Internet of Things Workshop

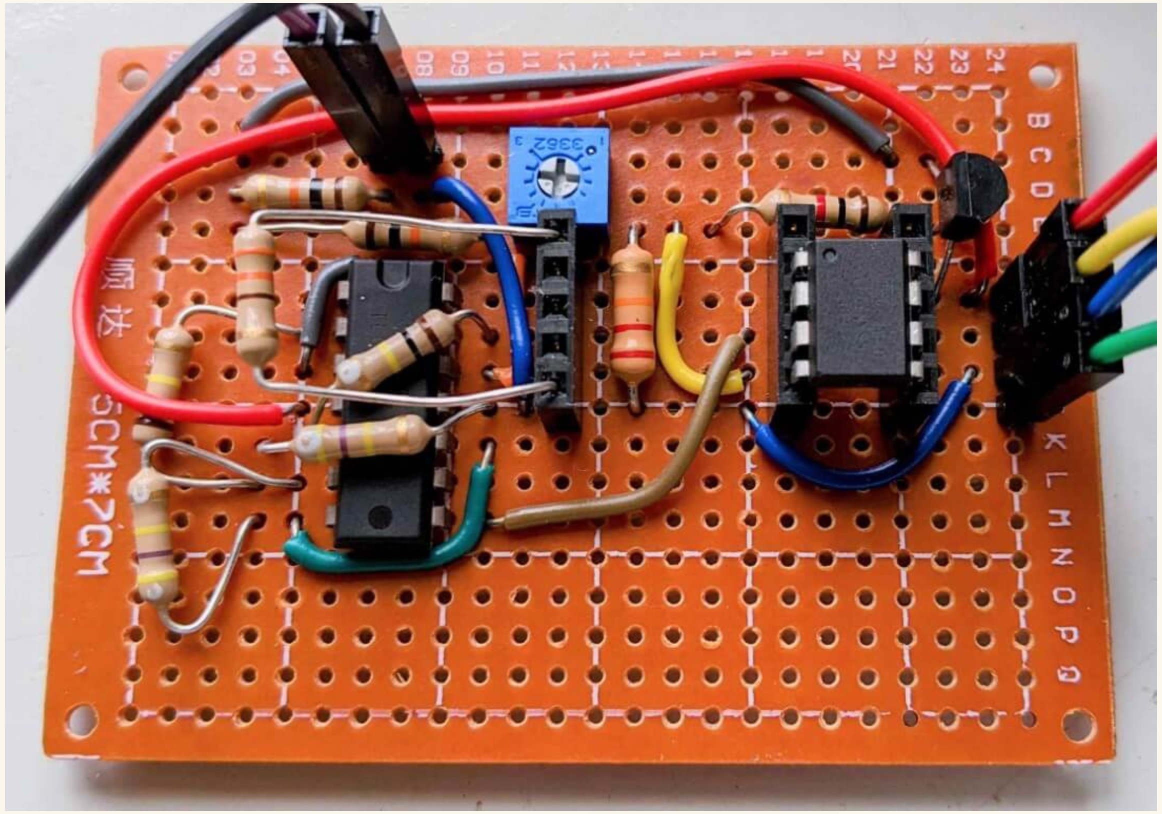
Salinity Sensor Prototype

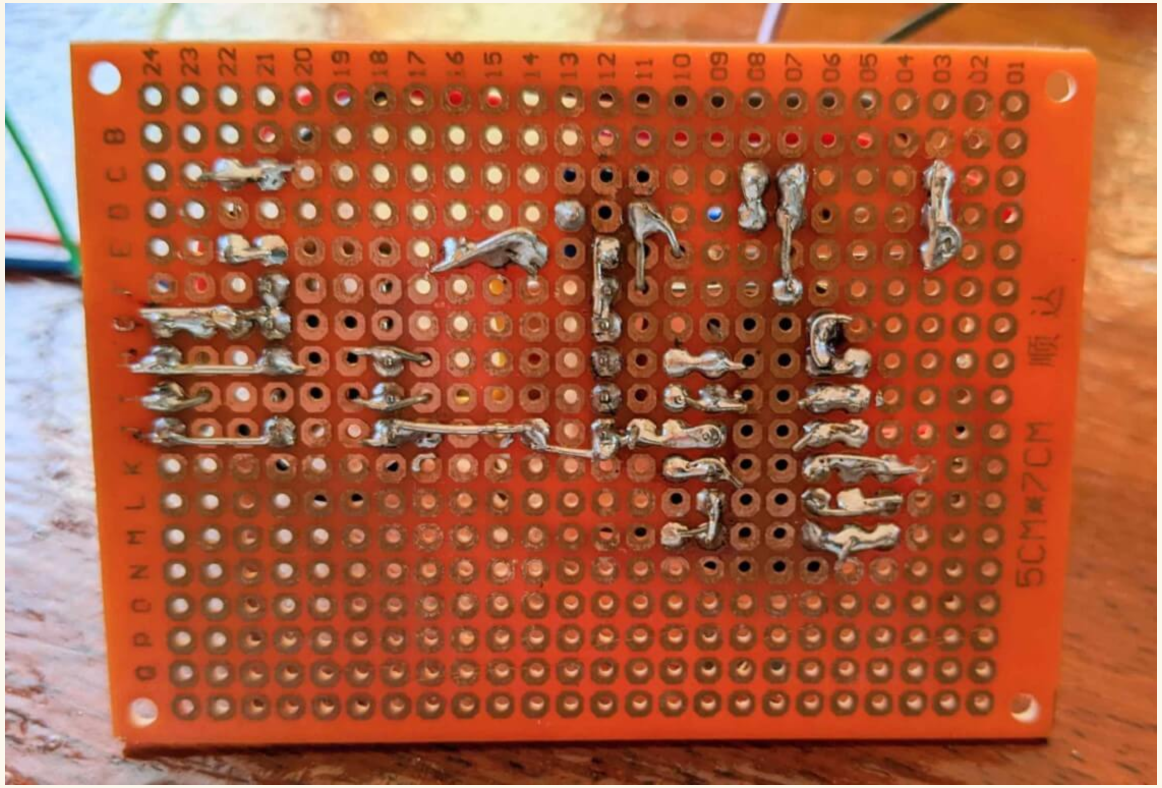
ESP32 & I^{2}C

ARTESIS PLANTIJN
HOGESCHOOL ANTWERPEN

KARUME INSTITUTE OF SCIENCE
AND TECHNOLOGY

Salinity Sensor

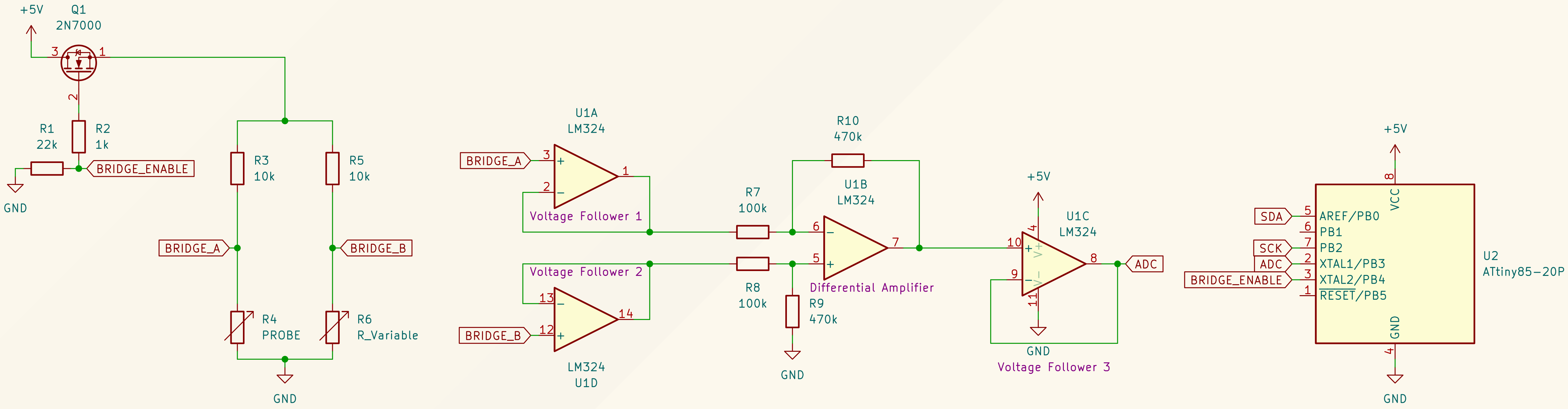




Salinity Sensor

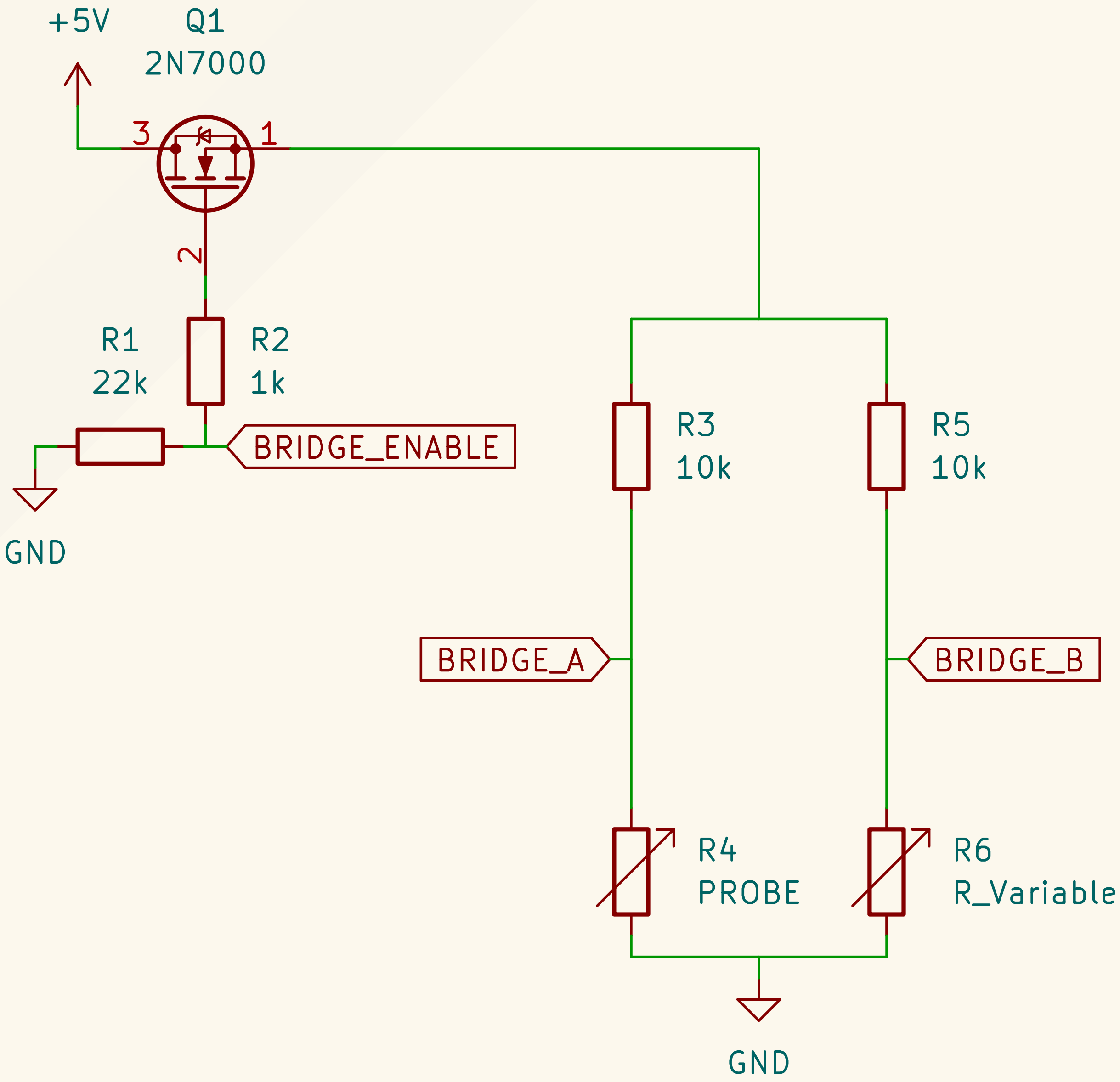
$$V_{out} = \frac{R_4}{R_3 R_4} \cdot V_{in}$$

$$V_{out} = \frac{R_{10}}{R_7}(V_2 - V_1)$$



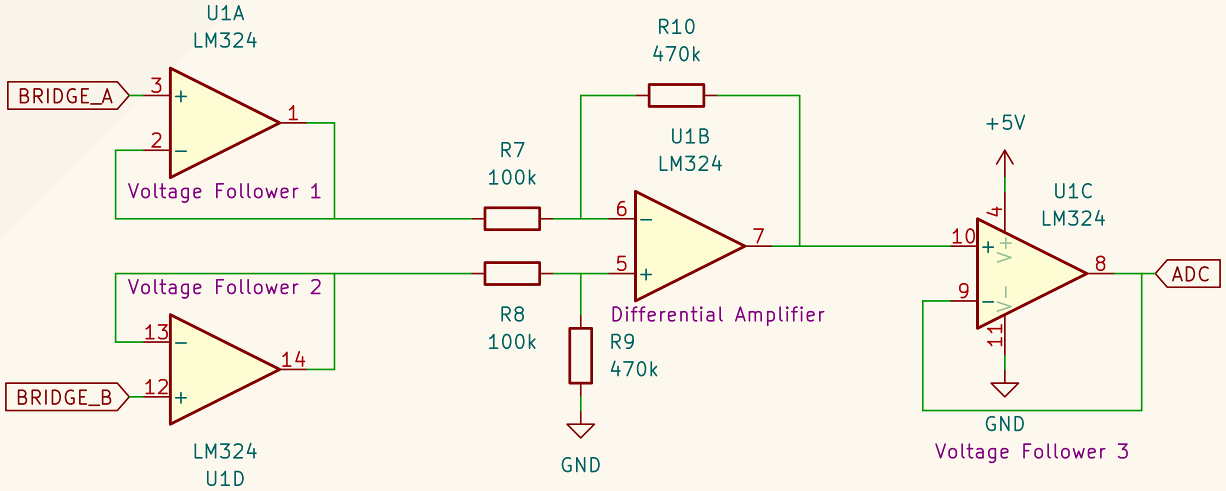
Wheatstone bridge

- Two voltage dividers
- $V_{out} = \frac{R_4}{R_3 R_4} \cdot V_{in}$
- Only enabled when needed



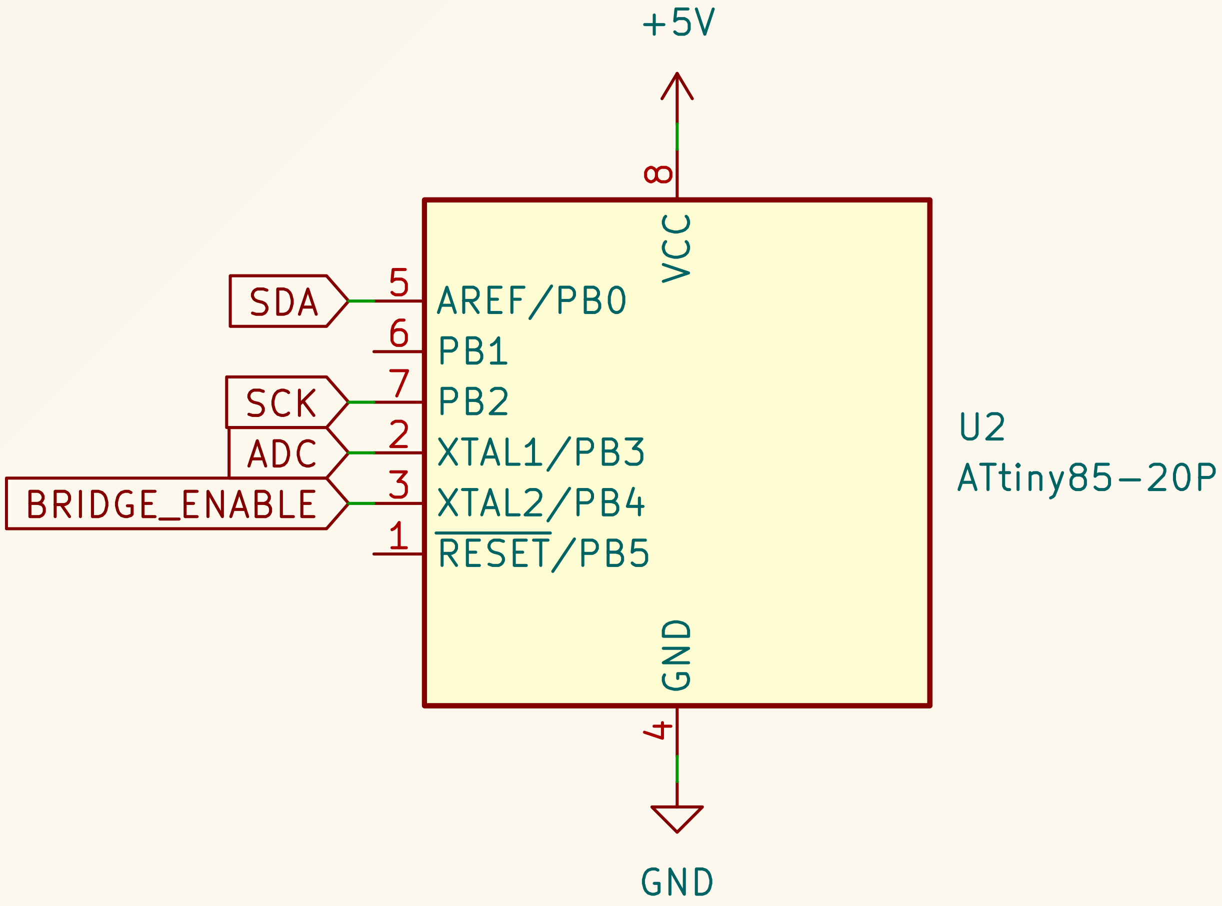
Amplifier

- Voltage followers
  - Stable reading
- Differential amplifier
  - $V_{out} = \frac{R_{10}}{R_7}(V_2 - V_1)$



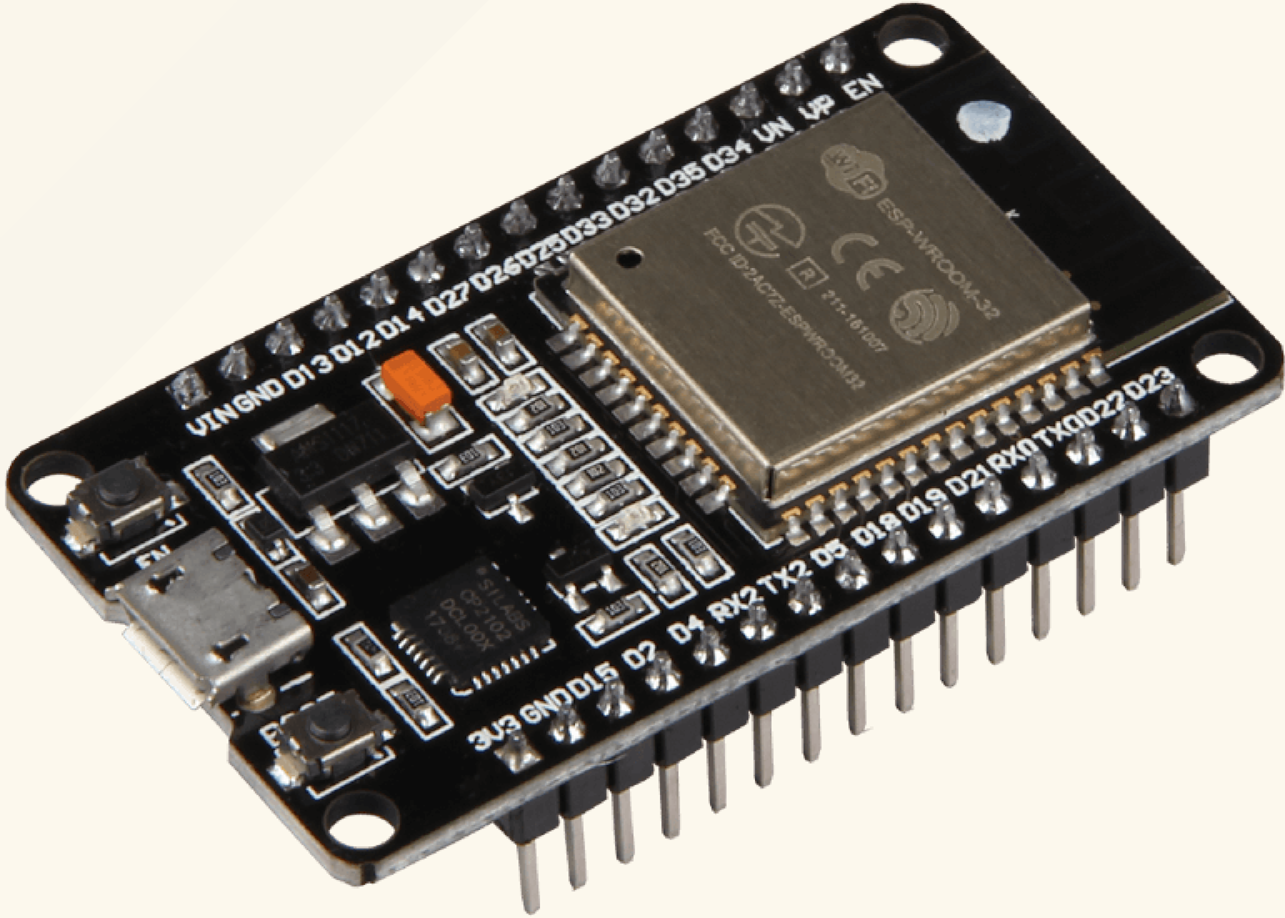
ATtiny

- Reads Amplifier Output
- Moving Average Filter
- Sends Reading Over I^{2}C



ESP32 DOIT V1

- Microcontroller
- Arduino + WiFi & Bluetooth
- 30 pins


VIN GND D13 D12 D14 D27 D26 D25 D33 D32 D35 D34 VN VP EN
3V3 GND D15 D2 D4 RX2 TX2 D5 D18 D19 D21 RX0 TX0 D22 D23
ESP-WROOM-32
EN

Setting up the Arduino IDE

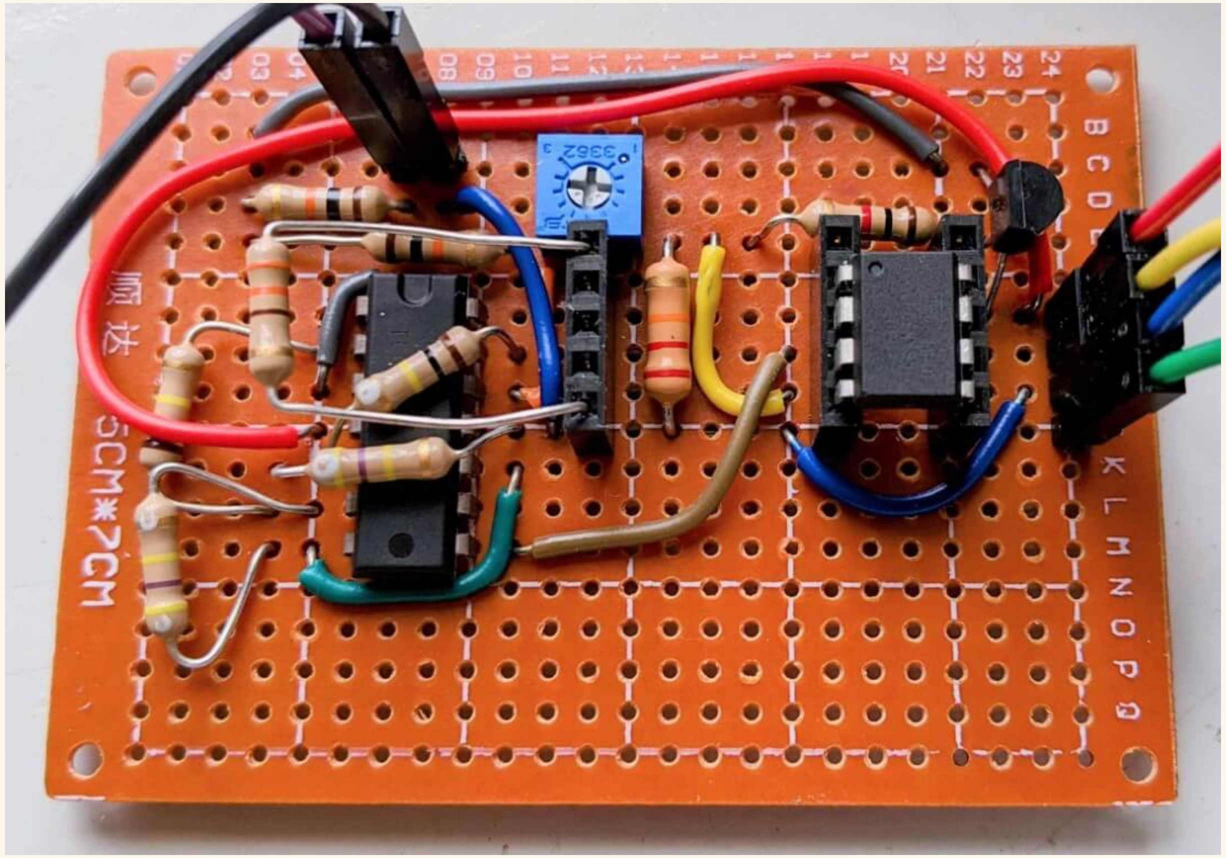
1. https://www.arduino.cc/en/software
2. Open "`File` > `Preferences` > `Additional Board Manager URLs`" and add: https://dl.espressif.com/dl/package_esp32_index.json
3. Open the Boards Manager at "`Tools` > `Board` > `Boards Manager`", search for "ESP32" and press the install button for "ESP32 by Espressif Systems"

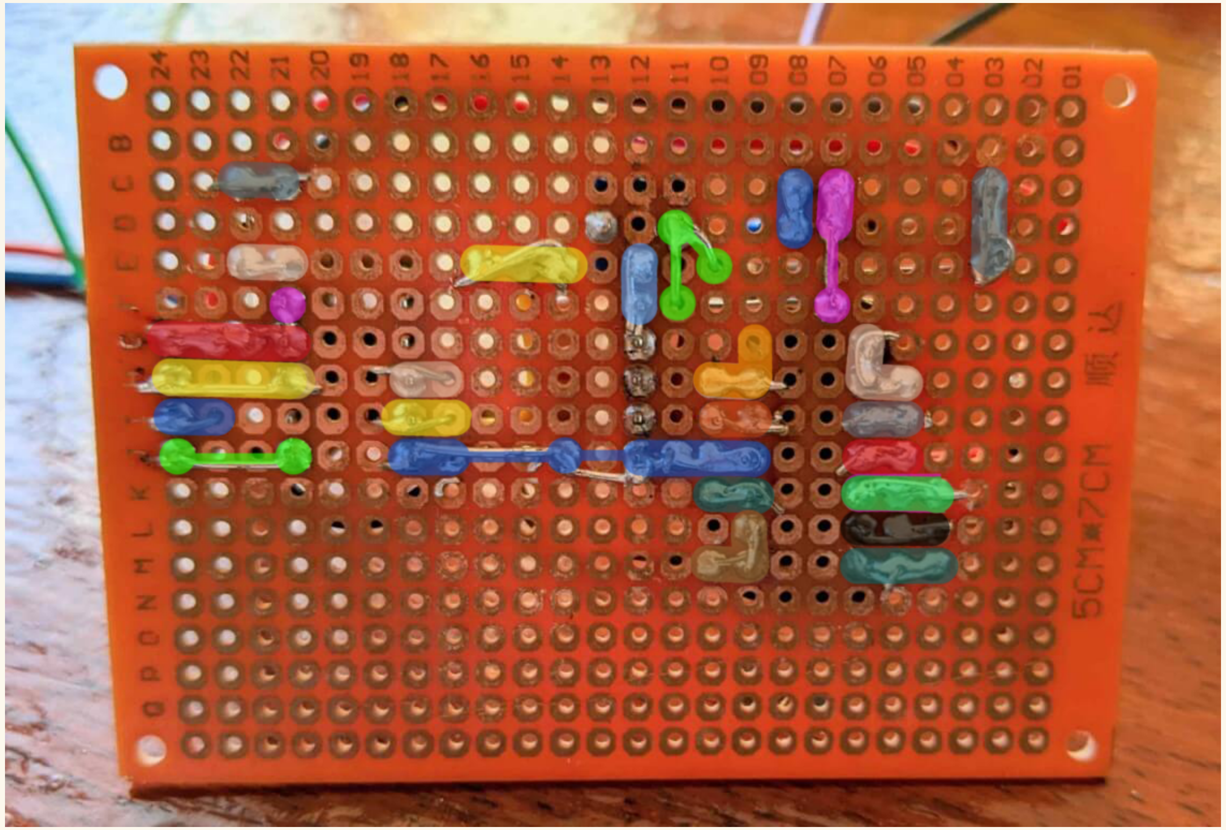
Testing Arduino IDE

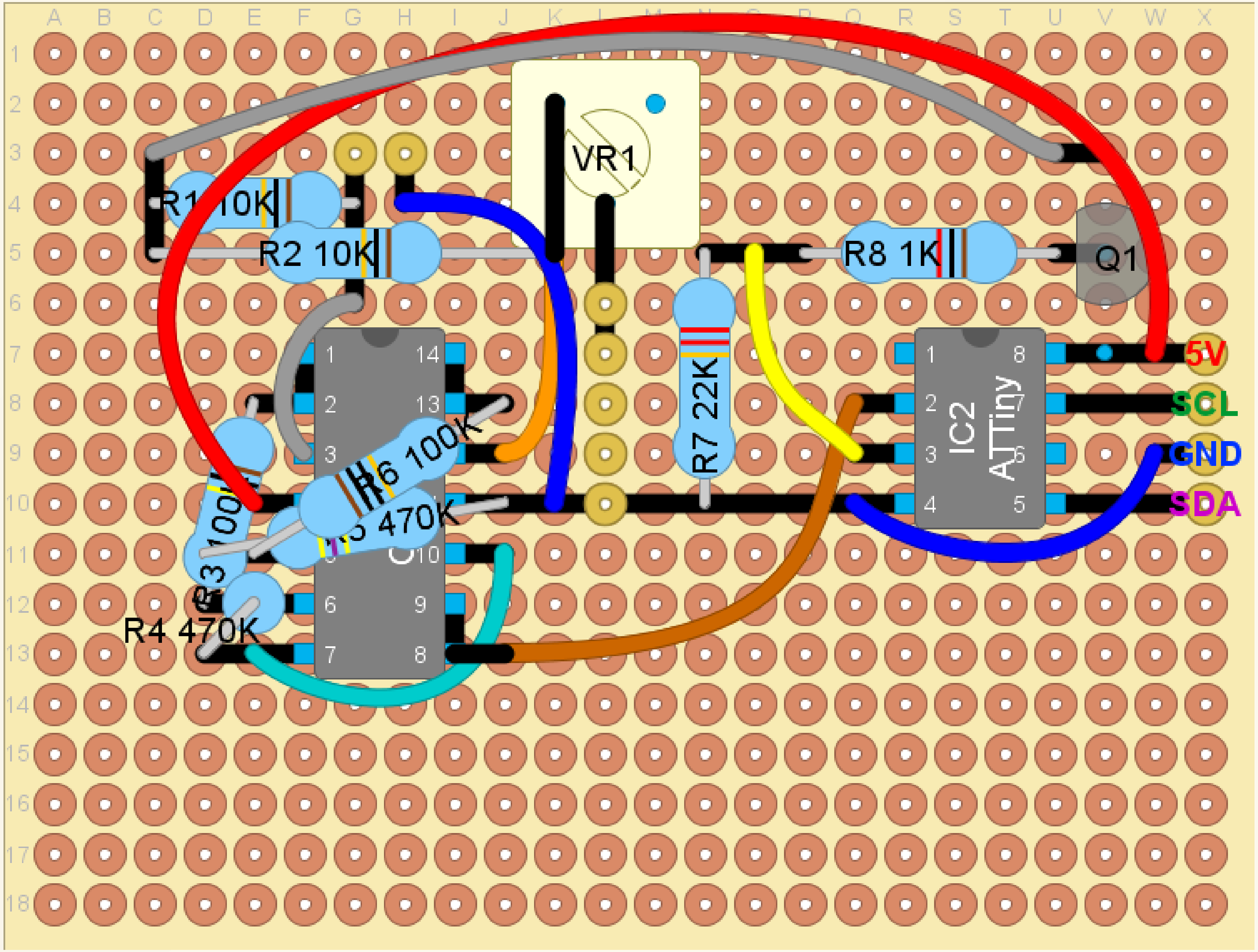
1. Select "`DOIT ESP32 DEVKIT V1`" at "`Tools` > `Board`"
2. Select the correct COM port under "`Tools` > `Port`"
3. Choose an example program in "`File` > `Examples` > `Examples for DOIT ESP32 DEVKIT V1` > `WiFi` > `WiFiScan`"
4. Program the code to the ESP32 with the Upload button (➡️)
5. Open the Serial Monitor via "`Tools` > `Serial Monitor`" and set the Baud-rate to "115200 baud"
6. If you can see the nearby WiFi networks everything is working!

Source: https://microcontrollerslab.com/install-esp32-arduino-ide/

Soldering the Salinity Sensor






A B C D E F G H I J K L M N O P Q R S T U V W X
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
VR1
R1 10K
R2 10K
R8 1K
Q1
R7 22K
R6 100K
470K
R3 100K
R4 470K
1 14
2 13
3
10
6 9
7 8
IC2 ATtiny
1 8
2 7
3 6
4 5
5V
SCL
GND
SDA

Connecting to the Salinity Sensor

Using I^{2}C and an ESP32

I²C

- I²C = Inter-Integrated Circuit
- Invented in 1982 by Philips
- SDA = Serial Data Line
- SCL = Serial Clock Line
- Every target has his own address

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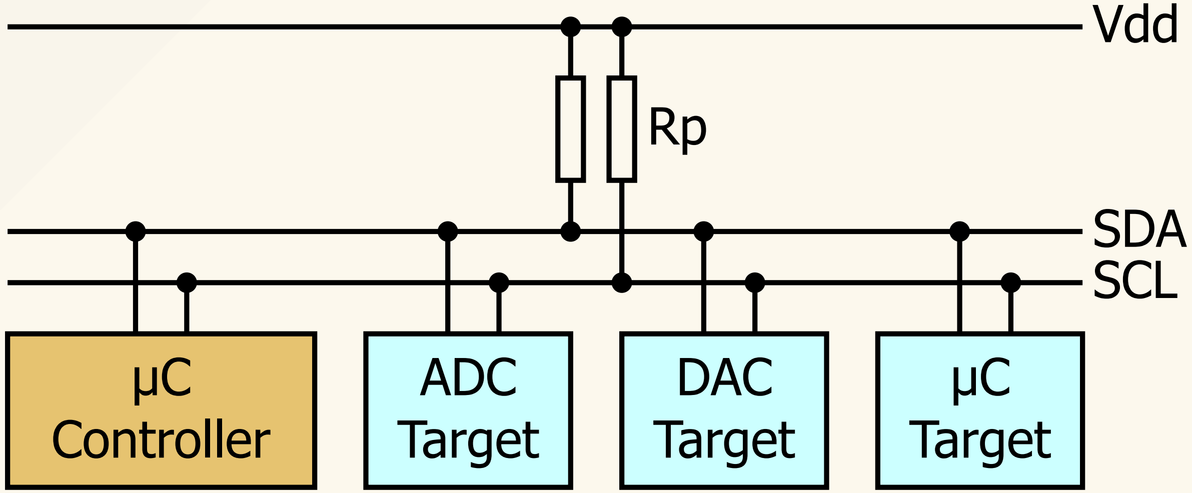

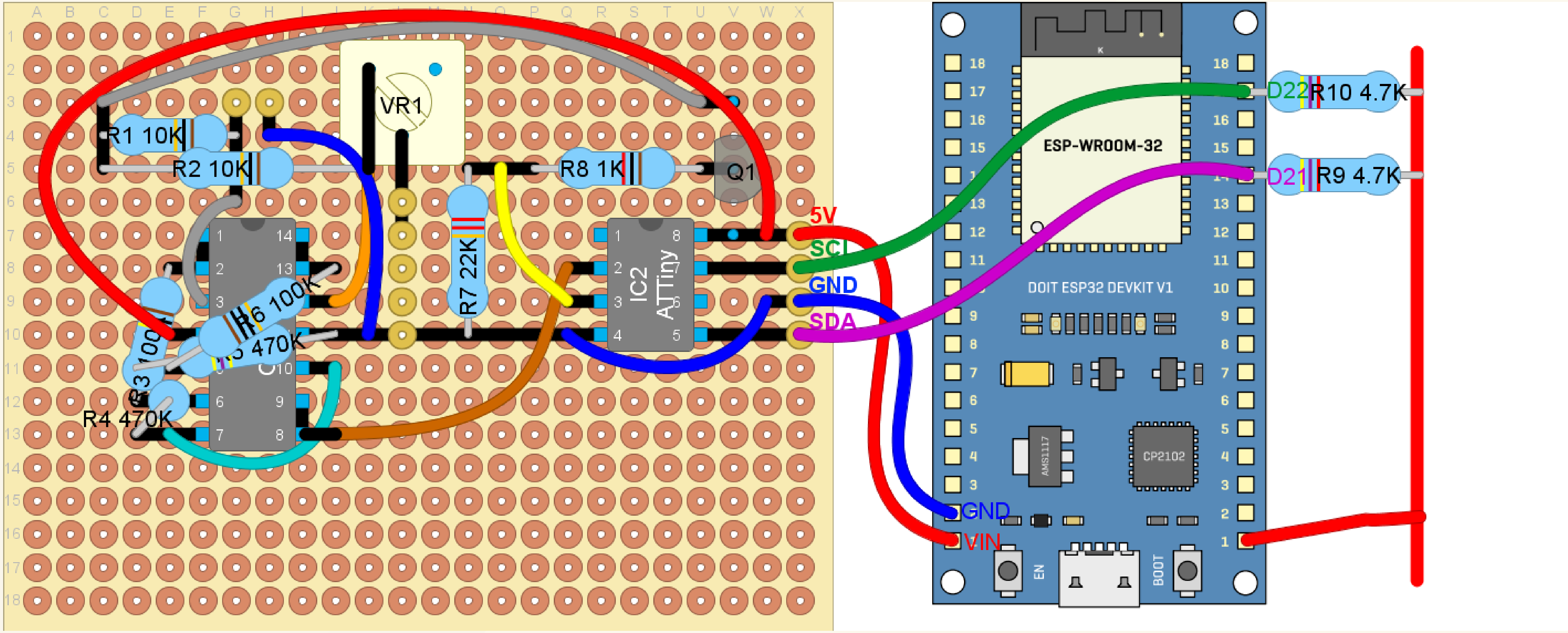
A B C D E F G H I J K L M N O P Q R S T U V W X
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
R1 10K
R2 10K
VR1
R8 1K
Q1
R7 22K
R6 100K
R5 470K
R3 100K
R4 470K
IC2
ATTiny
5V
SCL
GND
SDA
ESP-WROOM-32
DOIT ESP32 DEVKIT V1
AMS1117
CP2102
EN
BOOT
GND
VIN
D22
D21
R10 4.7K
R9 4.7K

Send to serial monitor

```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}
```

Send to serial monitor

```
void setup() {
  Serial.begin(115200); // Open the serial port at 115200 baud
}

/* Send "Salamu, Dunia!" via serial every second. */
void loop() {
  Serial.println("Salamu, Dunia!"); // Send text over the serial port
  delay(1000); // Wait 1000ms or 1s
}
```