



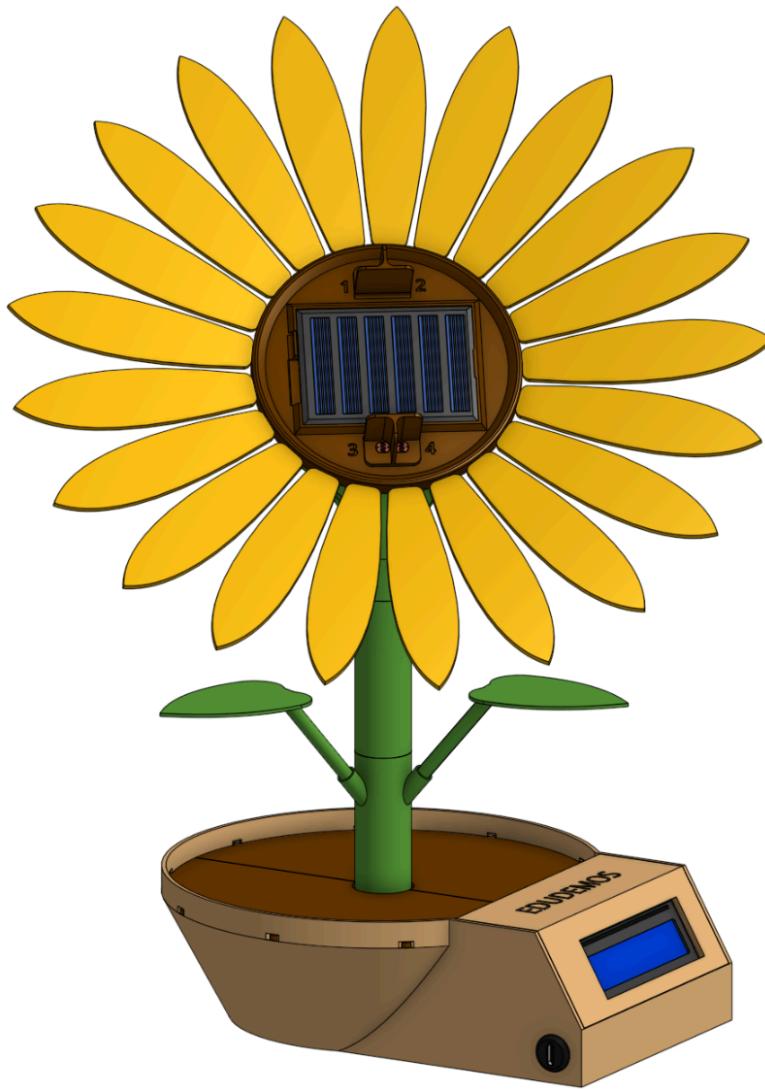
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Gerda Stetter Stiftung  
**Technik macht Spaß!**

# EDUDEMOS

EDUcating through Sustainable DEMOnstrators

## Shortened Workshop Guide Sun-Tracker



Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Gerda Stetter Stiftung

**Technik  
macht  
Spaß!**

Finnova

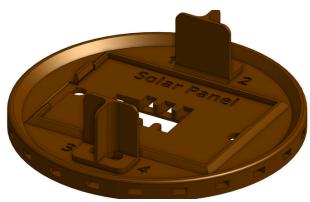
gbs  
sg.ch

ASA  
FUNDACIÓN SERGIO ALONSO

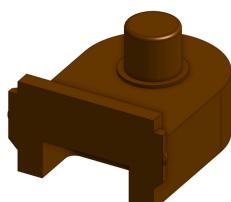
I.E.S.  
El Rincón

# Materials

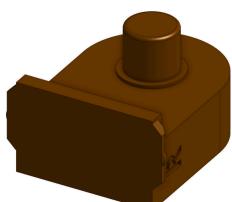
## Printed Parts



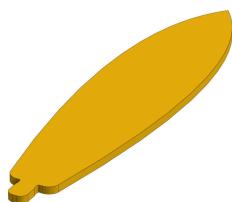
**1x** Flowerhead  
Base



**1x** Flowerhead  
Joint L



**1x** Flowerhead  
Joint R



**21x** Flowerhead  
Leaf



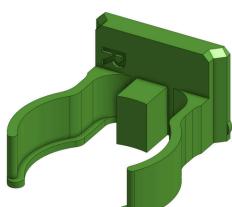
**1x** Pot Cover R



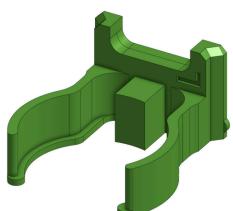
**1x** Pot Cover L



**1x** Stem Top  
Segment



**1x** Flowerhead  
Clip R



**1x** Flowerhead  
Clip L



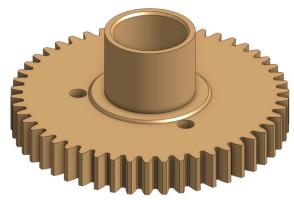
**1x** Stem  
Segment



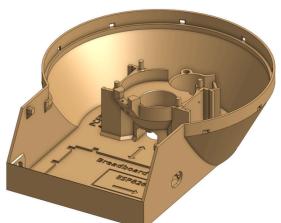
**1x** Leaf  
Segment



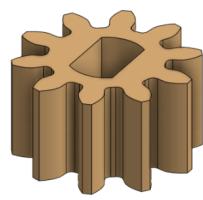
**3x** Stem Leaf



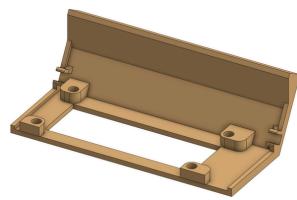
**1x** Large Gear



**1x** Flowerpot



**1x** Motor Gear



**1x** LCD Frame



**1x** Bearing  
Spacer

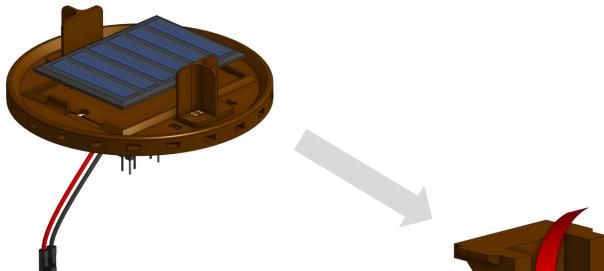
### Print Settings:

All STL-files already have the optimal orientation for printing. Enable supports starting only on the build plate.

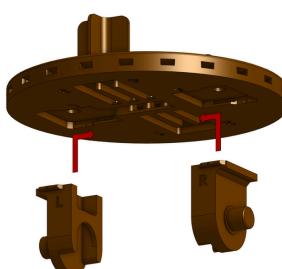
# 1: Flowerhead Assembly

The wires you have might have different colors than the ones shown here. This does not matter and you can use any colors for any wire. To help you keep track of which wire belongs where, you can note down the actual colors on the “**Wire Colors**” table.

**1.1:** Guide the *Solar Panel* wires from the top through the central hole of the *Flowerhead Base* and attach it in its frame.

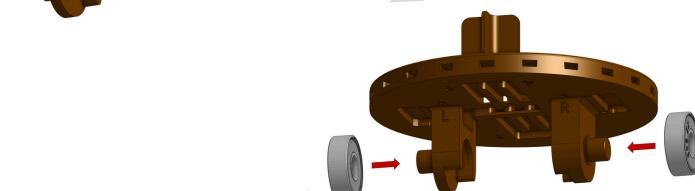


**1.2:** Then guide all wires (7) coming from the *Flowerhead Base* through the tunnel in the *Flowerhead Joint L*.

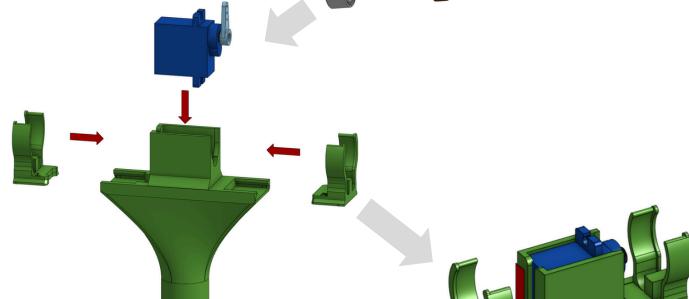


**1.3:** Move the *Joint L* all the way up to the *Base* and slide it into place.

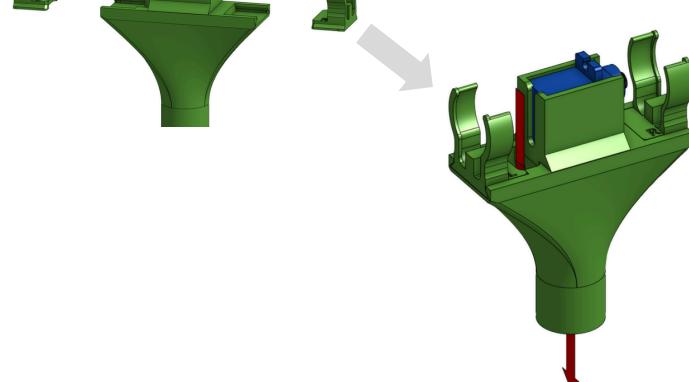
**1.4:** Attach *Flowerhead Joint R* the same way on the opposite side.



**1.5:** Push the two *608zz Bearings* onto the joints.



**1.6:** Attach both *Flowerhead Clips* and the *Servo Motor* in the *Stem Top Segment*.

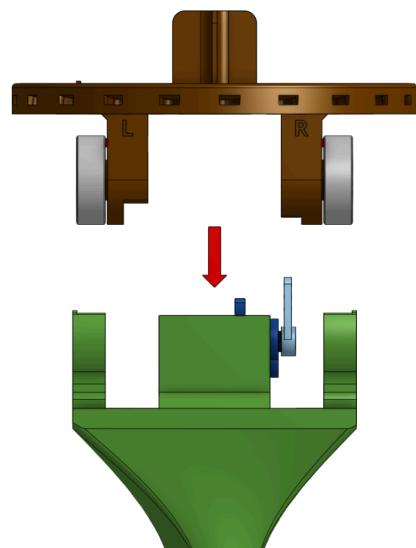


**1.7:** Guide the *Servo Motor* wires all the way through the hole in the *Top Segment*.

Do the same with all wires coming from the *Flowerhead Assembly*.

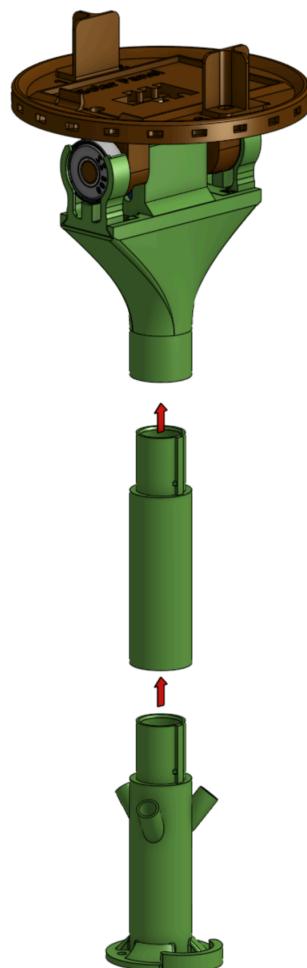
**1.8:** Attach the *Flowerhead Assembly* to the *Top Segment* by pushing the *Bearings* into their clips.

Make sure to cleanly pull all the wires through the *Top Segment* and that they are still grouped together with tape!



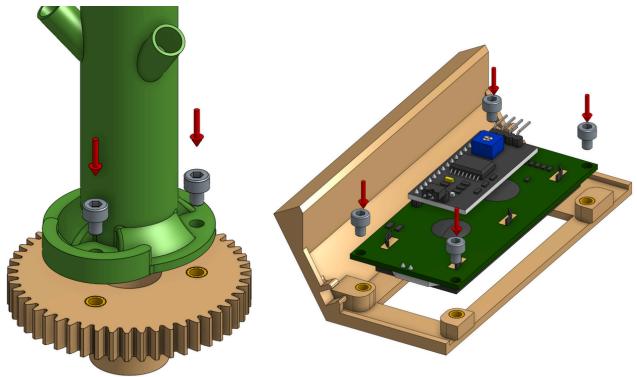
**1.9:** Take the *Stem Segment*, guide the wires through it and attach it to the *Top Segment*.

**1.10:** Do the same for the *Leaf Segment*.

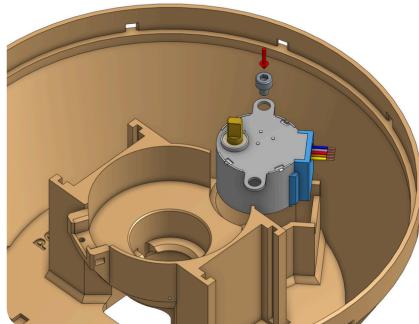


## 2: Wiring and Assembly: Flowerpot

**2.1:** Attach the *Large Gear* to the *Leaf Segment* with three M3 (5mm) screws.

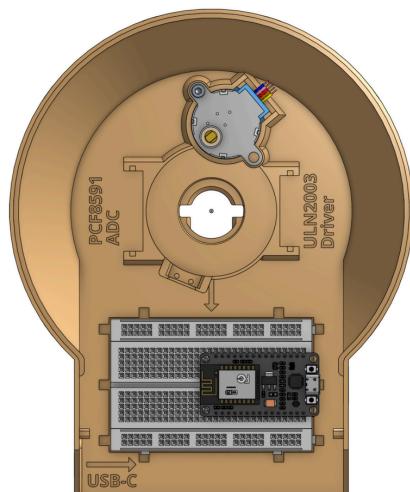


**2.1.6:** Mount the *LCD Display* to the *LCD Frame* the same way.



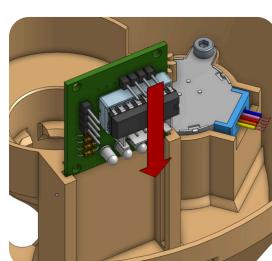
**2.2:** Place the *Stepper Motor* in the *Flowerpot*.

You can mount it with one screw if it's not tight enough.



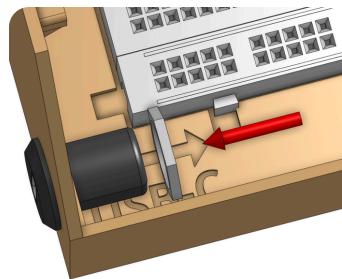
**2.3:** If you haven't already, place the *ESP8266 Microcontroller* on the *Breadboard* with the USB Port facing right.

**2.5:** Place the *Motor Gear* onto the *Stepper Motor*.



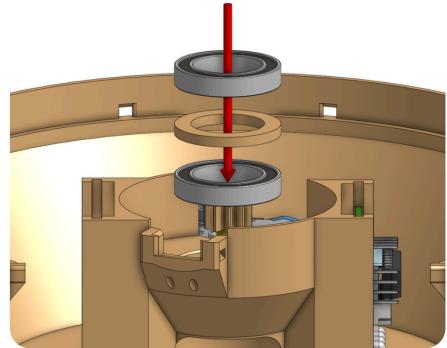
**2.6:** Connect the *Stepper Motor* with the *ULN2003 Driver Board*.

**2.7:** Place the *Driver Board* on the right of the *Flowerpot* like in the picture. Try to stow the wires on the side so they are not in the way.

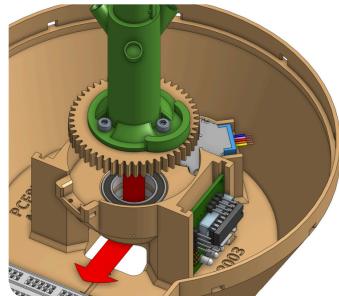


**2.8:** Insert the *USB-C Connector* into its socket and secure it with a nut from the inside.

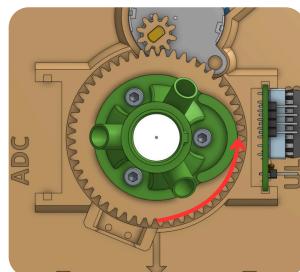
**2.9:** Place a *Bearing (17x26x5mm)*, the *Bearing Spacer* and then another *Bearing (17x26x5mm)* in the central socket of the *Flowerpot*.



**2.10:** Carefully guide the wires through the *Bearings* and out to the *Breadboard*. Then slide the *Flower Assembly* into the *Bearings*.

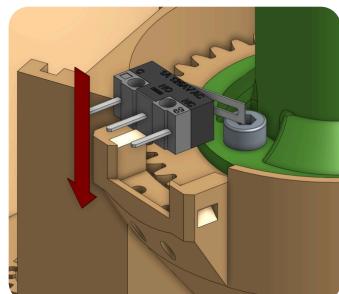


**2.11:** Make sure that the little lip of the *Leaf Segment* roughly points to the right!



**2.12:** Slide the *Limit Switch* into place with some force.

If the *Leaf Segment* is in the way you can carefully remove the *Motor Gear* and rotate it away.

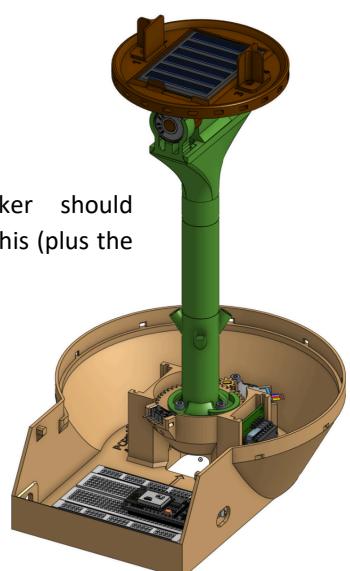


**2.13:** Make sure all wires coming from the stem are there and that they can reach far enough onto the far side of the *Breadboard*.

There should be **10 wires**:

- **Five** from the *Photoresistors*
- **Two** from the *Solar Panel*
- **Three** from the *Servo Motor*

Your Sun-Tracker should look similar to this (plus the wires).

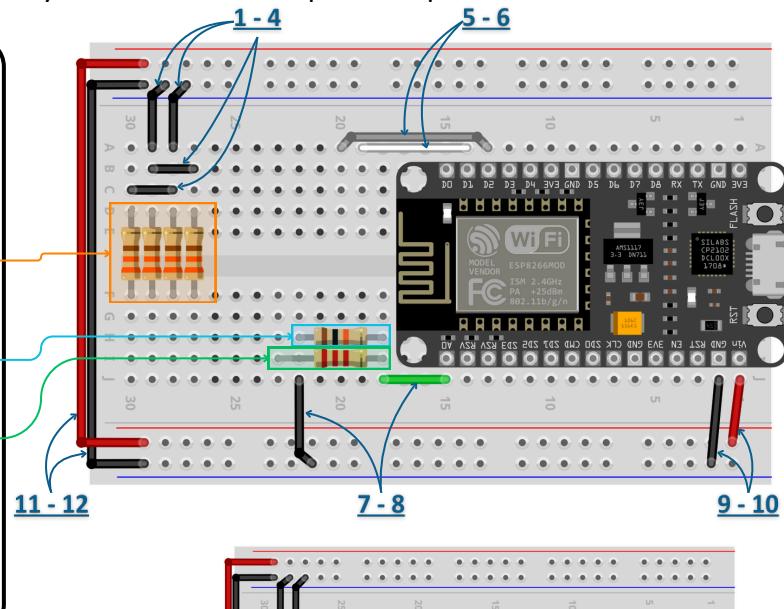


### 3: Connecting the remaining electronics

Now its time to connect all of the electronics. The following pictures show the wiring in a 2D schematic. The colors are approximately the same as in the previous pictures.

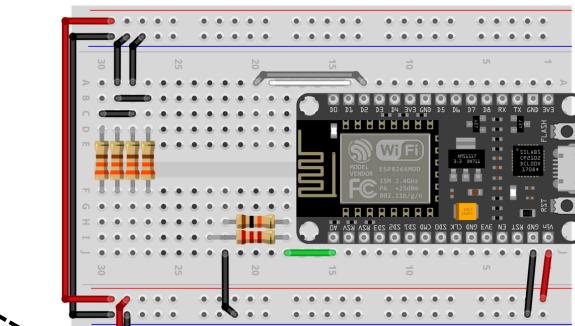
**3.1:** On the *Breadboard* in the *Flowerpot* place the following components like in the picture:

- **4x 330Ω Resistors**
  - D27 - F27 ◦ D28 - F28
  - D29 - F29 ◦ D28 - F28
- **1x 2.2kΩ Resistor**
  - H18 - H22
- **1x 10kΩ Resistor**
  - I18 - I23
- **10x U-Shaped Jumpers**
  - (Jumper 1 - 10)
- **2x U-Shaped Jumpers**
  - (Jumper 11 and 12)



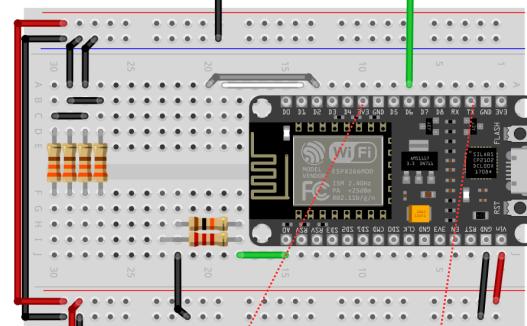
**3.2:** Connect the *USB-C Port* to the bottom supply bus:

- **5V to VCC**
- **GND to GND**

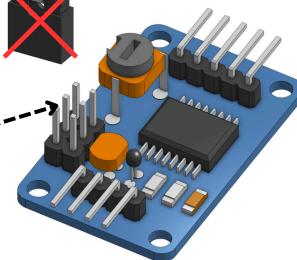


**3.3:** Connect the *Limit Switch*:

- **C to GND**
- **NO to D6**



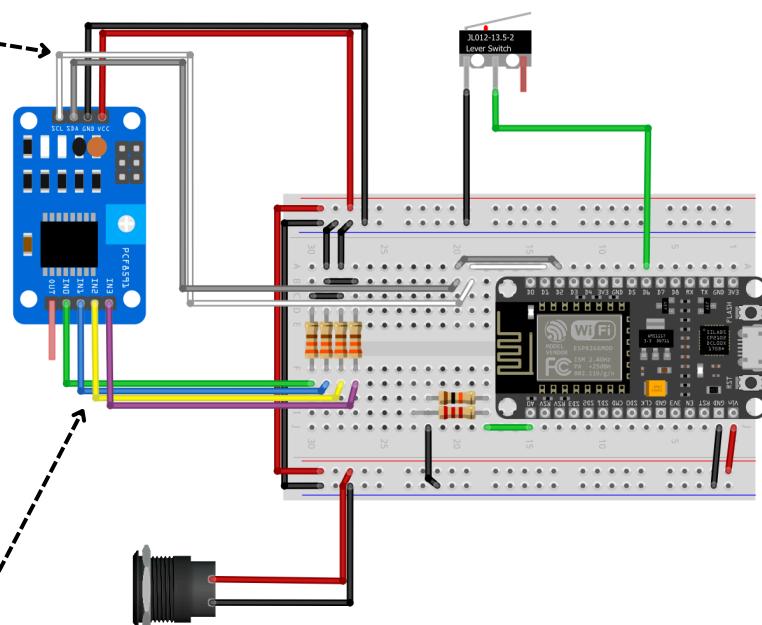
**3.4:** Make sure there are no *Jumpers* on the 2x3 pin array of the *PCF8291*.



**3.5:** Connect the power and communication pins of the **PCF8291** to the **Breadboard**. Use 20cm F-M wires:

- **VCC** to **5V**
- **GND** to **GND**
- **SCL** to **B19**
- **SDA** to **B20**

*Note: Depending on the manufacturer, the pins on some PCF modules are in a different order. Always check the names on the board for each pin!*

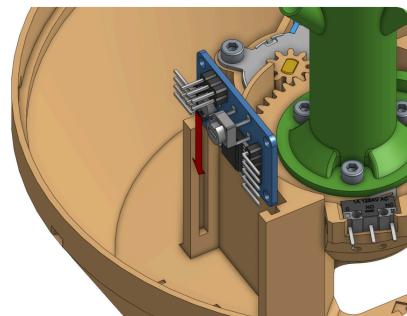


**3.6:** Connect the input pins of the **PCF8291** to the four **330Ω resistors**. Use 10cm F-M wires:

- **IN0** to **R1 (Green)**
- **IN1** to **R2 (Blue)**
- **IN2** to **R3 (Yellow)**
- **IN3** to **R4 (Violet)**

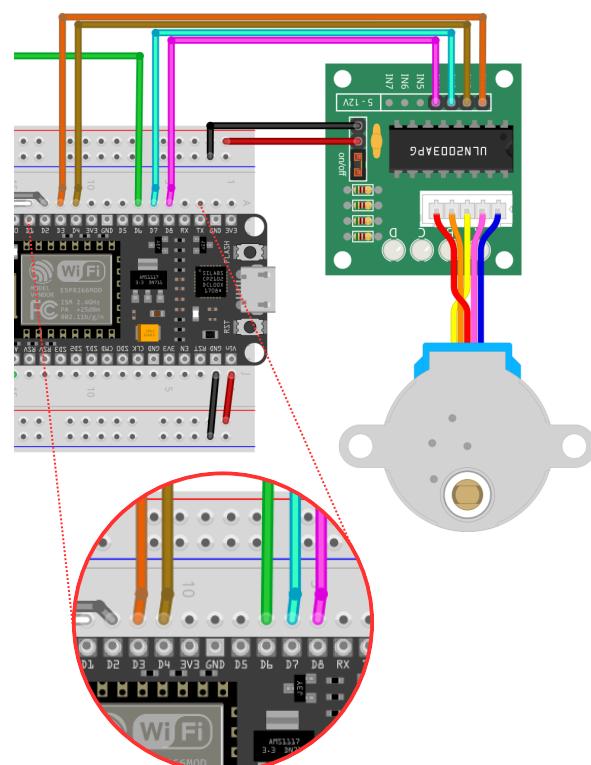


**3.7:** Slide the **PCF** into the **Flowerpot** like in the picture (with the 2x3 pin array on top).



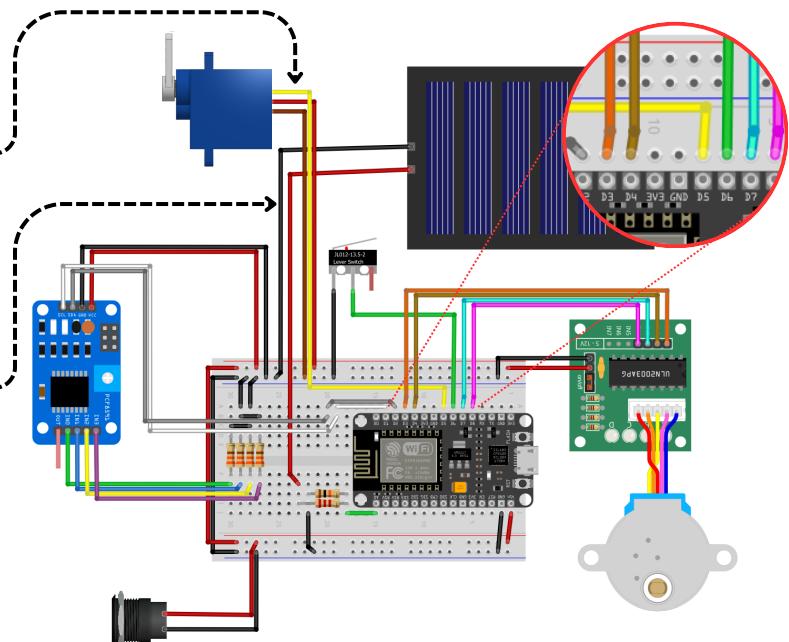
**3.8:** Connect the **ULN2003 Stepper Driver** to the **Breadboard** using 10cm F-M wires:

- **+** to **5V**
- **-** to **GND**
- **IN1** to **D3**
- **IN2** to **D4**
- **IN3** to **D7**
- **IN4** to **D8**



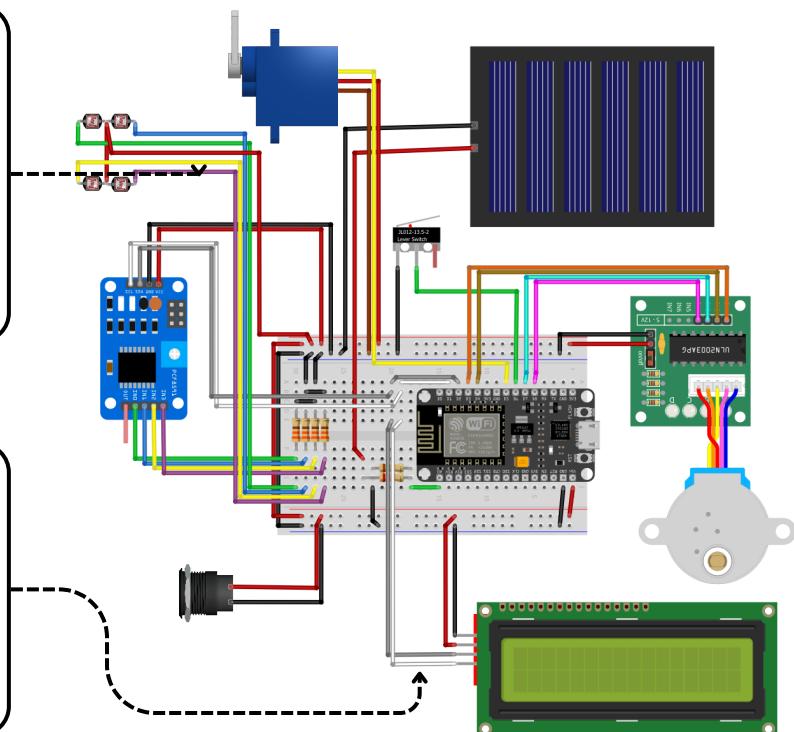
**3.9:** Find the three wires from the *Servo Motor* and connect them:

- DATA to D5
  - VCC to 5V
  - GND to GND



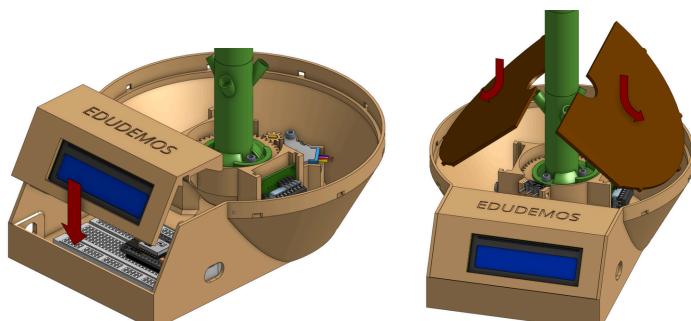
**3.11:** Find the five wires from the *Photoresistors* and connect them:

- **VCC** to **5V**
  - **LDR1** to **R1**
  - **LDR2** to **R2**
  - **LDR3** to **R3**
  - **LDR4** to **R4**



**3.12:** Take the *LCD Frame* with the *LCD Display* and connect it:

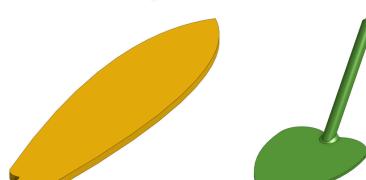
- GND to GND
  - VCC to 5V
  - SDA to E20
  - SCL to E19



**3.13:** Slide the *LCD Frame* into place.

**3.14:** Carefully stow all wires inside of the *Flowerpot* and place *Cover L* and *Cover R* on the *Pot*.

**3.15:** Finally you can attach the *Flower Leafs* and the *Stem Leafs*.

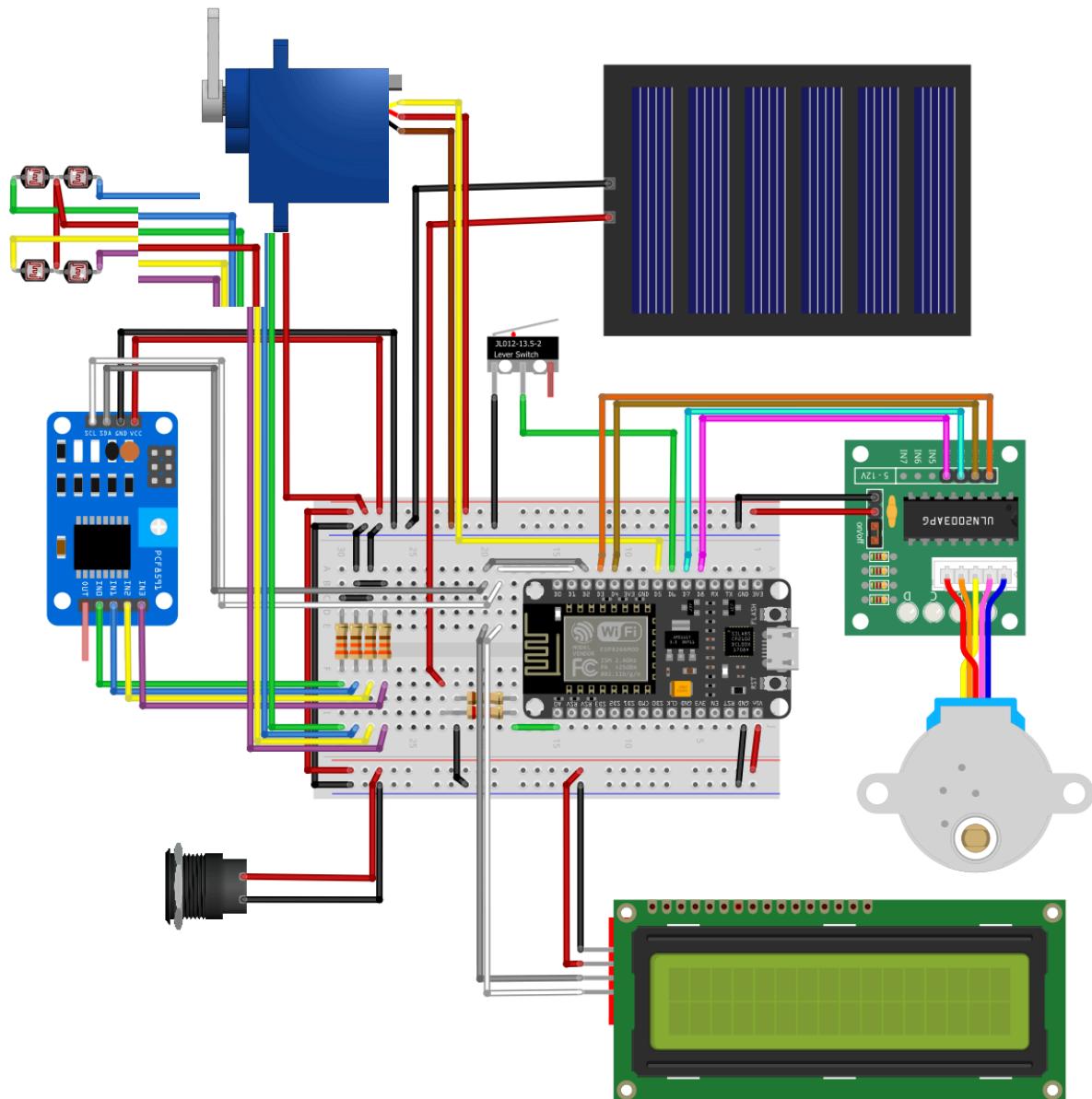
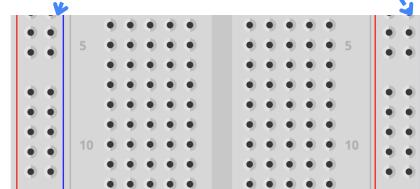
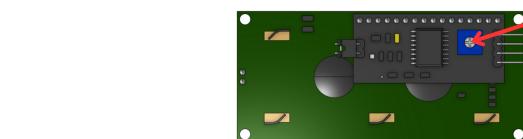


## Well done again!

You have finished the electronics. This page shows the entire circuit for reference. Make sure to double check the following:

- No red wire (**VCC**, **5V**, **+**) is connected to any **GND** or to any of the [blue breadboard bus slots](#).
- All resistors and wires are properly plugged in.
- All wires coming from the [Stem](#) have at least a little play.

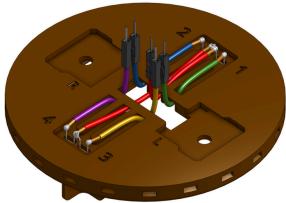
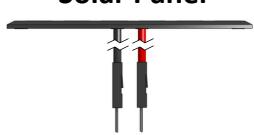
It can happen that everything is connected correctly but the LCD Display still shows nothing. In this case the contrast has to be adjusted via the potentiometer on the back. Just turn it with a screwdriver until the screen is readable.



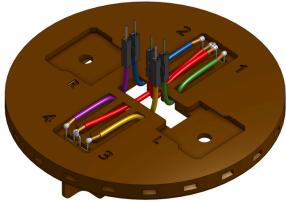
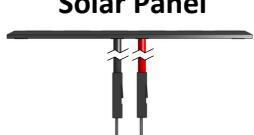
**Congratulations!**

**You have finished the EduDemoS Sun-Tracker.**

## Wire Colors

Part	Connection	Color (Instructions)	Color (Real)
<b>Photoresistors (LDR)</b> 	<b>VCC</b>	Red	
	<b>LDR 1</b>	Green	
	<b>LDR 2</b>	Blue	
	<b>LDR 3</b>	Yellow	
	<b>LDR 4</b>	Purple	
<b>Servo Motor</b> 	<b>DATA</b>	Yellow	
	<b>VCC</b>	Red	
	<b>GND</b>	Black	
<b>Solar Panel</b> 	<b>+</b>	Red	
	<b>-</b>	Black	

## Wire Colors

Part	Connection	Color (Instructions)	Color (Real)
<b>Photoresistors (LDR)</b> 	<b>VCC</b>	Red	
	<b>LDR 1</b>	Green	
	<b>LDR 2</b>	Blue	
	<b>LDR 3</b>	Yellow	
	<b>LDR 4</b>	Purple	
<b>Servo Motor</b> 	<b>DATA</b>	Yellow	
	<b>VCC</b>	Red	
	<b>GND</b>	Black	
<b>Solar Panel</b> 	<b>+</b>	Red	
	<b>-</b>	Black	