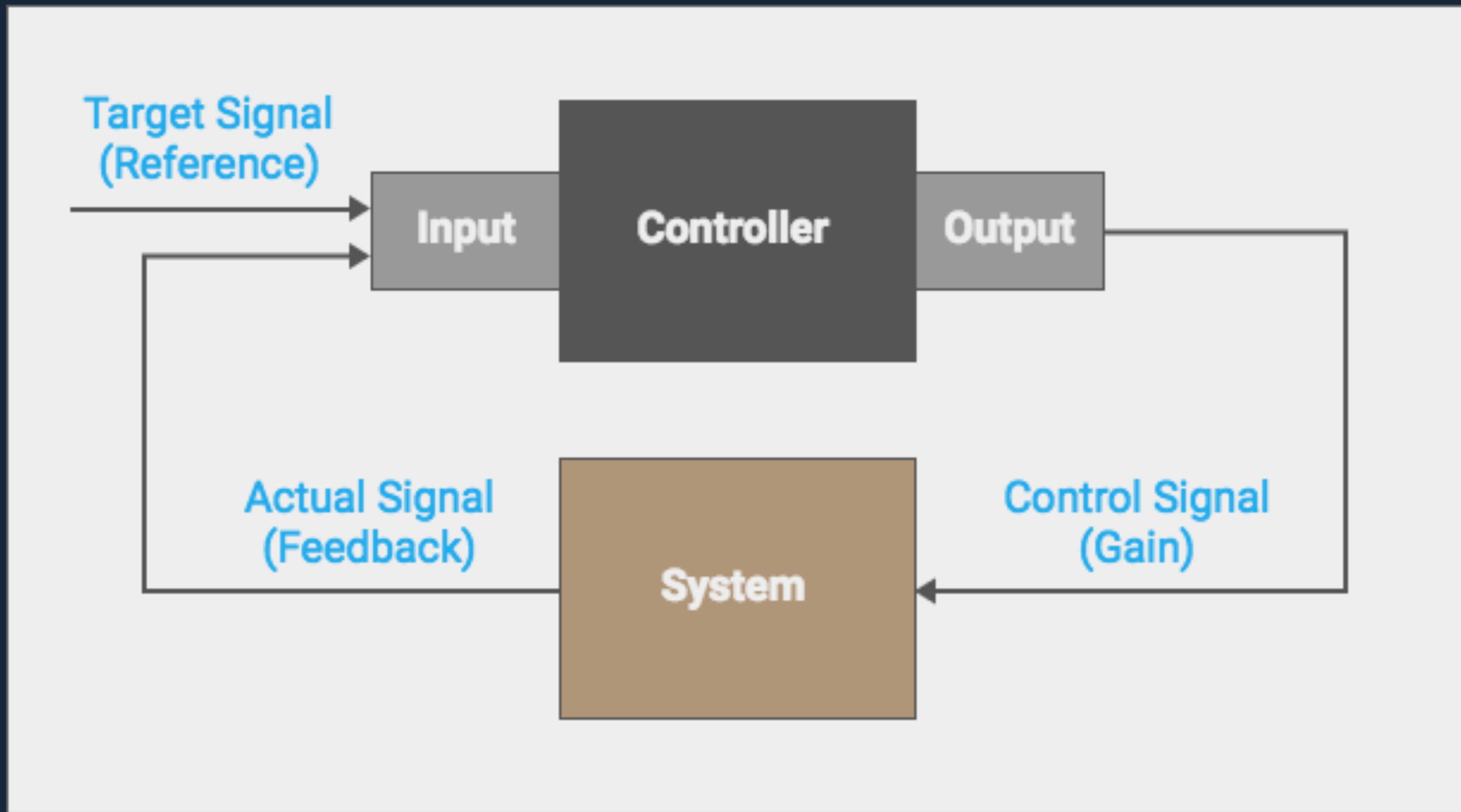
$$u(t) = \text{MV}(t) = K_p e(t) + K_i \int_0^t e(\tau) d\tau + K_d \frac{de(t)}{dt}$$



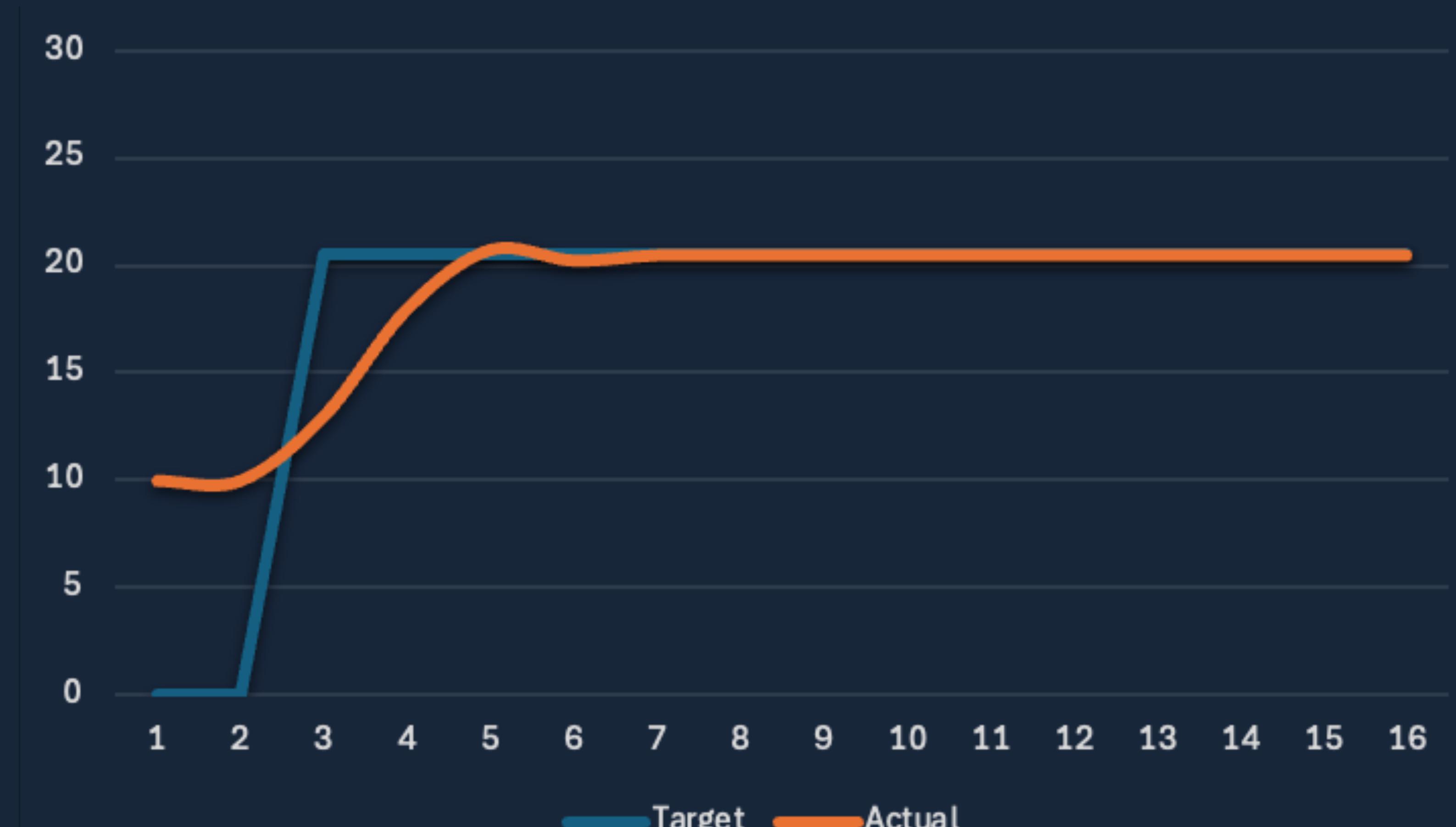
Shaun Lawrence

@bijington

Control theory



Proportional, Integral, Derivative (PID)



Shaun Lawrence

@bijington

Using PID in our code

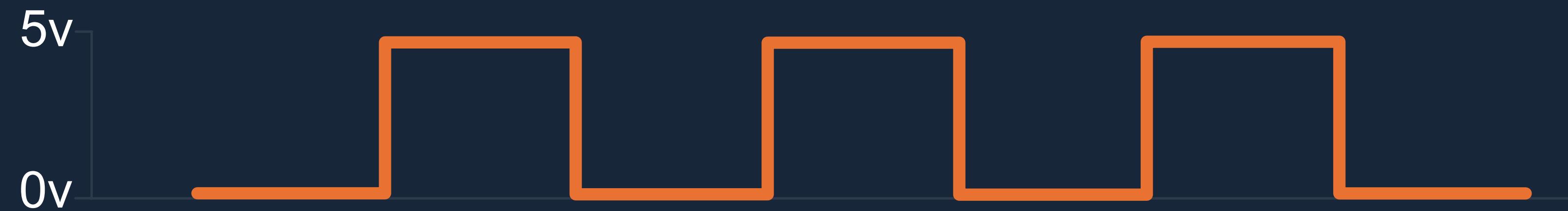


Shaun Lawrence

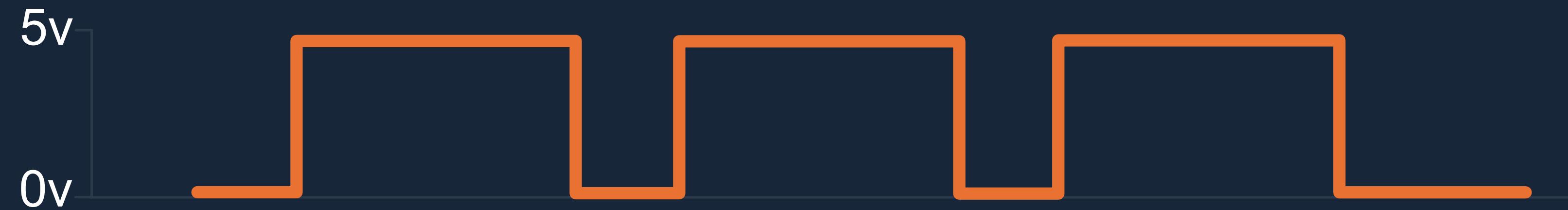
@bijington

Pulse Width Modulation (PWM)

50% duty cycle



75% duty cycle



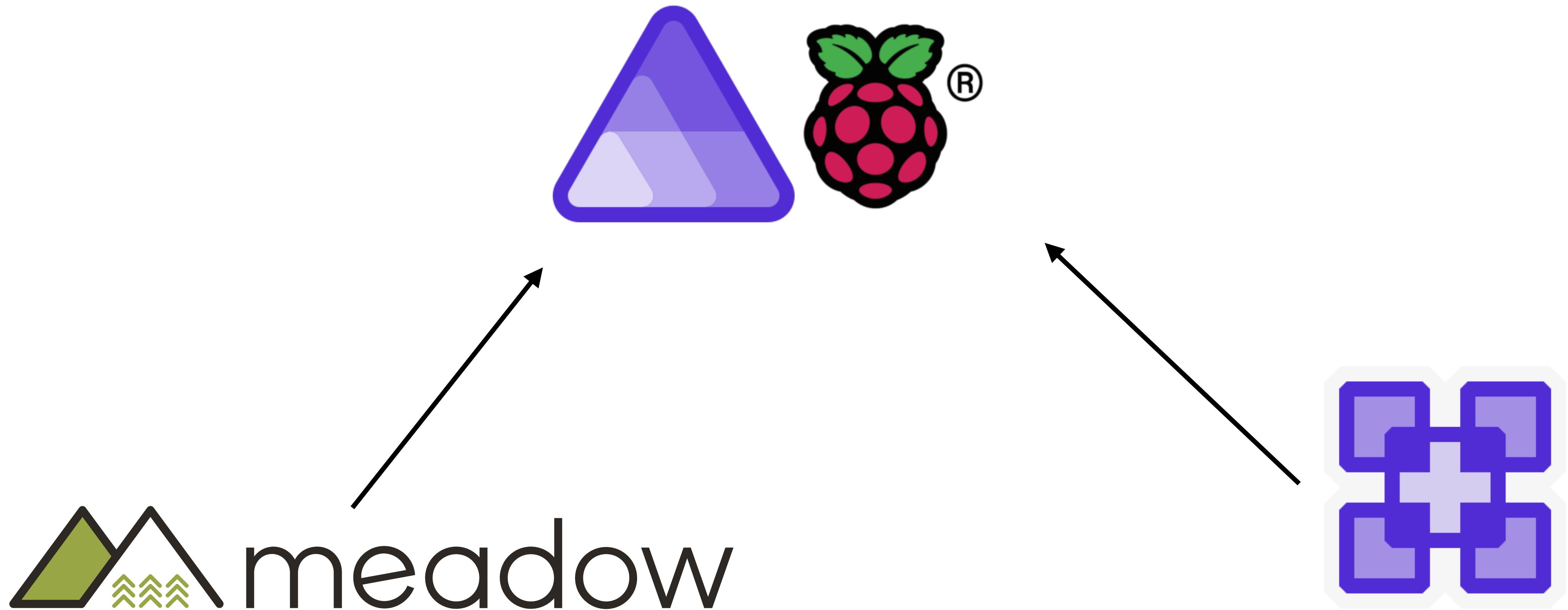
Using PWM in our code



Shaun Lawrence

@bijington

How .NET brews beer



Summary

- Cheers
- <https://github.com/bijington/BrewIoT>
- https://developer.wildernesslabs.co/Getting_Started/
- Shaun Lawrence - Bijington



Shaun Lawrence

@bijington