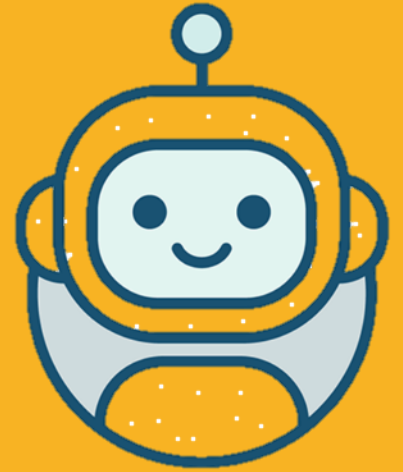
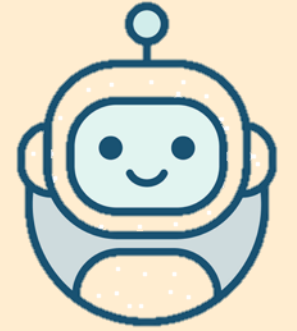


**EASY ROBOTICS
FORMATION FOR
MAKERS**

**MINICAT
WORKSHOP
&
CURRICULUM**

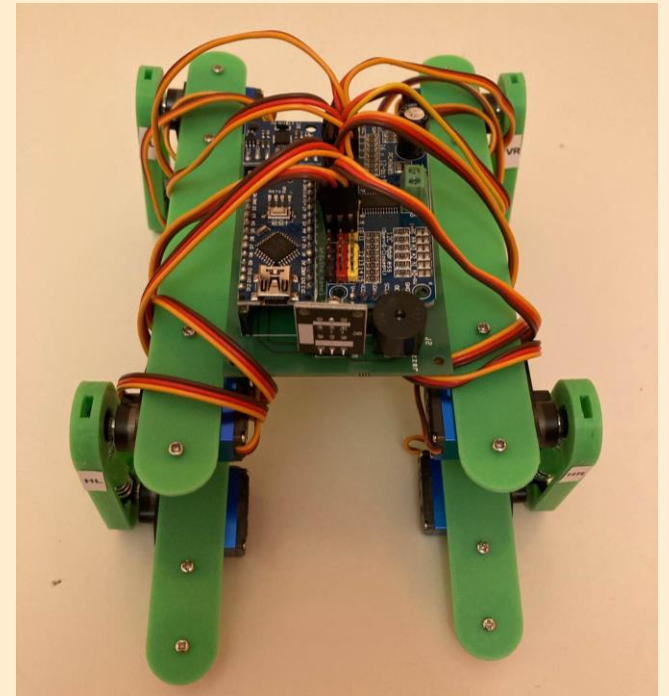


MINICAT WORKSHOP

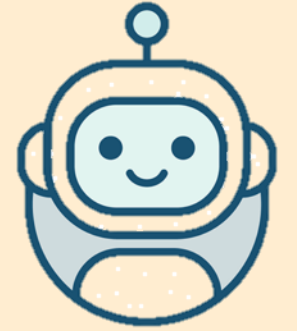


Affordable robotics for makers

- Build your full robot from scratch !
- Workshop at Schools / MakerFabs

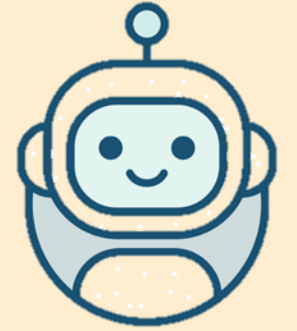


AGENDA



- Workshop Introduction
- 3D Parts models & Printing
- Hardware Modules & Test
- Final Software Integration

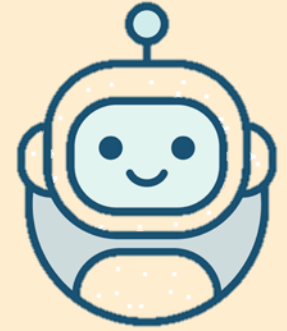
AGENDA



- **Workshop Introduction**
- 3D Parts models & Printing
- Hardware Modules & Test
- Final Software Integration

Workshop Overview

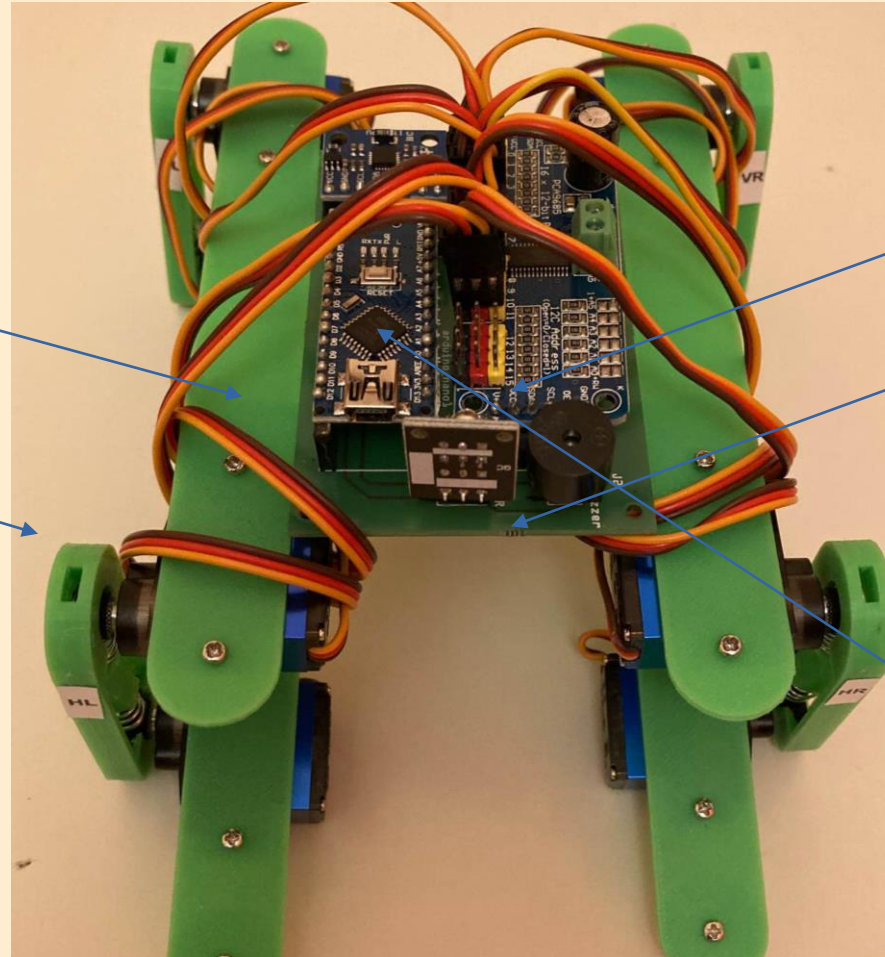
MiniCat Robot modules



1. 3D Printed parts

Body
structure

4
legs



2. Electronics

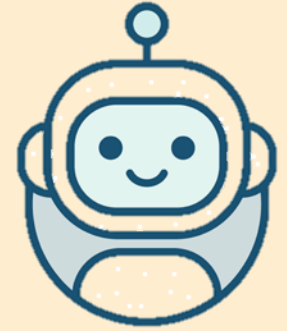
Electronics
Modules
on custom PCB
(green)

3. Software

Running on Arduino
Module

Workshop Overview

Maker tools [installation check](#) w/ participants



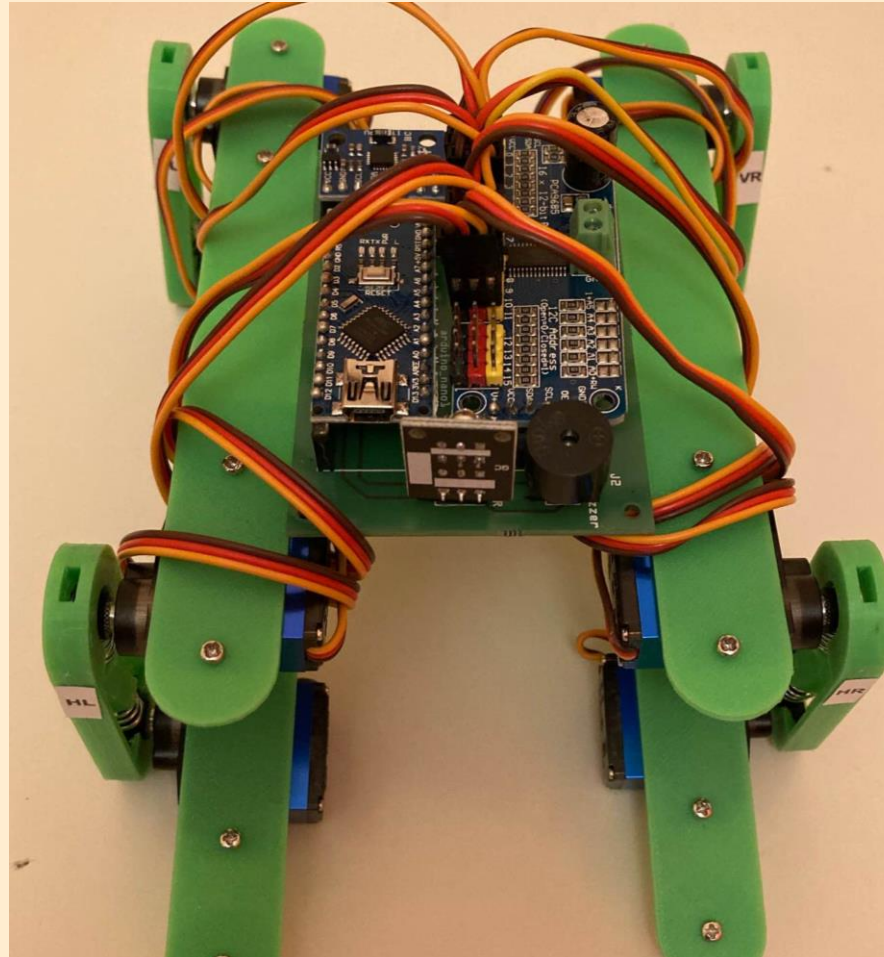
1. Tools for 3D Print

- Modelling

- **Fusion360** tool
- .stp files

- Slicing/Printing

- **Cura** tool
- .STL files



2. Tools for Electronics

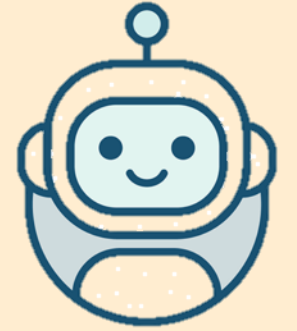
- no in scope

3. Software

- **Development Environment**
 - **Arduino IDE** tool

Workshop Overview

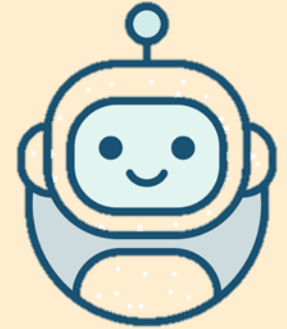
Toolset installation (to do before workshop)



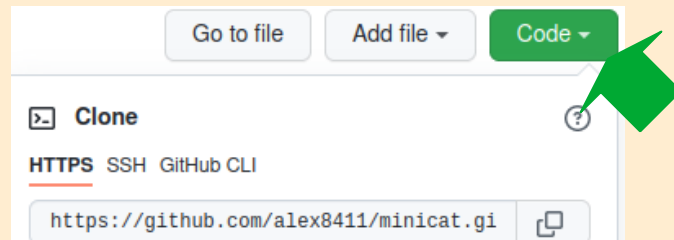
- Open : <https://roboticsformakers.com/index.php/maker-software-tools/>
- Follow the instructions to install all the Maker tools

Workshop Overview

Software [download](#)



- Open : <https://github.com/alex8411/minicat>
- Click on “Code” then “Download ZIP”:

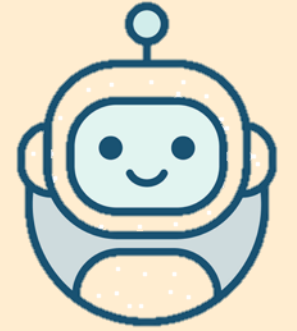


- Store the ZIP in your preferred Folder & extract it to get “minicat-main”

ToDo :

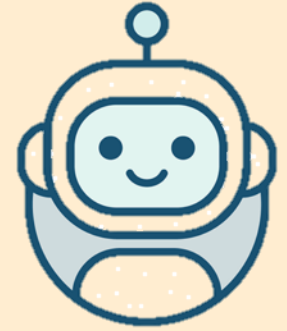
- Explore the folder especially :
 - “3D_printing”
 - 3D parts for modelling & 3D print
 - “Software” for MiniCat Modules
 - **GIT** .ino files
 - Remark: [Libraries](#) to install separately

AGENDA



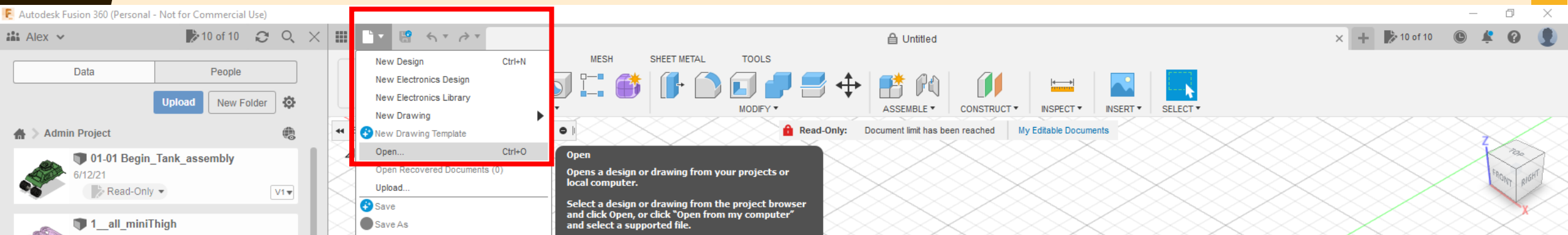
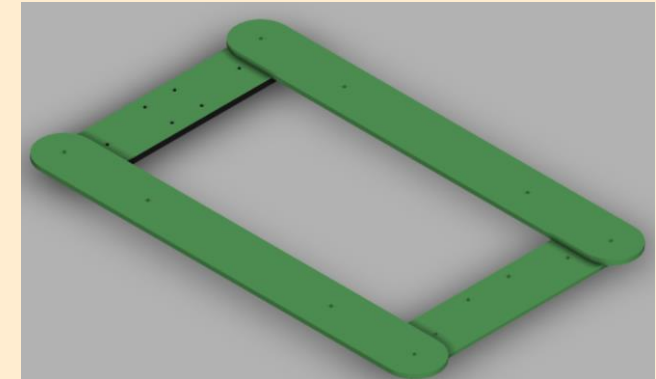
- Workshop Introduction
- **3D Parts models & Printing**
- Hardware Modules & Test
- Final Software Integration

3D parts models & printing

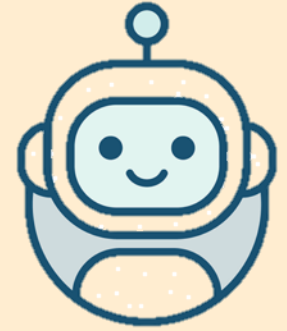


ToDo (.f3d assembly opening)

- Open **Fusion360**
- Click on “**File/Open/Open from my computer**”
- Navigate to “minicat-main/CAD/” & click “**MiniCat_full_assembly_v32.f3d**” (works only on Windows 10)

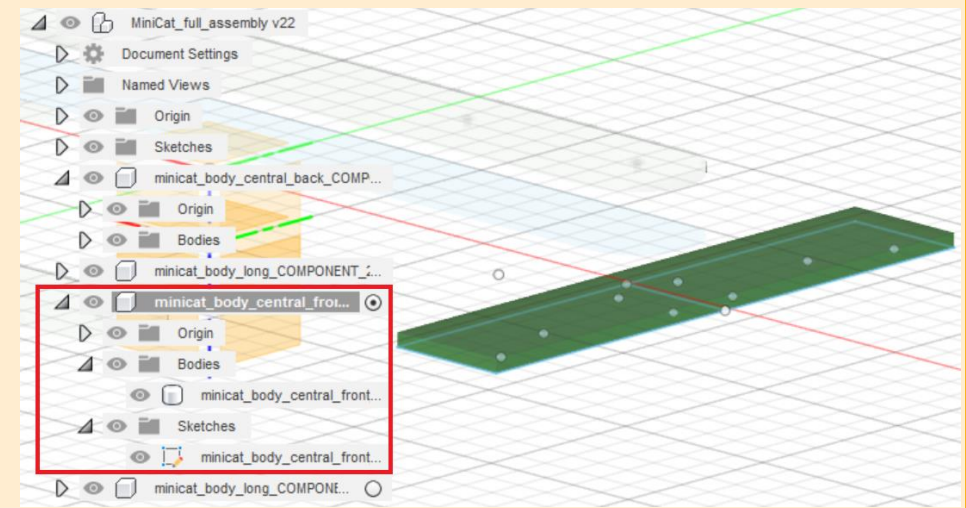


3D parts models & printing

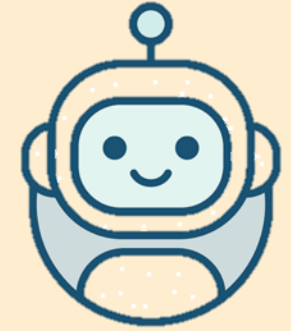


ToDo (Sketch opening & modifying)

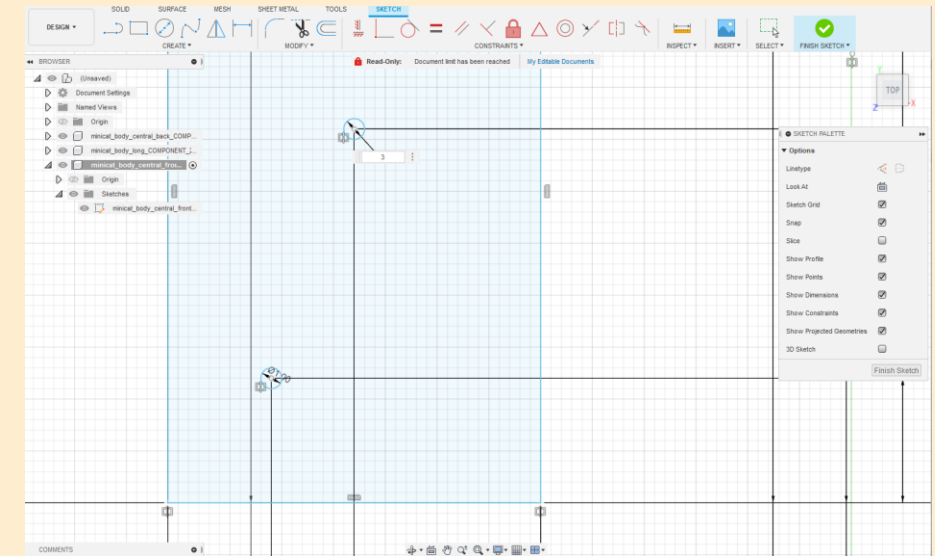
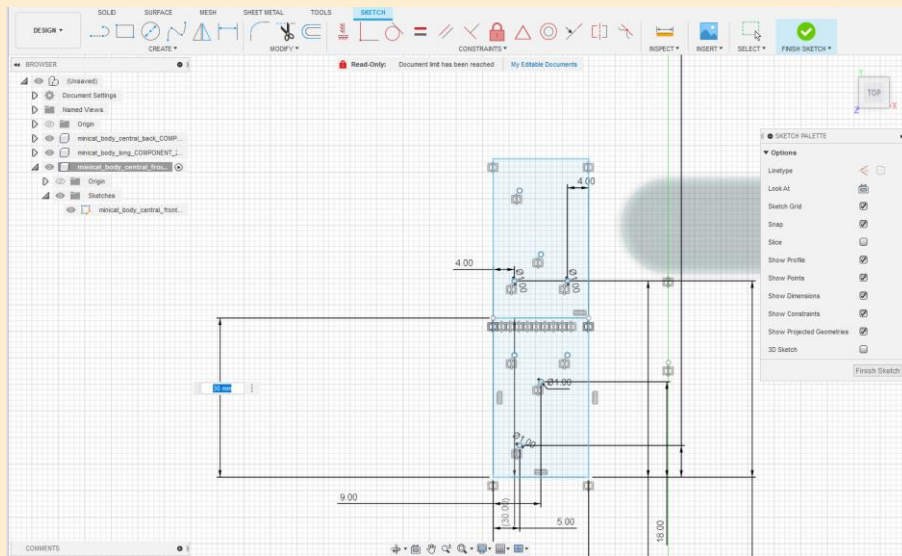
- Navigate to:
 - “minicat_body_central_front_COMPONENT”
 - “Sketches”
 - “minicat_body_central_front_SKETCH”
- Right click on: “minicat_body_central_front_SKETCH”
 - “Edit Sketch”
- Try to modify it



3D parts models & printing

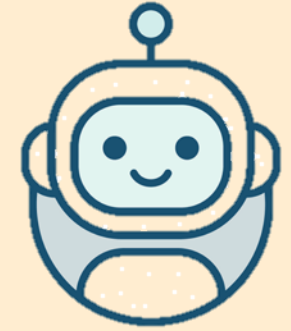


- **ToDo Editing the Sketch front part : rectangle and hole dimensions:**

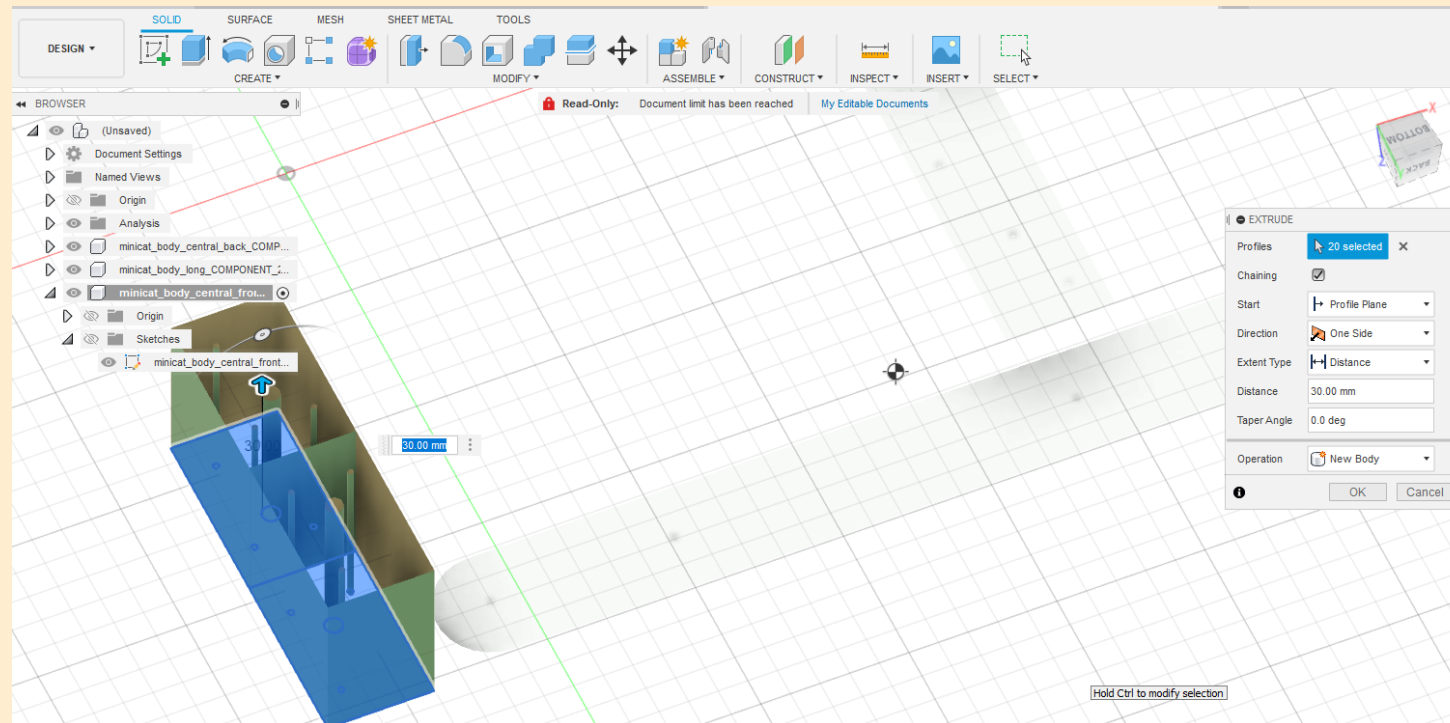


- **click on “Finish Sketch” and observe the changes**

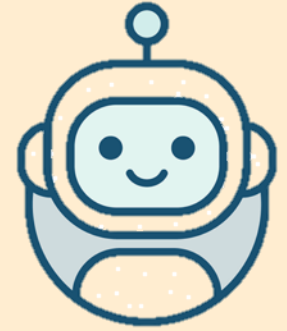
3D parts models & printing



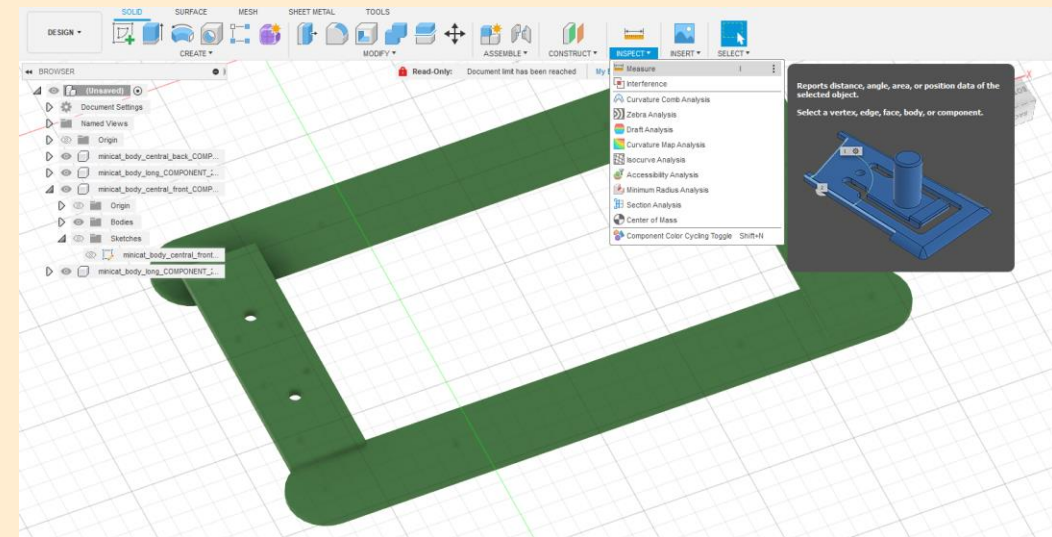
- Changing the Extrusion dimension :



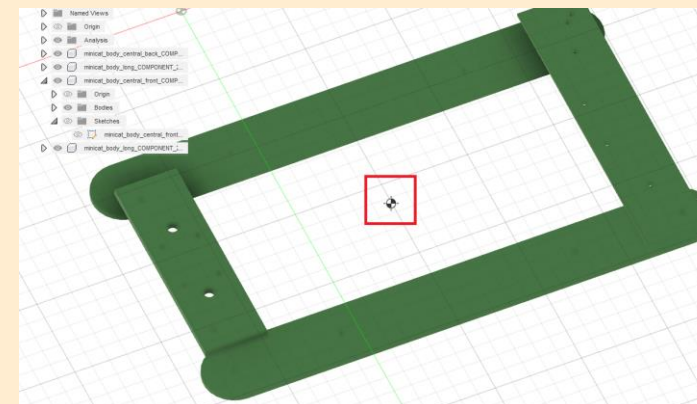
3D parts models & printing



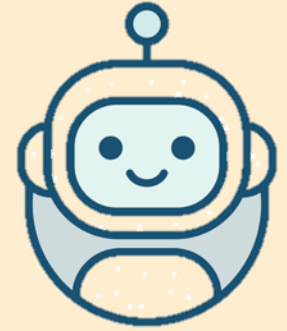
- - measuring with “Inspect” a dimension :



- - and gravity center :

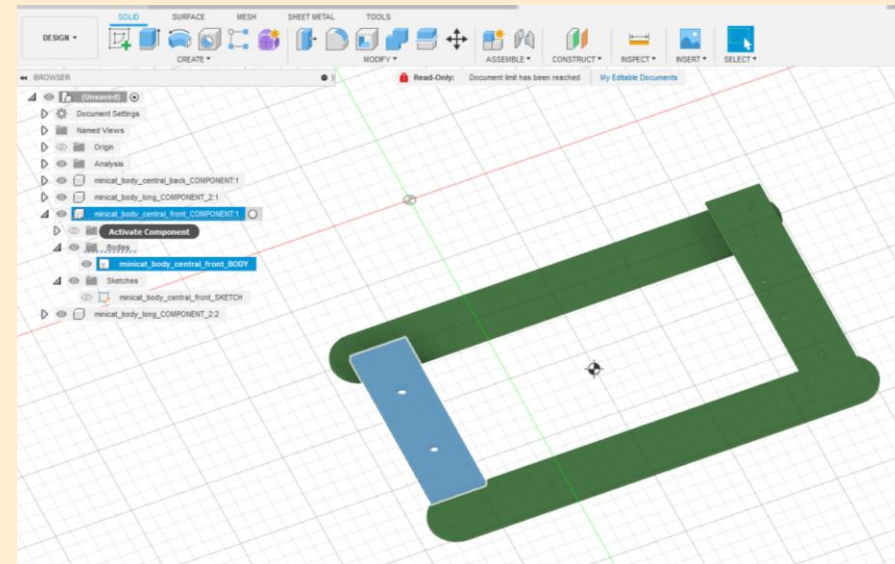


3D parts models & printing

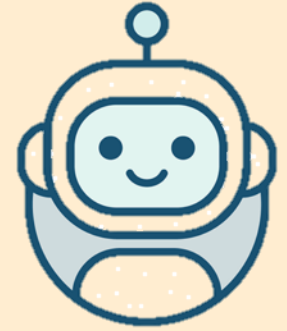


ToDo (.STL file generation)

- Navigate to: “minicat_body_central_front_COMPONENT”
 - “Bodies”
 - “minicat_body_central_front_BODY”
- “Activate” the “minicat_body_central_front_COMPONENT”

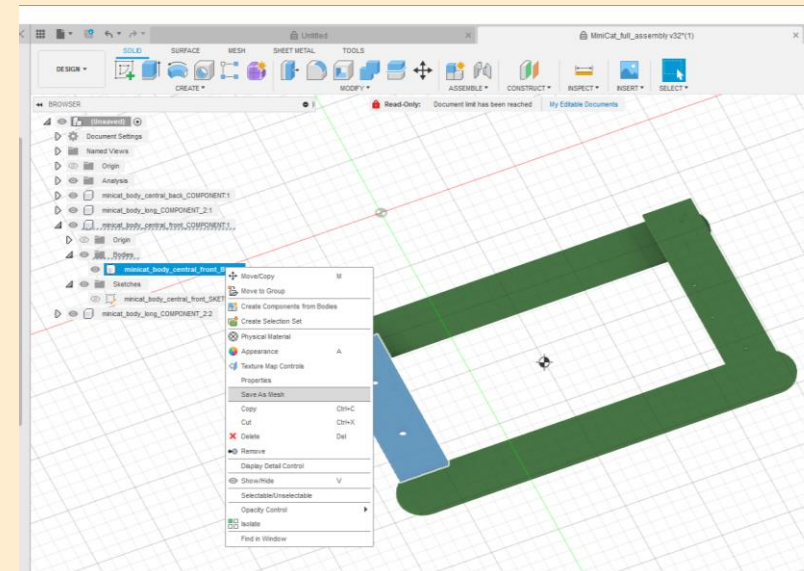


3D parts models & printing

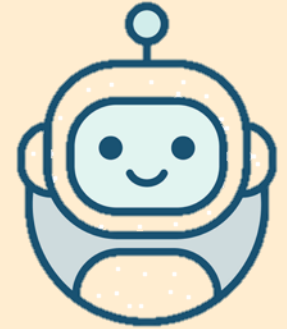


ToDo (.STL file generation)

- Right click on “minicat_body_central_front_BODY”
- “**Save as Mesh**” (=“als Netz speichern”)
/ and select Format “**STL (Binary)**” / “Save”



3D parts models & printing

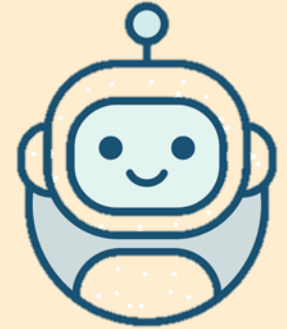


ToDo (.STL file generation)

- Open CURA and Add a Non Networked Printer “**Creality Ender3 Pro**”
- “File/Open file(s)” the .STL file you just generated !
- “**Slice**” it !
- Check the “**Preview**” / click on “Play” button
- “**Save to Disk**” to save it as a 3D Printer Machine code (.gcode)

3D parts models & printing

.STL file, generate your own

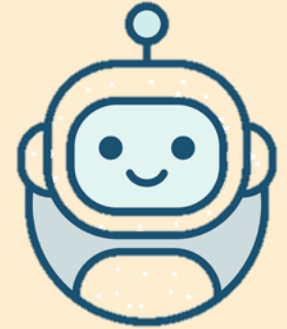


ToDo (Opening Toes .STL, Slicing & Simulation)

- For the Workshop we will not use the previously generated Body STL file but use an existing .STL :
“minicat-main/3D_printing/STL/3__all_miniToe_rubber.stl”
- Background :
Printer is now optimized for TPU (“gummi”) print,
not PLA rigid plastic
- Open CURA
- Open “minicat-main/3D_printing/STL/3__all_miniToe_rubber.stl”
- **“Slice” and write the time**

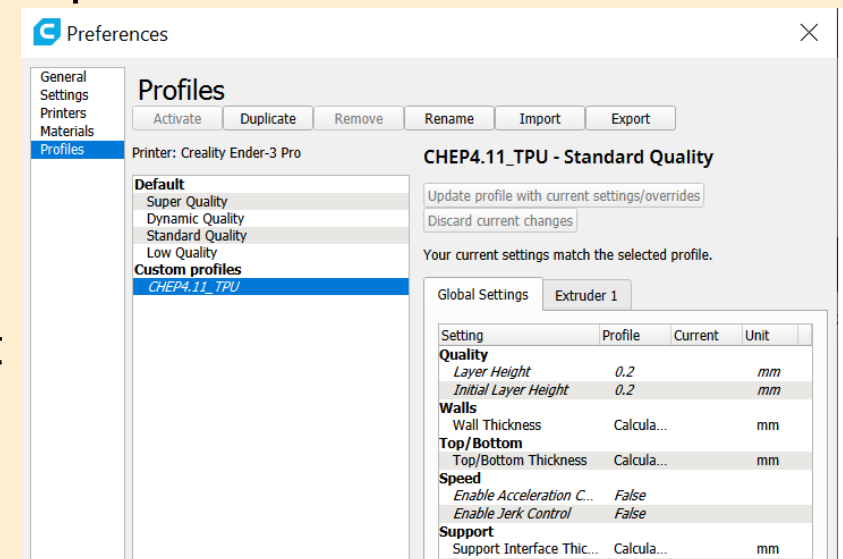
3D parts models & printing

.STL file, generate your own

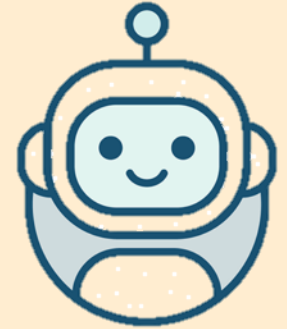


ToDo (3D printer config for TPU)

- Open Cura
- click on “Preferences/Configure Cura/Profiles
- ”Import” the content of “CHEP4.11_TPU” profile from “minicat-main/3D_printing/printing_profiles/ender3pro/tpu”
- ”Activate” the profile (work on on Mac, Windows10)
- Open your previously generated .STL file
- Slice it and check if the simulated printing time is different with the TPU profile vs “Default/Standard Quality” profile
- **“Save to Disk”** (.gcode machine code)



3D parts models & printing



ToDo (Printing !)

3 ways to print a .gcode file :

1- SD Card:

- save generated .gcode and plugin in printer

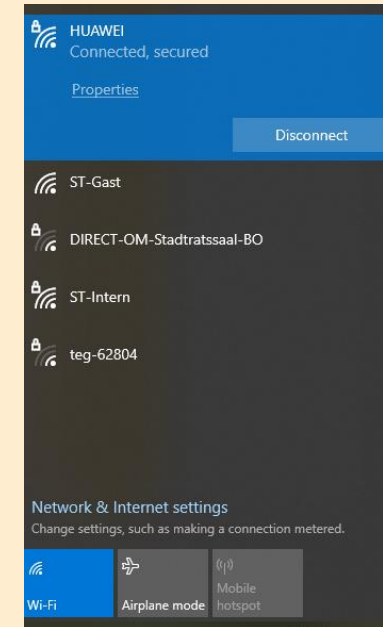
2- Octoprint Server on Raspi:

- WLAN :

connect to **HUAWEI** WLAN / Password: **2Groesser?**

- Server :

- open <http://octopi.local/login> in your browser
- login: **roboticsformakers** / Password: **2Groesser?**



Bitte einloggen

roboticsformakers

.....

☒ Login merken

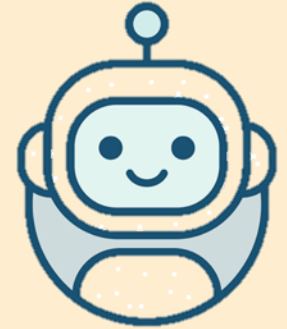
[Passwort vergessen?](#)

Einloggen

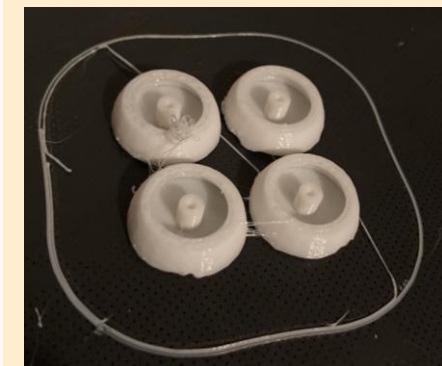
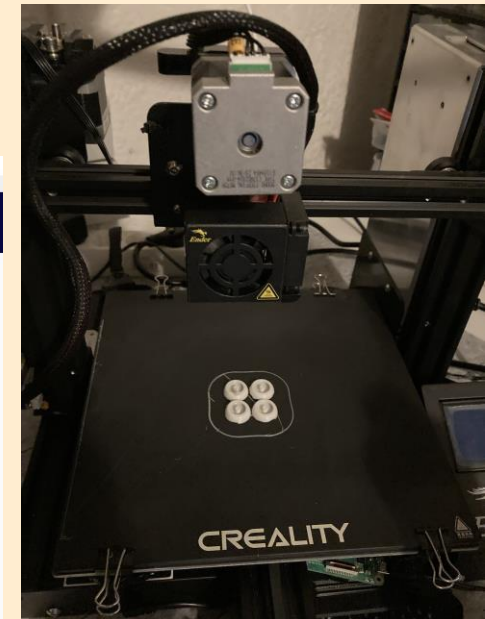
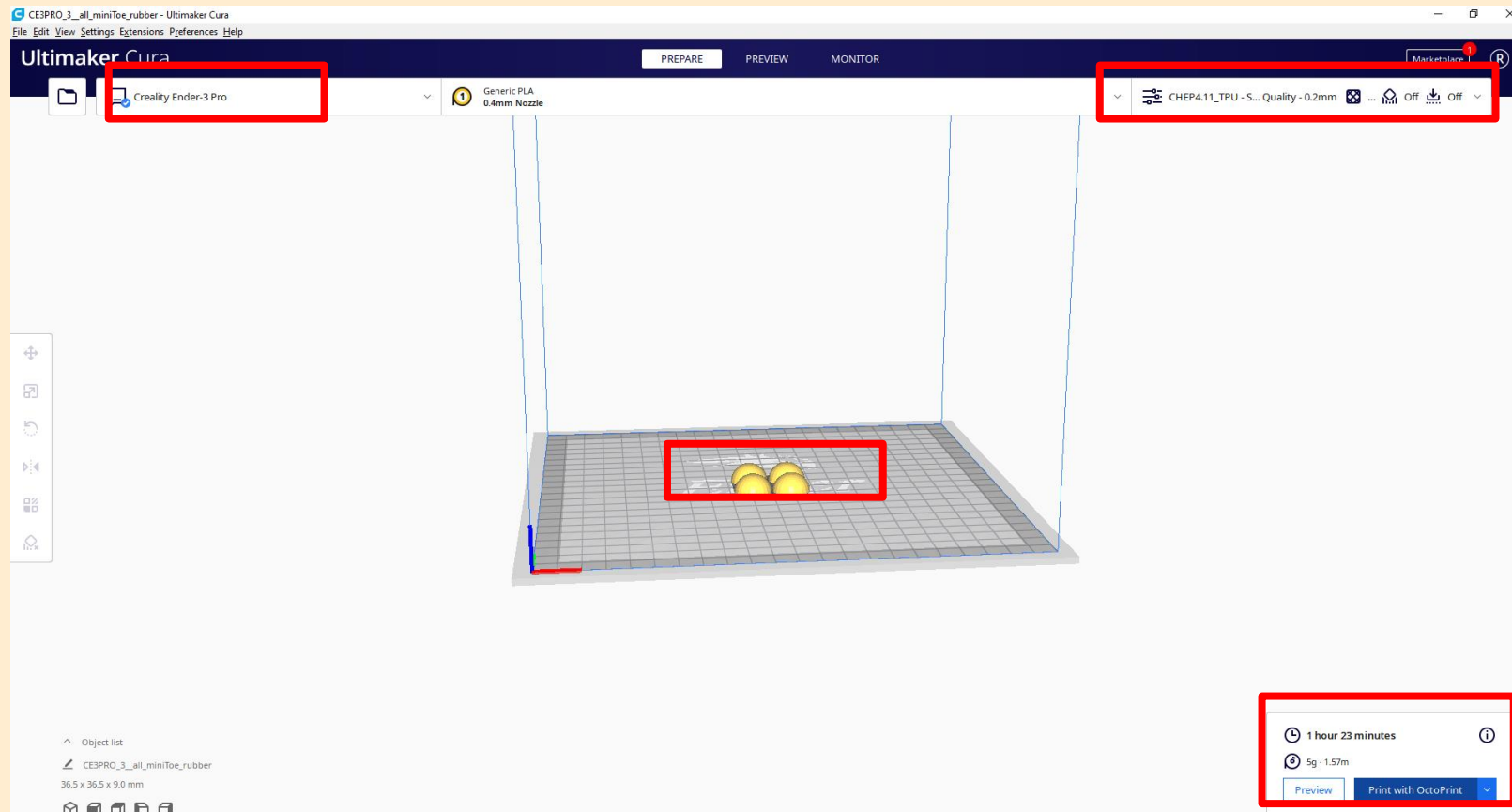
3- Octoprint Plugin for CURA: -> Focus today

- connect to HUAWEI WLAN / Password: 2Groesser?
- open CURA and install Octoprint Plugin
- start the "Preparation" and Print

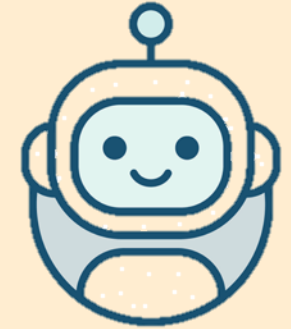
3D printing



I loaded the TPU (flexible filament profile) in CURA and generated the .gcode for you :



3D parts models & printing



- Try to change some params : in “Temperatur” “Soll” for “Tool” and “Bett”
 - click on “Upload”
- choose
“minicat-main\3D_printing\gcode\creality_ender3pro\ CE3PRO_3__all_miniToe_rubber.gcode

The screenshot shows a 3D printing software interface. On the left, there's a sidebar with status information: Status: Bereit, Resendverhältnis: 0 / 6 (0%), Datei: CE3PRO_3__all_miniToe_rubber.gcode, Hochgeladen: 2021-11-03 18:26:10, Nutzer: roboticsformakers, Zeitraffer: -, Filament (Tool 0): 1.60m, Ungefähre Dauer: 1,5 Stunden, Dauer: -, Verbleibend: -, Gedruckt: - / 1.8MB. Below this are buttons for Drucken, Pause, and Abbruch. A search bar and a file list are also visible. The main area shows a temperature graph with a green octopus icon. Below the graph is a table with temperature settings:

	Ist	Soll	Offset
Tool	18.8°C	Aus °C	0 °C
Bett	20.0°C	Aus °C	0 °C

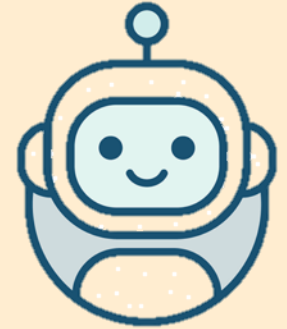
At the bottom left, there are buttons for Upload and Upload (SD).

The screenshot shows a file browser interface. The breadcrumb path is main > minicat / 3D_printing / STL /. The file list includes:

- minicat_eyes_STL
- 10_Body_B_Back.stl
- 11_Body_B_Front.stl
- 1_all_miniThigh.stl
- 2_all_miniServoHolder_Batch1.stl
- 2_all_miniServoHolder_Batch2.stl
- 3_all_miniToe_rubber.stl
- 4_Battery_holder_FIN
- 5_miniCircuit.stl

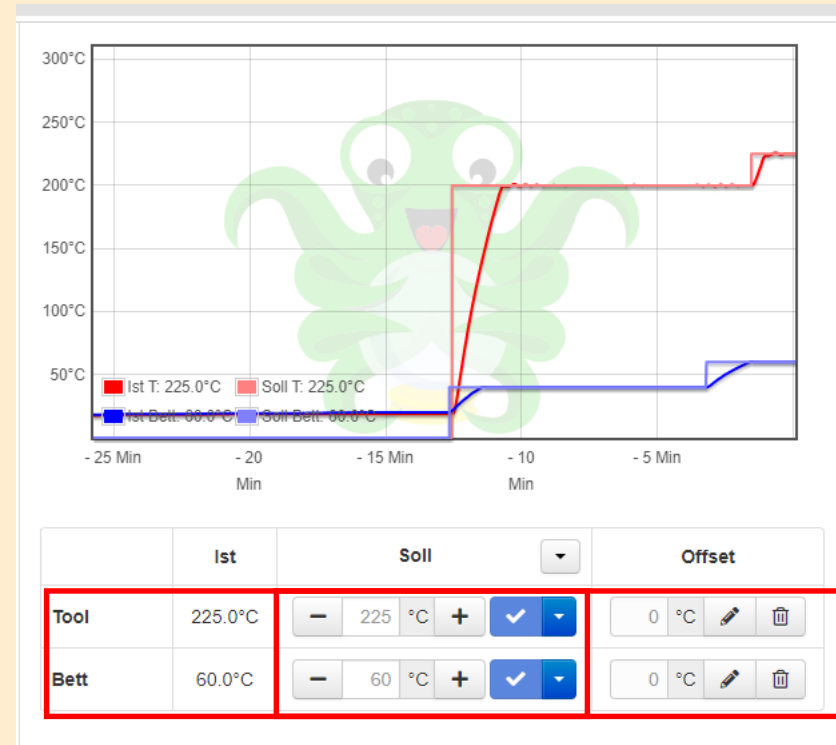
The file 3_all_miniToe_rubber.stl is highlighted with a red box.

3D parts models & printing

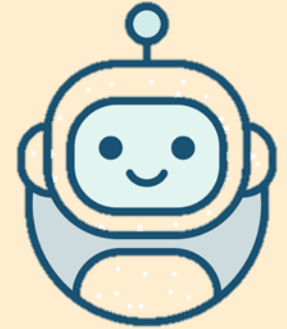


3D print w/ Octoprint :

- Preheat the Tool (Extruder) at 225°C
- Preheat the Bed at 60°C




3D parts models & printing



- **IMPORTANT:** Ask the teacher first !
- **only one participant can start the printing after another !**

Datei:
CE3PRO_3__all_miniToe_rubber.gcode
Hochgeladen: **2021-11-03 18:26:10**
Nutzer: **roboticsformakers**
Zeitraffer: -
Filament (Tool 0): **1.60m**
Ungefähre Dauer: **1,5 Stunden**

Dauer: -
Verbleibend: -
Gedruckt: - / **1.8MB**

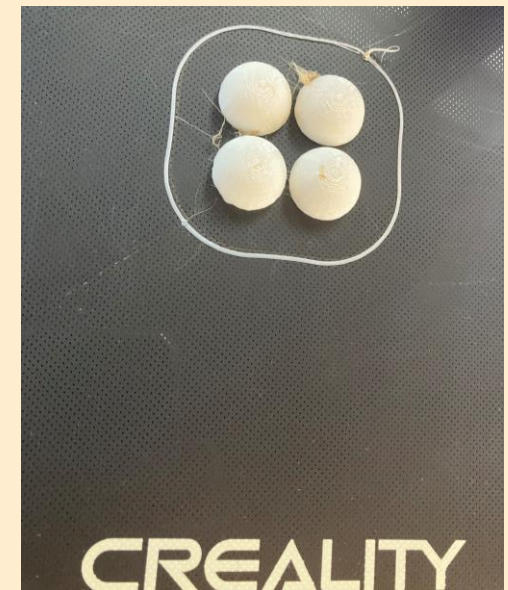
 **Drucken**  Pause  Abbruch

200°C
150°C
100°C
50°C

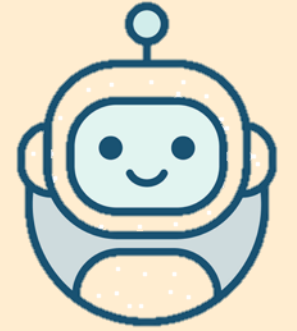
Ist T: 18
Ist Bett:

End of
the 2h

After the
2 hours
break :



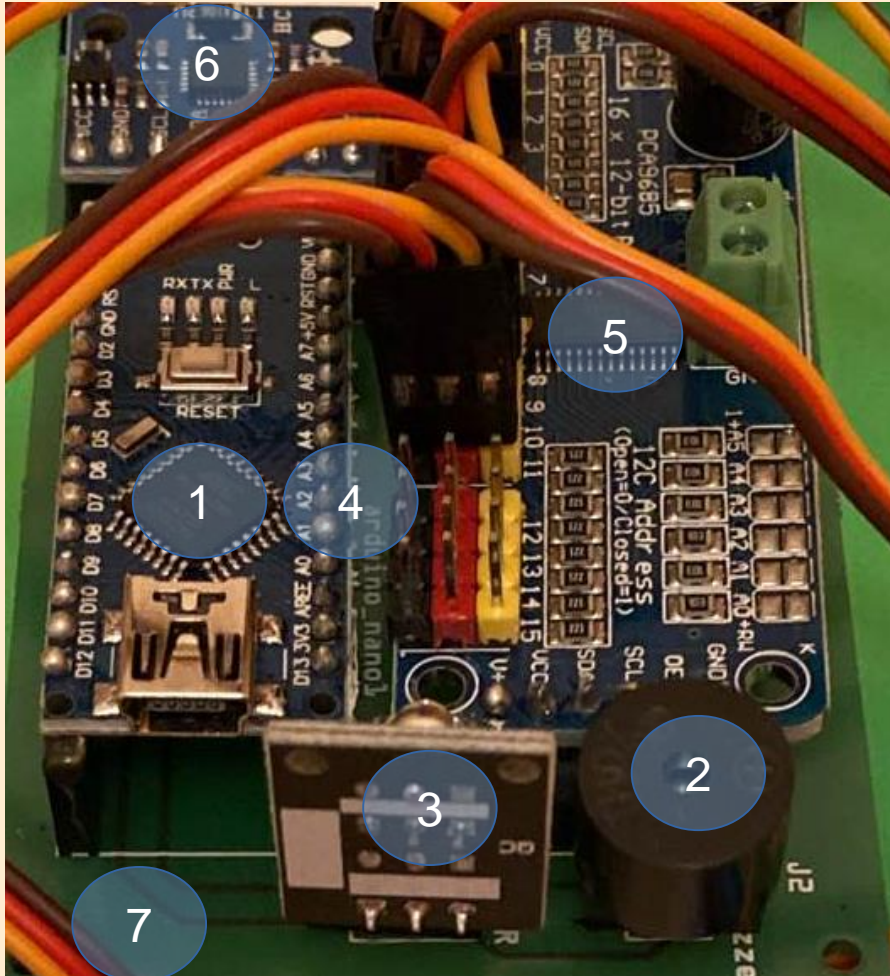
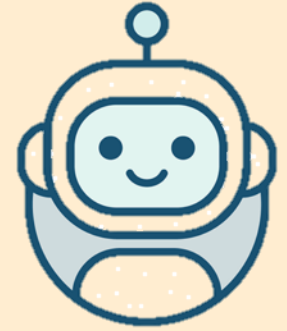
AGENDA



- Workshop Introduction
- 3D Parts models & Printing
- **Hardware Modules & Test**
- Final Software Integration

Hardware Modules & Test

Overview



Module 1: Arduino board

- “Brain” of the robot, runs Software

Module 2: Buzzer

- “Alive” signal generation

Module 3: Infrared Receiver & Remote

- Remote control

Module 4: I2C Bus

- comm. Betw. Arduino, Servomotors & Gyro boards

Module 5: Servomotors driver board

- drives the 8x Servomotors

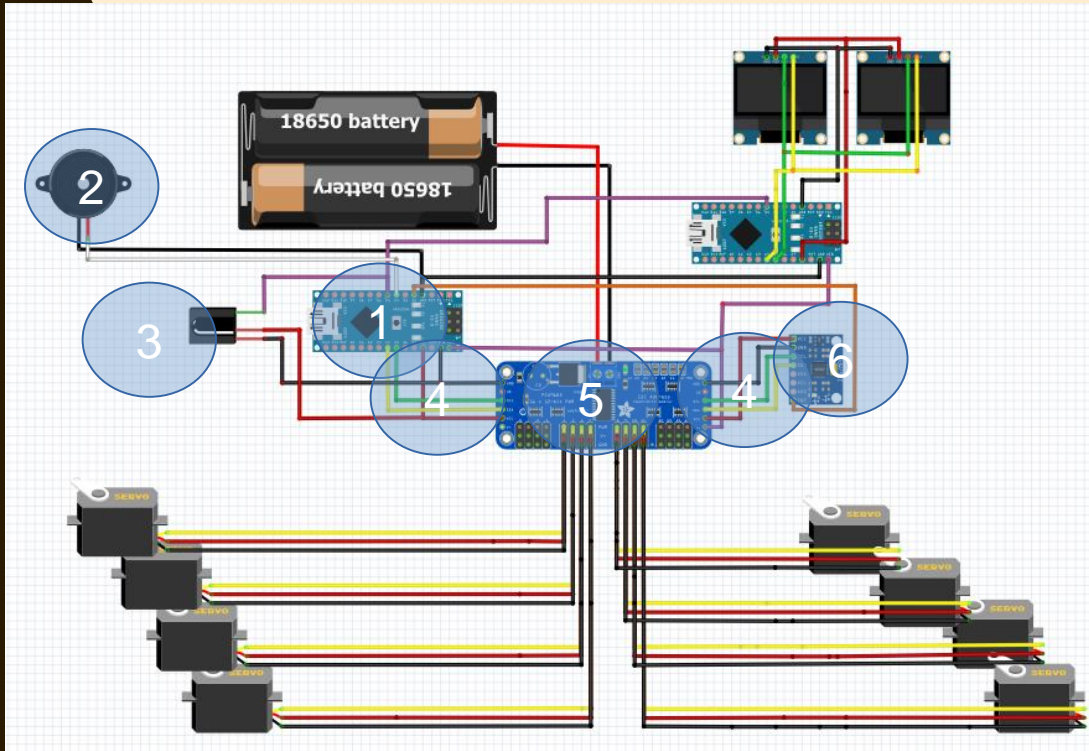
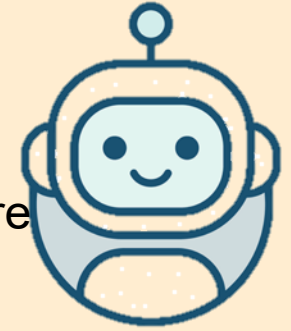
Module 6: Gyroscope board

- roll/pitch/yaw meas. vs calibrated 0 for robot balance

Module 7: PCB w/ all Modules & Final Software

Hardware Modules & Test

Overview



Module 1: Arduino board

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- comm. between Arduino, Servomotors & Gyro boards

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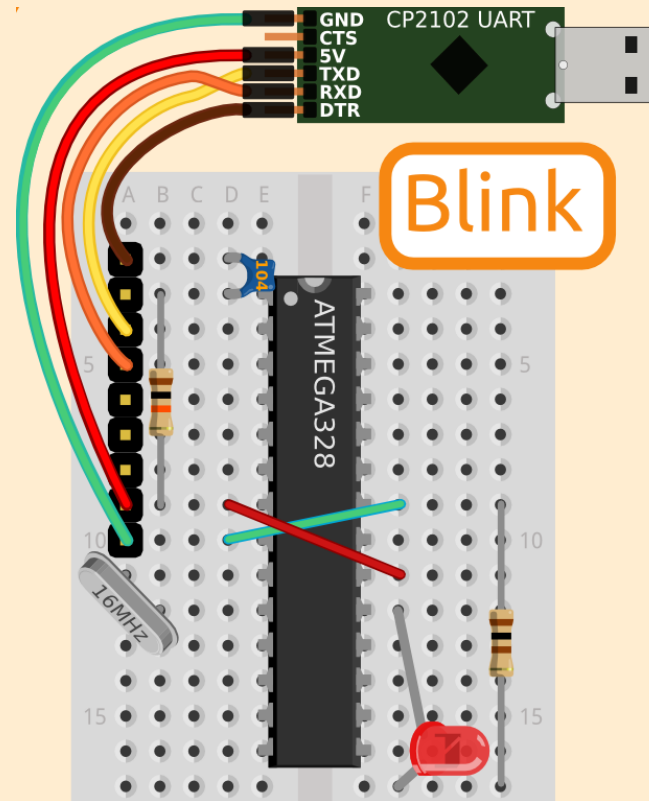
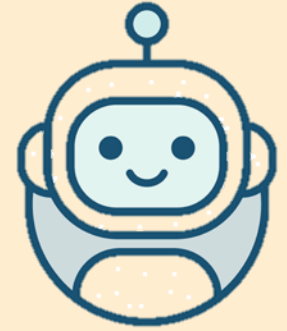
Module 6: Gyroscope board

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Module 7: PCB w/ all Modules & Final Software

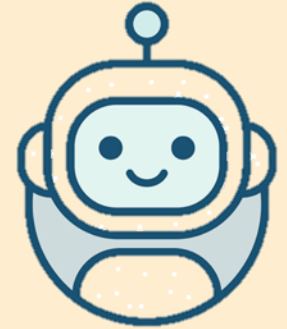
Hardware Modules & Test

Module 1: Arduino Board, blink Led



Hardware Modules & Test

Module 1: Arduino Board



Module 1: Arduino board & blink Led

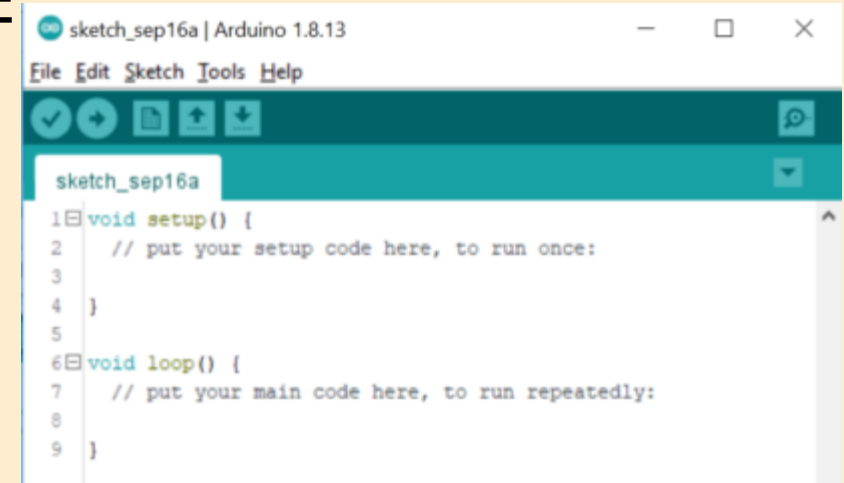
- “Brain” of the robot, runs the Software

ToDo:

- Plugin the provided USB cable to your Laptop
- Start the Arduino IDE

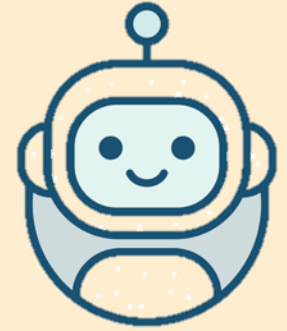


Your Laptop
USB



Hardware Modules & Test

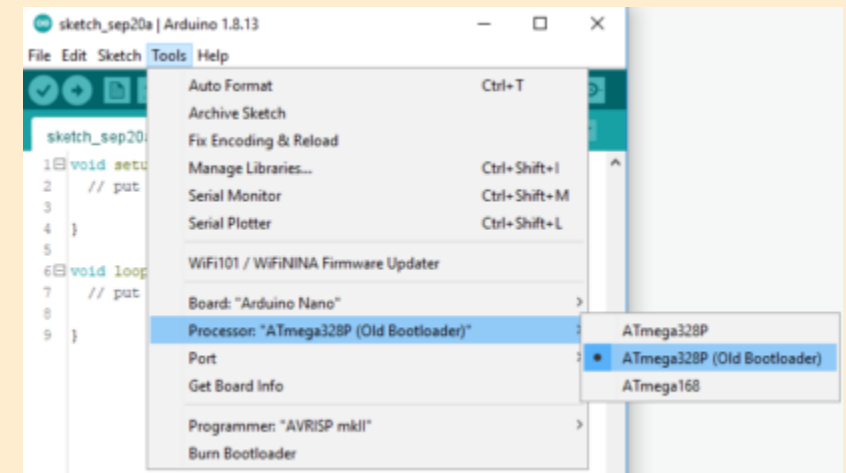
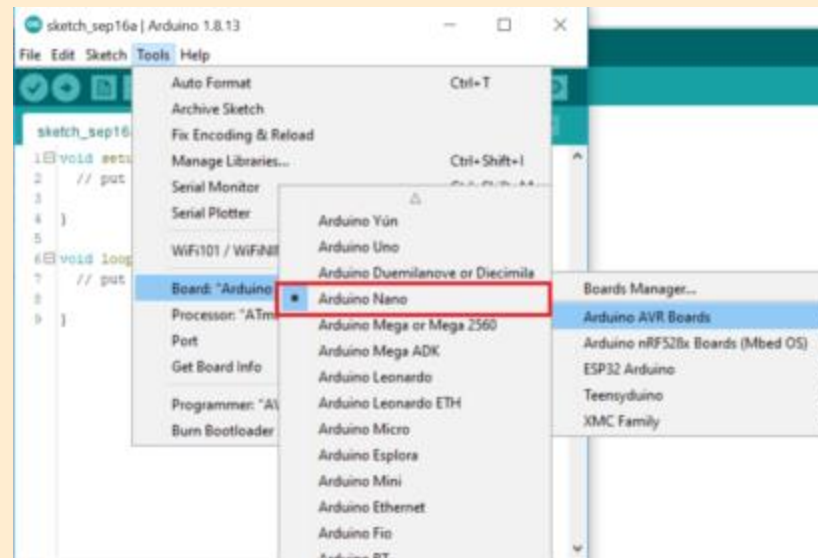
Module 1: Arduino Board



- ToDo:**
- Connect Arduino Nano Board w/ PC over USB
 - In the IDE, choose the Serial Port "**COM***"
 - Choose the Board "**Arduino Nano**"
 - Choose the Bootloader "**Old Bootloader**"

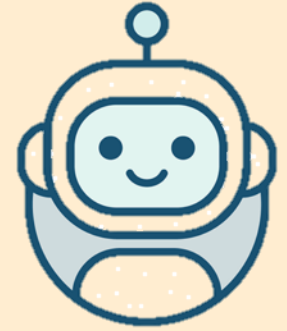


Your Laptop
USB



Hardware Modules & Test

Module 1: Arduino Board

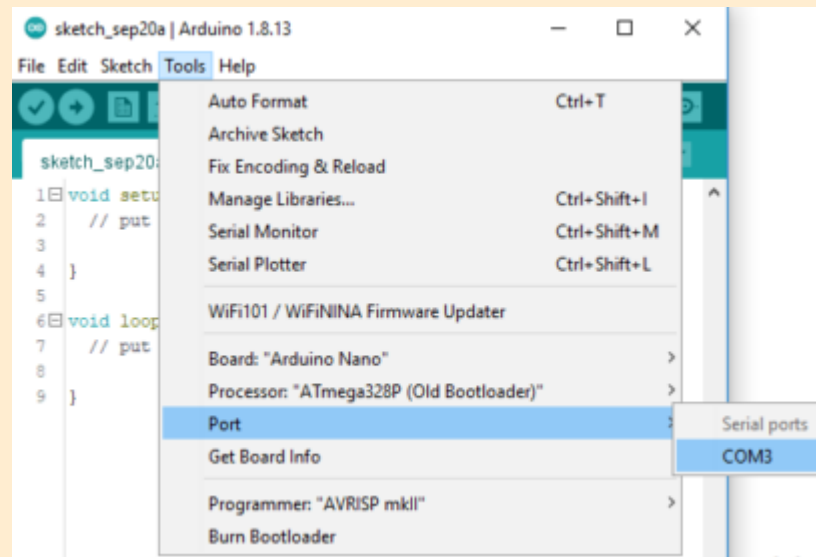


ToDo:

- In the IDE, choose the USB / Serial Port you are using :

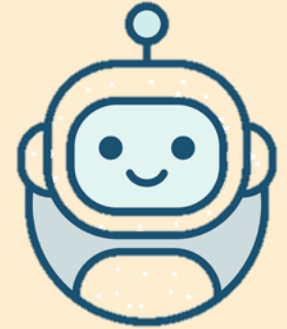


Your Laptop
USB



Hardware Modules & Test

Module 1: Arduino Board



ToDo:

- Click on "File/Examples/Digital/**Blink without delay**"



Your Laptop
USB

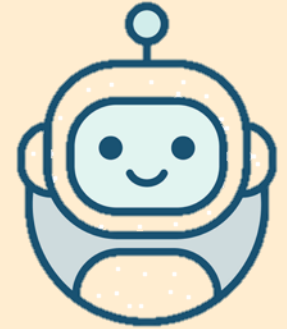
```
File Edit Sketch Tools Help
[Icons]
BlinkWithoutDelay
/*
Blink without Delay

Turns on and off a light emitting diode (LED) connected to a digital pin,
without using the delay() function. This means that other code can run at the
same time without being interrupted by the LED code.
```

- For Windows 10, please install **USBtoSerial driver „CH340G** this is part of MiniCat [GIT](#), see Software folder (or [„DirectLink“](#))
- MacOS and Ubuntu 20.04, no problems, no driver needed

Hardware Modules & Test

Module I: Arduino Board & Led



BlinkWithoutDelay.ino

```
// constants won't change. Used here to set a pin number:
const int ledPin = LED_BUILTIN; // the number of the LED pin

// Variables will change:
int ledState = LOW;              // ledState used to set the LED

// Generally, you should use "unsigned long" for variables that hold time
// The value will quickly become too large for an int to store
unsigned long previousMillis = 0; // will store last time LED was updated

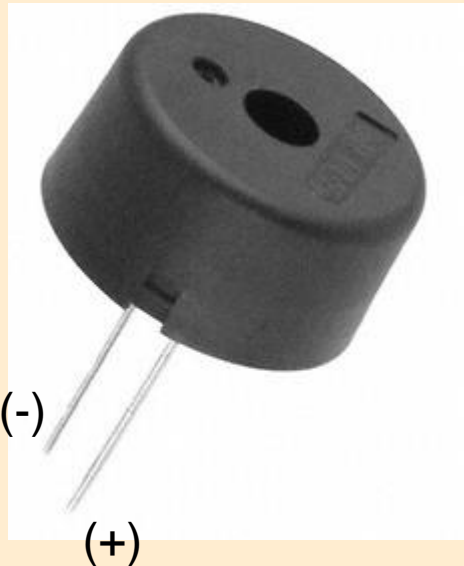
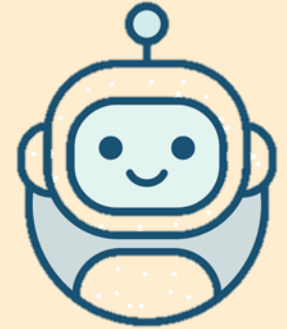
// constants won't change:
const long interval = 5000;      // interval at which to blink (milliseconds)
```

ToDo (Software):

- Change the **blinking interval** to 5000 (default 1000=1s)
- Click on **“Upload”** to start the Software
- **Observe the result on the Arduino board**

Hardware Modules & Test

Module 2: Buzzer



Module 2: Buzzer

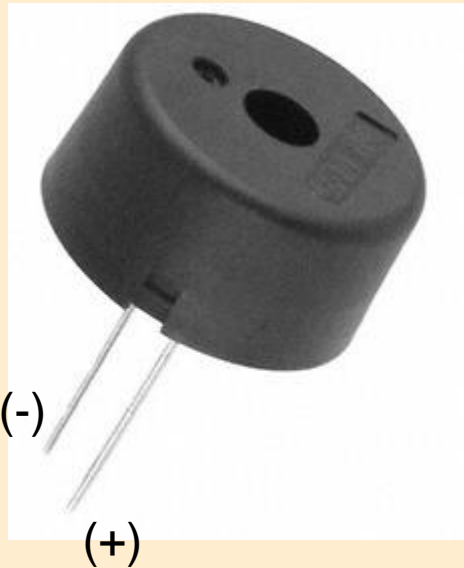
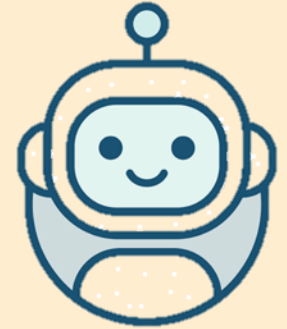
- “Alive” signal generation

ToDo:

- Unplug the USB cable from your Laptop
 - Plugin the **Arduino & Servodriver board** on the PCB
 - Plugin the USB cable to your Laptop
-
- **open the buzzer test software** : double click on “minicat-main/Software/buzzer_test/minicat_buzzer_test.ino”

Hardware Modules & Test

Module 2: Buzzer, **modify the code adding:**



```
int counter = 0;
```

```
void loop() {
```

```
    while (counter < 5)
```

```
    {
```

```
        byte melody[] = {8, 13, 10, 13, 8, 0, 5, 8, 3, 5, 8, // definition of the tones list  
                           as a "melody"
```

```
                        8, 8, 32, 32, 8, 32, 32, 32, 32, 32, 8
```

```
                        //8,8,16,16,8,16,16,16,16,16,8
```

```
        };
```

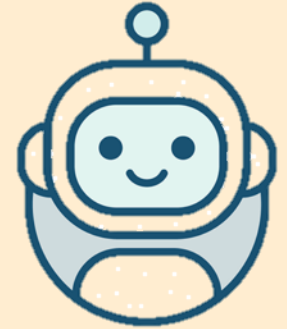
```
        playMelody(melody, sizeof(melody) / 2); // we play the melody
```

```
    }
```

```
}
```

Hardware Modules & Test

Module 2: Buzzer



minicat_buzzer_test.ino

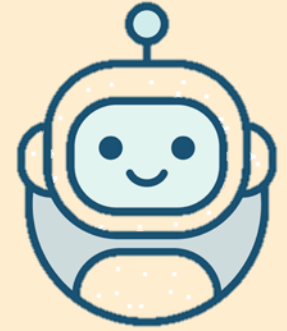
```
void loop() {  
  
    byte melody[] = {8, 13, 10, 13, 8, 0, 5, 8, 3, 5, 8, // definition of the tones list as a "melody"  
                     8, 8, 32, 32, 8, 32, 32, 32, 32, 32, 8  
                     };  
}
```

ToDo (Software):

- Change the melody by changing the values / deleting some
- Click on “**Upload**” to start the Software
- **Observe the result on the Arduino board**

Hardware Modules & Test

Module 3: Infrared receiver & remote

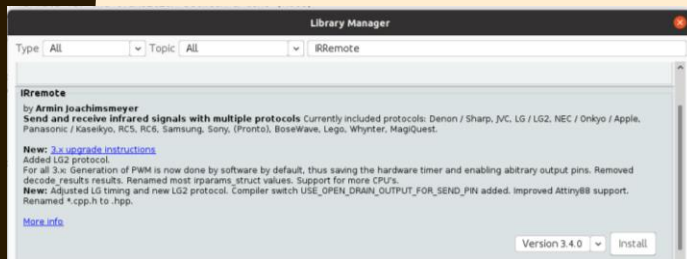


Module 3: Infrared receiver & remote

- Remote Control

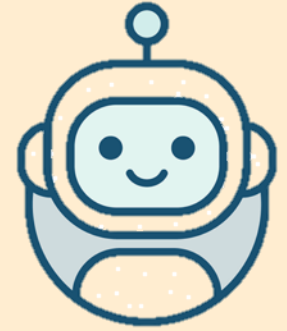
ToDo:

- Unplug the USB cable from your Laptop
- Plugin the Infrared receiver on the PCB
- Plugin the USB cable to your Laptop
- Check if the led is ON when you push the remote
- the **Software Library** “[IRRemote](#)” should be installed (Tools/Manage Libraries “IRremote”)
- **open the IRRemote test software** : double click on “minicat-main/Software/ minicat_IRremote_test /minicat_IRremote_test.ino”



Hardware Modules & Test

Module 3: Infrared receiver & remote



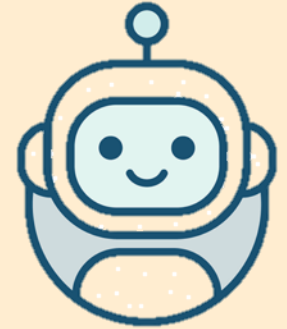
ToDo:

- Open the Arduino **Serial Monitor** (Arduino IDE “Tools/Serial Monitor”)
- in serial monitor, set the communication speed to **57600 baud**
- **Push on the buttons** on the Remote control and verify that they are correct in the Serial Monitor



Hardware Modules & Test

Module 3: Infrared receiver & remote



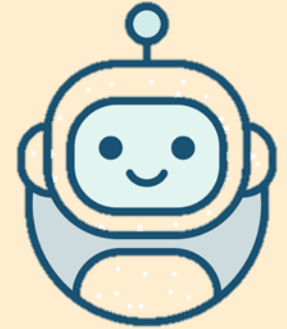
ToDo (Software):

- change a button description :
- push this button on remote
- verify that it is displayed in the serial monitor

```
minicat_IRremote_test $  
  
}  
  
void translateIR() { //fonction pour associer une action à chaque bouton  
  
  switch(result.value){ //switch permet de lister tous les cas possibles et  
    //de leur associer une action  
  
    //on va donc lister tous les codes et retourner leur nom sur la télécommande  
  
    //AV: FOR MINICAT1, "Carm3" RemoteControl  
    //AV: almost all original MiniCat RemoteControl codes are working except for the "Carm  
  
    //AV: original MiniCat SW :  
    case 0xFF18E7: Serial.println(" 2 (grey1) or 2 (grey2) or UP (black)"); break;  
    //case 0x3D9AE3F7: Serial.println(" HAUT"); break;  
  
    case 0xFF10EF: Serial.println(" 4 (grey1) or 4 (grey2) or LEFT (black) or Mode (grey2)  
    //case 0x8C22657B: Serial.println(" GAUCHE"); break;  
  
    case 0xFF38C7: Serial.println(" 5 (grey1) or 5 (grey2) or OK (black)"); break;  
    //case 0x488F3CBB: Serial.println(" -OK-"); break;  
  
    case 0xFF5AA5: Serial.println(" 6 (grey1) or 6 (grey2) or RIGHT (black)"); break;  
    //case 0x449E79F: Serial.println(" DROITE"); break;  
  
    case 0xFF4AB5: Serial.println(" 8 (grey1) or 8 (grey2) or DOWN (black)"); break;  
    //case 0x1BC0157B: Serial.println(" BAS"); break;  
  
    case 0xFFA25D: Serial.println(" CH- (grey1) or ON (grey2) or 1 (black)"); break;  
    //case 0xE318261B: Serial.println(" 1"); break;  
  
    case 0xFF629D: Serial.println(" CH (grey1) or Mode (grey2) or 2 (black)"); break;  
    //case 0x511DBB: Serial.println(" 2"); break;  
  
    case 0xFFE21D: Serial.println(" CH+ (grey1) or LoudspeakerOFF (grey2) or 3 (black)");  
    //case 0xEE886D7F: Serial.println(" 3"); break;
```

Hardware Modules & Test

Module 4: I2C Bus connections

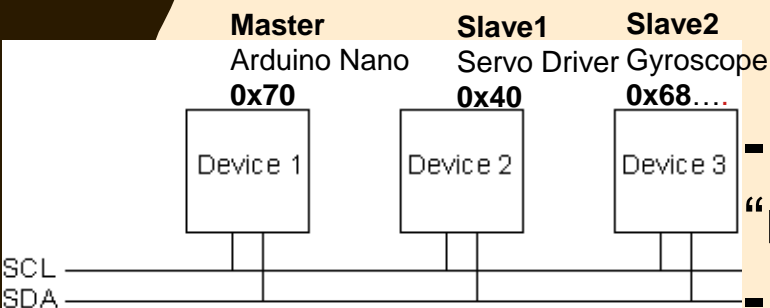
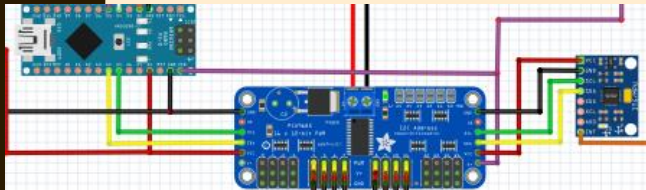


Module 4: I2C Bus connections / devices check

- comm. between Arduino & Servomotors & Gyro boards

ToDo:

- Unplug the USB cable from your Laptop
- Plugin the Gyro and Servodrivers boards on PCB
- Plugin the USB cable to your Laptop
- Put the 2 batteries in place and turn ON on holder (MPU6050 need enough power from Servodrivers board)
- I2C library ("Wire") is installed by default (Arduino IDE)



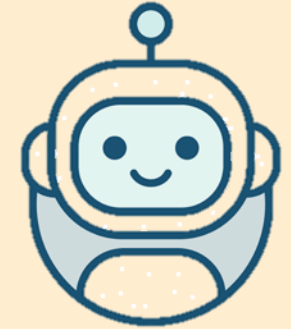
- **open the i2c communication test software:**

"minicat-main/Software/minicat_i2c_test/minicat_i2c_test.ino"

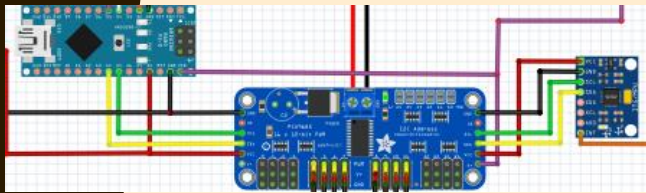
- **3x I2C devices should appear (serial monitor)**

Hardware Modules & Test

Module 4: I2C Bus connections



ToDo:

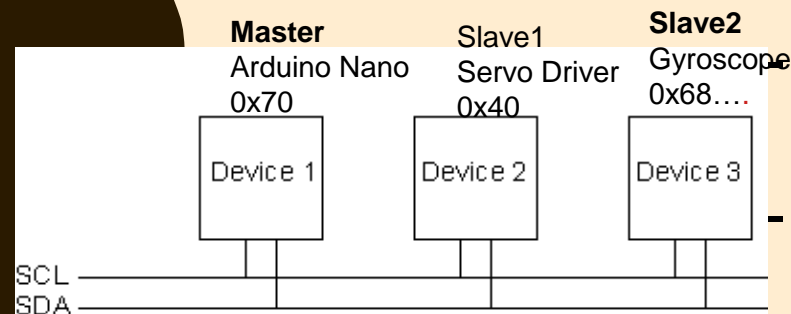


- Open the Arduino **Serial Monitor** (Arduino IDE “Tools/Serial Monitor”)

Set the communication speed to **57600 baud**

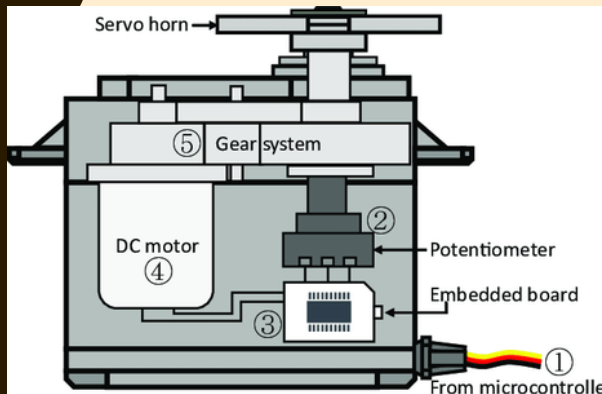
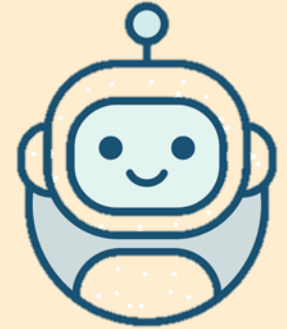
- **Verify that the 3 I2C Devices are present:**

- I2C device found at address 0x40 ! (Servos Driver)
- I2C device found at address 0x68 ! (Gyro)
- I2C device found at address 0x70 ! (Arduino Nano)



Hardware Modules & Test

Module 5: Servomotors driver board

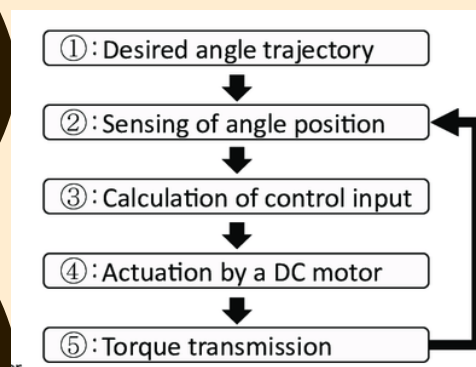


Module 5: Servomotors driver board

- drives the 8 servos, here we **test w/ 1 servomotor**
- based on Arduino inputs on I2C
- and Servodriver board 8 x PWM control signals outputs
- **we use first 5V supply from Arduino (no batteries)**

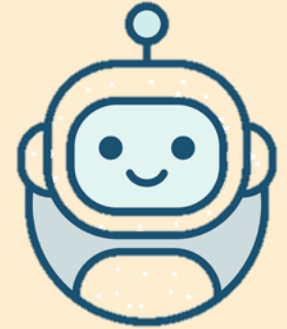
ToDo:

- Unplug the USB cable from your Laptop
- The 8x Servomotors cables are already plugged



Hardware Modules & Test

Module 5: Servomotors driver board



ToDo:

- Plugin the USB cable to your Laptop
- Start the Arduino IDE

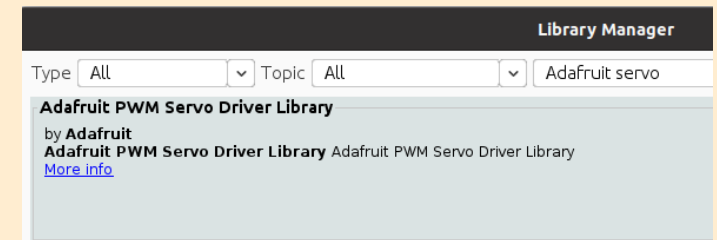
- the Software Library

“[Adafruit PWM servo driver library](#)”

should be installed

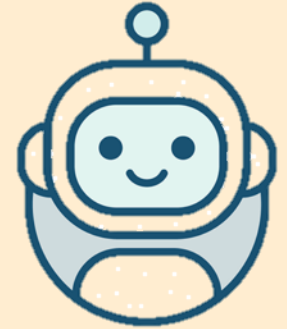
(Tools/Manage Libraries “Adafruit PWM Servo Driver Library”)

- **open the minicat_one_servo_test software** : double click on “minicat-main/Software/minicat_one_servo_test/minicat_one_servo_test.ino”



Hardware Modules & Test

Module 5: Servomotors driver board



ToDo (Software):

change servo n.
and delay :

```
minicat_one_servo_test $
//pwm.setPWM(SERVO, 0, SERVOMIN+range/2); //l'impulsion est large de SERVOMIN + range
//=>position milieu du servomoteur

//delay(2000);

//AV: Commenting out below lines and changing the rotation angle to avoid too much r

//Contrôle du servomoteur par angle (voir fonction setToAngle)
//Serial.println("position 45 degrés ");
//setToAngle(45);

//Serial.println("position 20 degrés");
//setToAngle(20);

//AV : ToDo : MODIFY here to test the Servo Angle position,

/*#####*/

//AV: ToDo : MODIFY THE 1st POSITION OF THE SERVO :

Serial.println("position 10 degrés");
setToAngle(10);

//AV: ToDo : MODIFY THE DELAY (in Miliseconds) BETWEEN 2 POSITIONS AS YOU WANT :

delay(1000);

//AV: ToDo : MODIFY THE 2d POSITION OF THE SERVO :

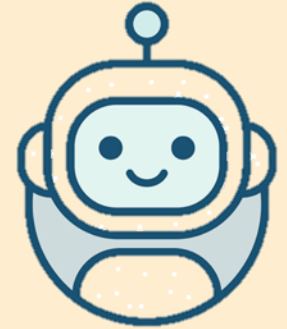
Serial.println("position 30 degrés");
setToAngle(30);

/*#####*/

}
```

Hardware Modules & Test

Module 5: Servomotors driver board



ToDo (Software):

Change the servo number to test all servos one by one :

```
minicat_one_servo_test 5

//on inclut les librairies nécessaires

#include <Wire.h>
#include <Adafruit_PWMServoDriver.h> //librairie spécifique à notre servo driver

Adafruit_PWMServoDriver pwm = Adafruit_PWMServoDriver(); //déclaration du driver pwm
|

/*#####*/

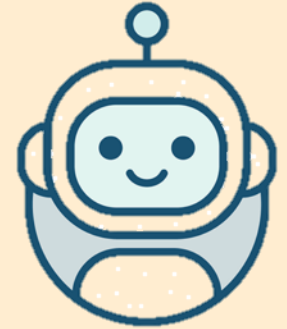
//AV: ToDo : Modify the Servo number

#define SERVO 4 //pin où est branché le servomoteur // AV : ToDo: Modify here to test all the Servos (4 to 11)

/*#####*/
```

Hardware Modules & Test

Module 5bis: Servomotors driver board



Module 5bis: Servomotors driver board

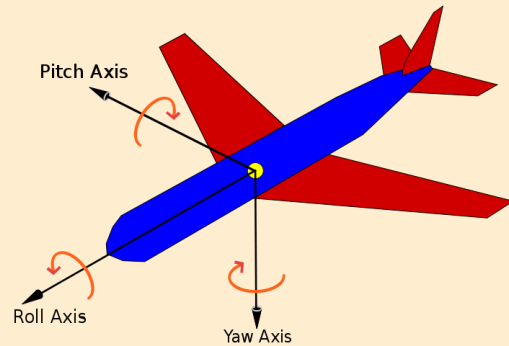
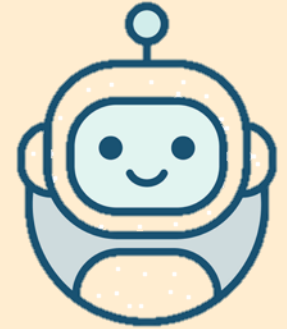
- we use now the 2x4,2V Lithium batteries supply
(your teacher will install them, please ask him)

ToDo:

- Unplug the USB cable from your Laptop
- Ask your teacher to install the 2 x Batteries in the robot
- Put the batteries holder button to “ON” under the robot
- Check if the Servomotor is moving (Front Right Top)

Hardware Modules & Test

Module 6: Gyroscope board



Module 6: Gyroscope board

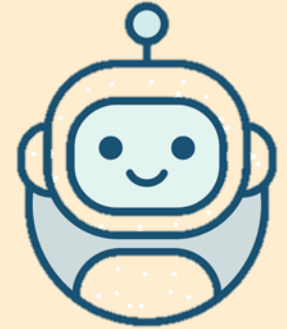
- measuring roll/pitch/yaw
- compared with calibrated “zero”
- compensate the legs height / balance

ToDo:

- Unplug the USB cable from your Laptop
- Plug the Gyro module in the PCB
- Plugin the USB cable to your Laptop
- Start the Arduino IDE'
- Get the Arduino Libraries “[I2Cdev and MPU6050](#)”
- Start the 1x Gyro test software “minicat_i2c_test.ino”

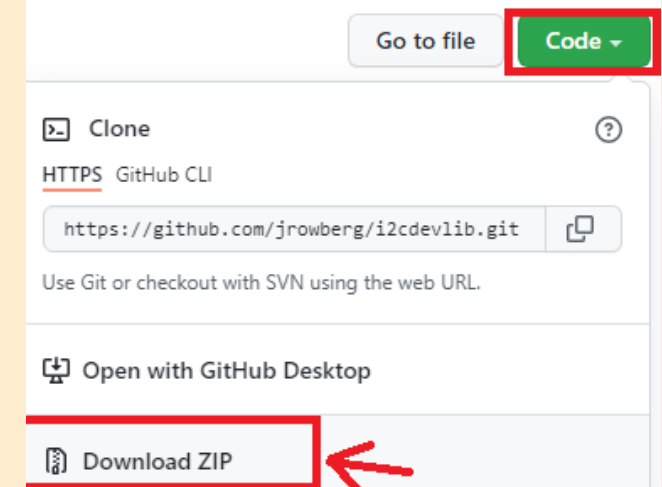
Hardware Modules & Test

Module 6: Gyroscope board



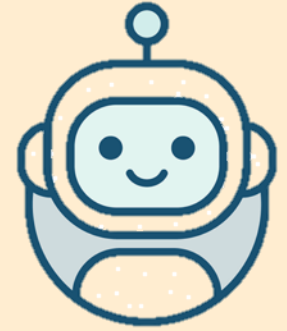
The Gyroscope module need the Libraries “**I2Cdev**” and “**MPU6050**” for I2C communication to Gyroscope MPU6050 sensor :

- Open : <https://github.com/jrowberg/i2cdevlib>
- Click on “Code” and then “**Download ZIP**”
- the Downloaded .zip is normally stored into your “C:\Users*UserName*\Downloads” folder
- **Unzip** the “i2cdevlib-master.zip” in your “C:\Users*UserName*\Downloads” folder to get a “i2cdevlib-master” folder



Hardware Modules & Test

Module 6: Gyroscope board

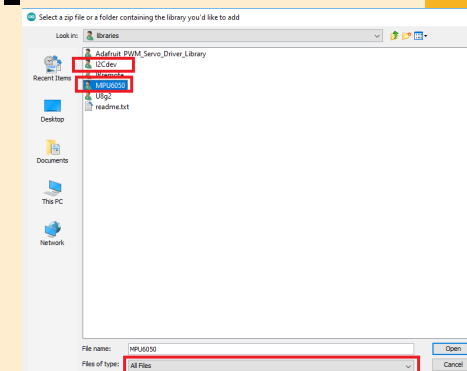
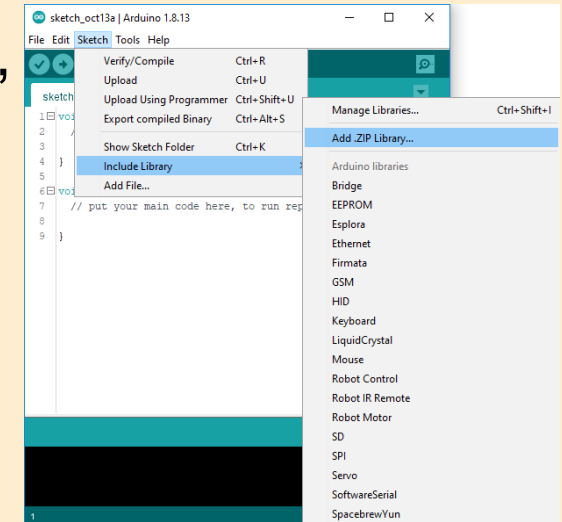


1- Now to add the 2 libs we need,
Click on “**Sketch/Include Library/Add .ZIP Library**”

2- Change the “Files of type” to “**All Files**”
(as we already unzipped) :

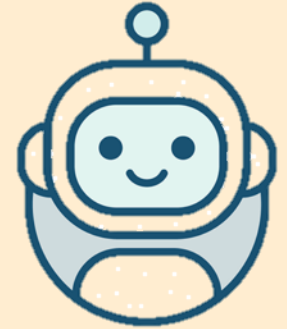
3- Navigate to

“C:\Users*UserName*\Documents\Arduino\libraries\i2cdevlib-master\i2cdevlib-master\Arduino\

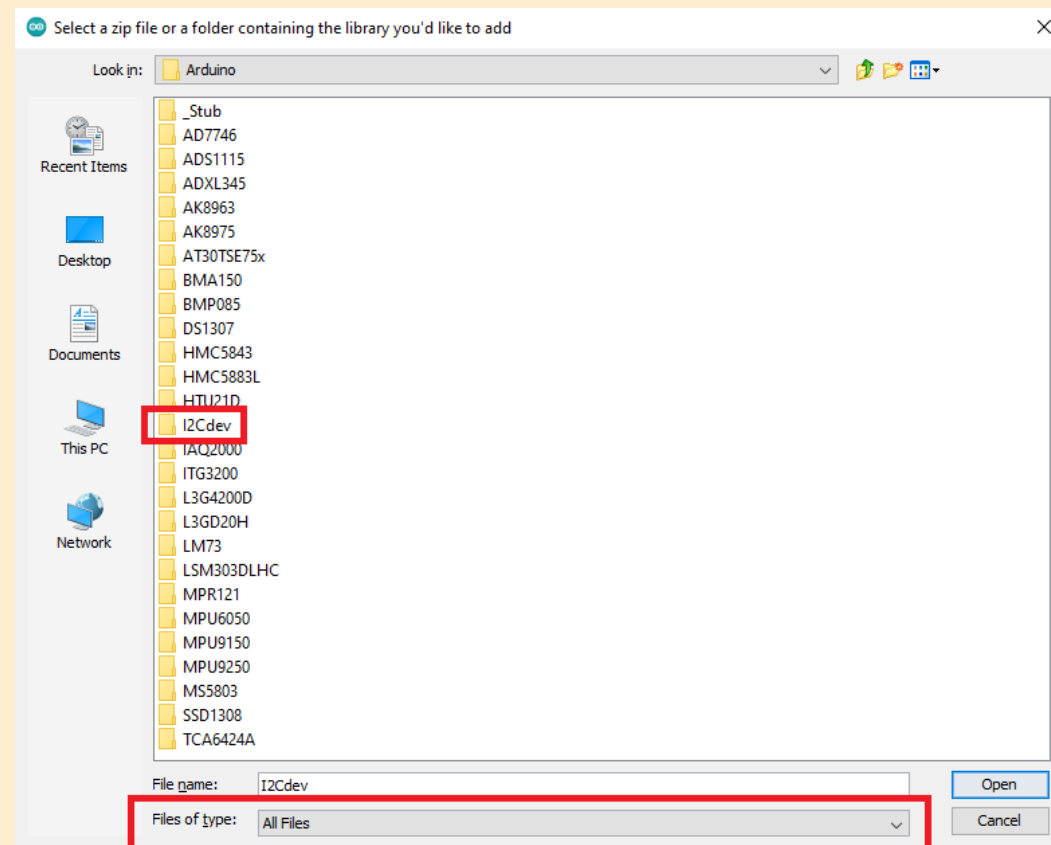


Hardware Modules & Test

Module 6: Gyroscope board

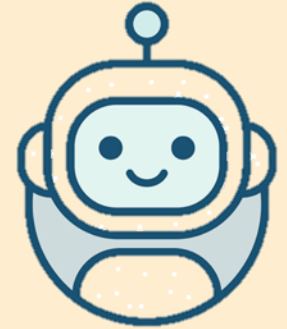


4- Then Single Click on the “**I2Cdev**” Folder and then “**Open**” :

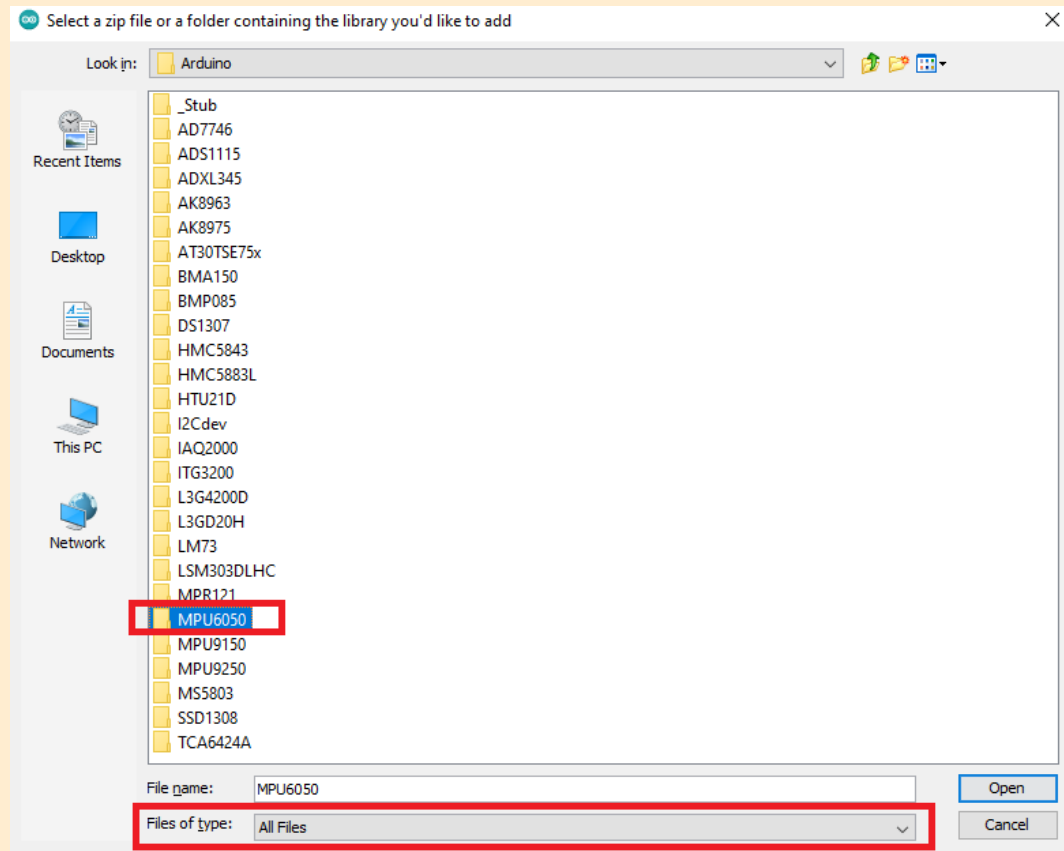


Hardware Modules & Test

Module 6: Gyroscope board

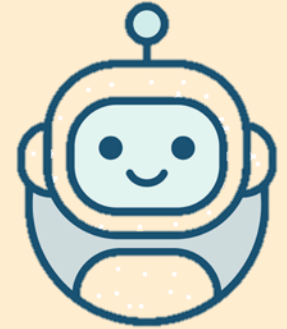


5- Repeat the steps above for adding the “**MPU6050**” lib :



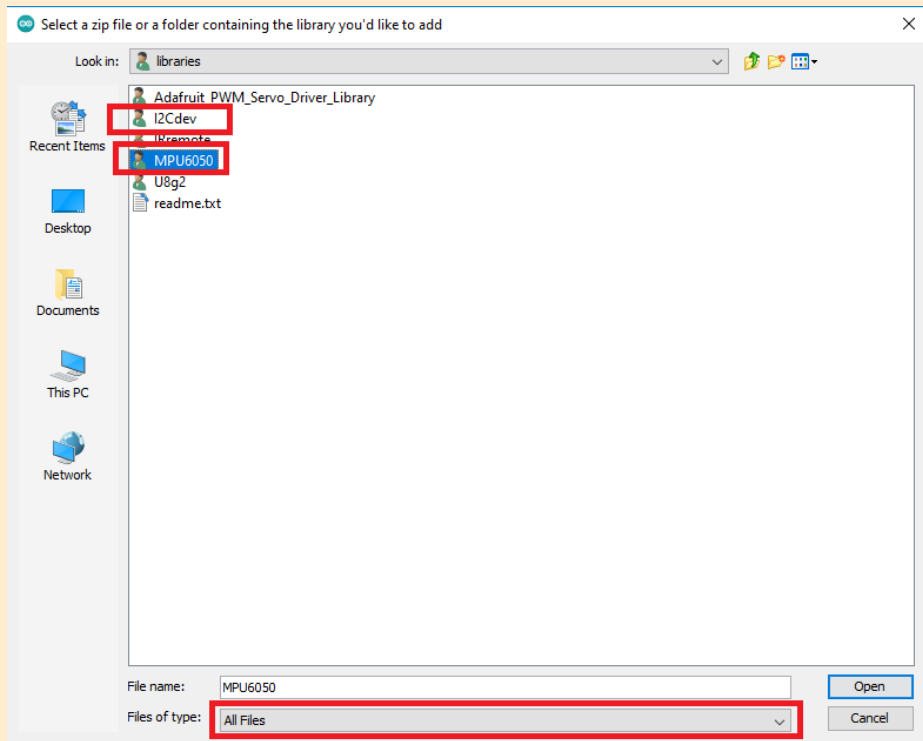
Hardware Modules & Test

Module 6: Gyroscope board

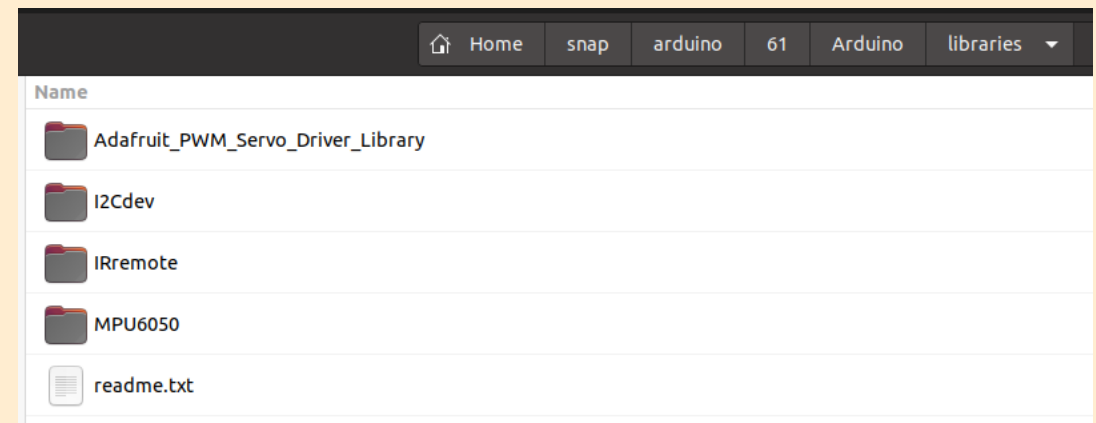


6- RESULT:

The **2 Libs** should now appear in your
“C:\Users*UserName*\Documents\Arduino\libraries\ folder:



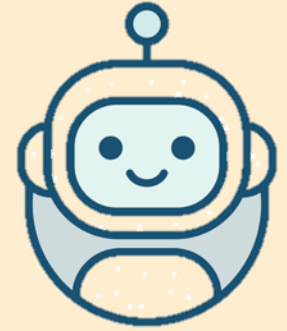
Windows 10



Ubuntu 20.04

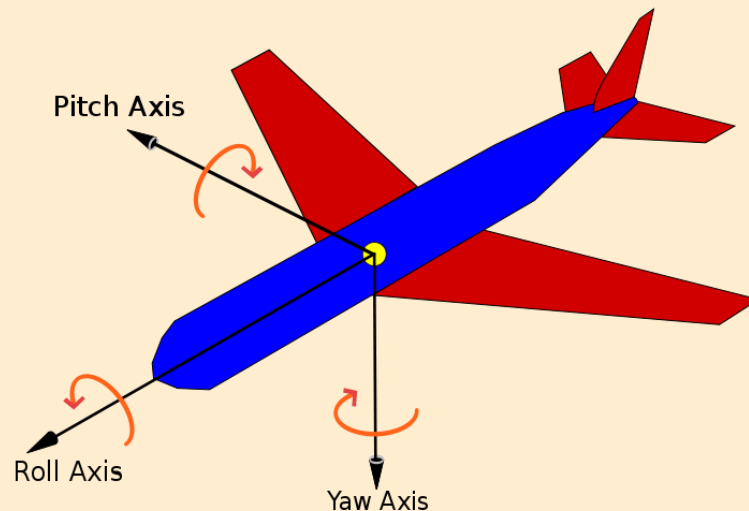
Hardware Modules & Test

Module 6: Gyroscope board



ToDo:

- Open the Serial Monitor
- Check the “ypr” = yaw pitch roll values when moving MiniCat :
(click on “Autoscroll” to stop)

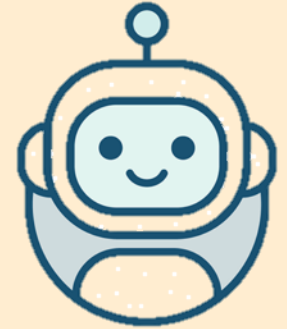


/dev/ttyUSB0			
accreal	553	-308	4142
ypr	5.81	5.19	0.40
accreal	555	-307	4137
ypr	5.81	5.19	0.40
accreal	562	-306	4137
ypr	5.83	5.19	0.40
accreal	564	-301	4139
ypr	5.84	5.19	0.40
accreal	562	-295	4144
ypr	5.86	5.20	0.40
accreal	555	-292	4142
ypr	5.87	5.19	0.40
accreal	544	-298	4147
ypr	5.88	5.19	0.40
accreal	543	-303	4141
ypr	5.89	5.19	0.40

☐ Autoscroll ☐ Show timestamp

Hardware Modules & Test

Module 7a: All modules + calib



Module 7a: All Modules + calibration

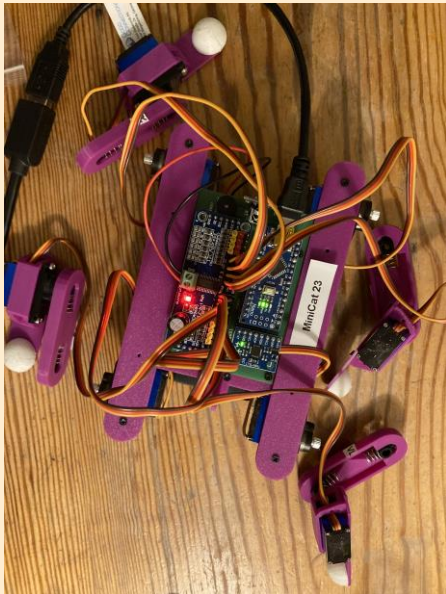
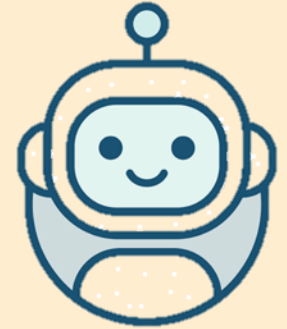
- servos check + gyro calibration
- **not in focus of this workshop (time consuming)**
- servo need to be placed at their zero (middle) angle
- gyro need to be calibrated to know its zero angles (rpy)

Todo:

- Make sure all modules plugged on the PCB
- **Put the battery holder button on “ON” first**
- **Plugin the USB cable to your Laptop**

Hardware Modules & Test

Module 7a: All modules + calib

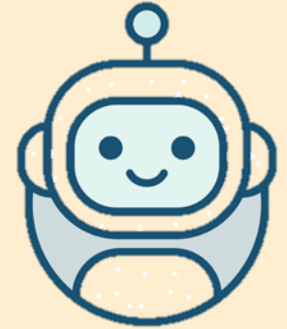


Todo (Software): calib done, not in focus of workshop

- disconnect all legs of MiniCat, no servo blocked
- make sure MiniCat is on a flat surface
- start the “**minicat_servos_and_gyro_calibration.ino**”
 - Open the **Serial Monitor**
 - “**Upload**” the Software
 - The Gyroscope will measure the MiniCat chassis roll/pitch/yaw angles offsets compared to the MPU6050 chip default zero angles, the **offsets will be shown** “
in the serial monitor

Hardware Modules & Test

Module 7a: All modules + calib



Background :

servos calib:

- we need to put all servos at their central zero position before mounting the legs of MiniCat

gyroscope (MPU6050 chip) calib:

- we need to measure the offset of the gyro yaw pitch roll angles compared to the default zero angles in the Gyro board firmware (MiniCat should be put on a flat surface)

Remark :

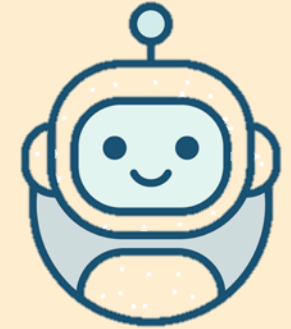
the gyro angles offset values will be stored in EEPROM

(non volatile memory of Arduino Nano)

so that this Calibration is needed only once on a particular Arduino

Hardware Modules & Test

Module 7a: All modules + calib



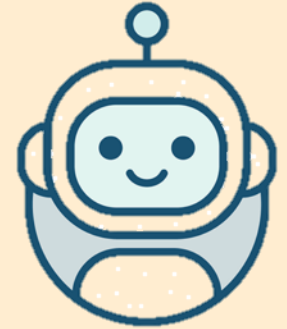
Todo (Software):

- the gyro and servos calibration process will start
- if everything is fine, you get this output in the serial monitor

```
/dev/ttyUSB0  
$GDSGXBCX-1  
-1  
-1  
-1  
-1  
+1  
-1  
* RoPet Writing Constants to EEPROM *  
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,  
  
MPU6050 Calibration Sketch  
  
Your MPU6050 should be placed in horizontal position, with package letters facing up.  
Don't touch it until you see a finish message.  
  
MPU6050 connection successful  
  
Reading sensors for first time...  
  
Calculating offsets...  
...  
...  
...  
5...  
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6...  
13456...  
12456...  
1246...  
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-
```

Hardware Modules & Test

Module 7a: All modules + calib



Todo (Software):

- keep the serial monitor open and type **“c”** in the command line then **“Enter”**

This will place the servos at their central “zero” position

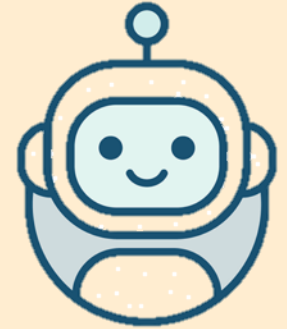
- The Servo angles will be shown w/ zeros in the serial monitor (only 8 to 15 are our 8 servos)

8,	9,	10,	11,	12,	13,	14,	15
0,	0,	0,	0,	0,	0,	0,	0,

- **Keep the battery holder button on “ON”**
- **Do not remove the USB cable from your Laptop yet !**
- **you will only insert the tighs & feet parts in the servos axis**
see how on next slide, do not turn the servo axis manually !
(as you just set the servos to their zero angle pos.)

Hardware Modules & Test

Module 7a: All modules + calib



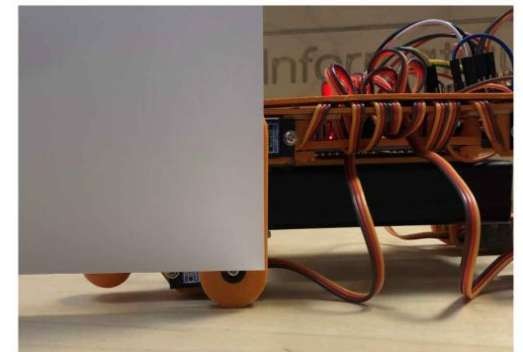
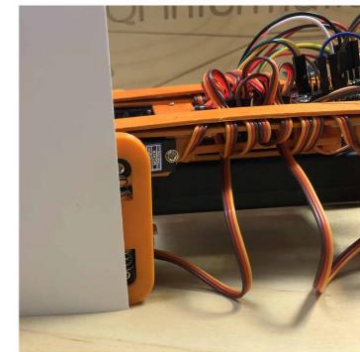
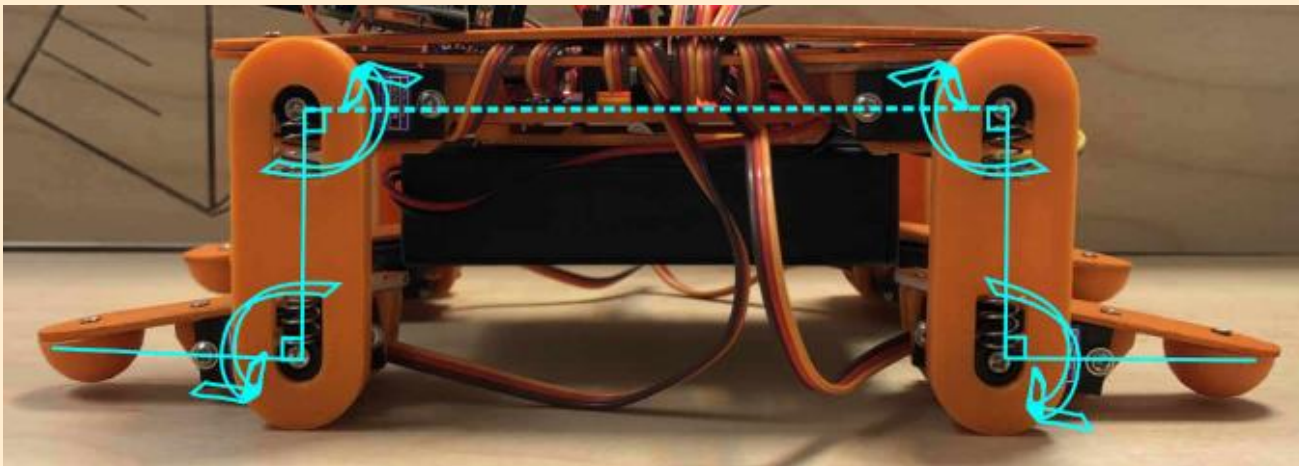
Todo (Software):

- Now that you have set the servos to their zero angle you can mount them as below

(Hint: **do not move the servo axis anymore!**)

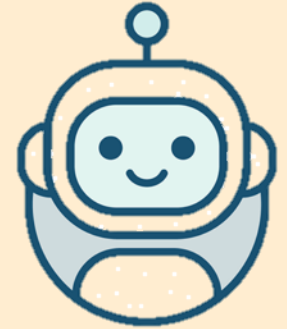
If so, start again

“minicat_servos_and_gyro_calibration.ino”):



Hardware Modules & Test

Module 7a: All modules + calib



Optional / Todo (Software): Servos angle Fine tuning :

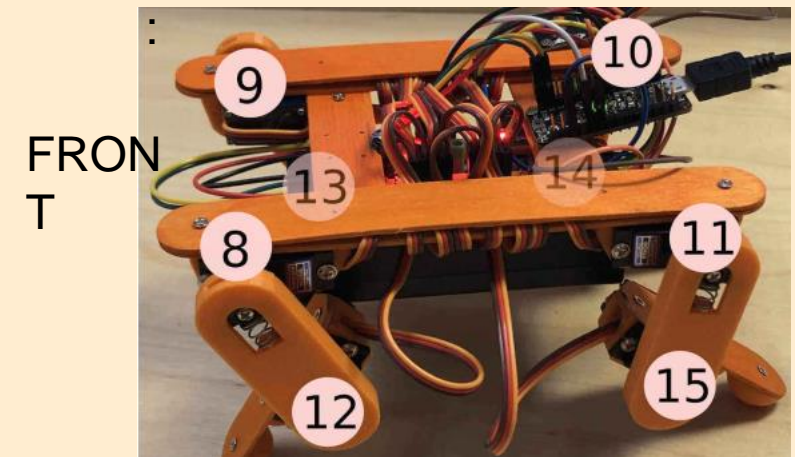
- If you can not achieve 100% the above, you can still **fine tune the servo angles by software by running the below in the Serial Monitor:**

c “servo link index” “correction angle

For example, if you want to change the angle of link 12 of +5 deg you can run : ***c12 5***

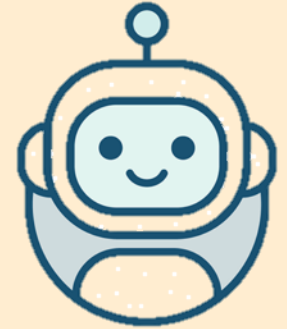
Remark : each tooth of the servo axis is 360deg/20teeth so 18deg so the fine tuning makes sense for +/- 9deg, if more needed just remove the servo arm from the servo axis and place it on a next tooth!

Servos indexes reminder



Hardware Modules & Test

Module 7a: All modules + calib



Todo (Software):

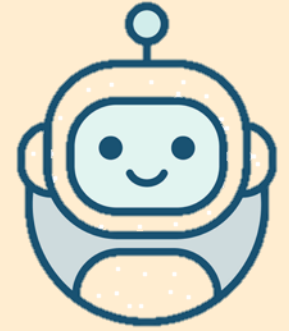
- put the servo screws in the servo axis to fix the positions :



- Once you have achieved the above, **type “s”** in the serial monitor (this will save your servos angles calibration in Arduino EEPROM (non volatile))

Hardware Modules & Test

Module 7a: All modules + calib



Todo (Software):

- to test your servos calibration, try different positions :
- type “**d**” in monitor to go in default position (“stop”), expected :

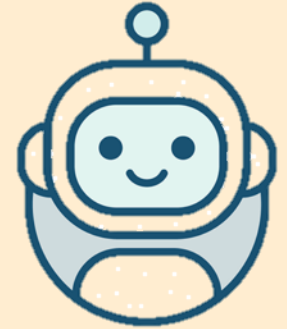


- type “**pbalance**” to go in “stand” position, expected :



Hardware Modules & Test

Module 7b: All modules on PCB



Module 7b: All Modules on PCB and Play !

ToDo:

- Unplug the USB cable from your Laptop
- Make sure all modules plugged on the PCB
- **Put the battery holder button on “ON” first**
- **Plugin the USB cable to your Laptop**
- **open the minicat_basic software : double click on “minicat-main/Software/minicat_basic/minicat_basic.ino**
- **Use the remote control to play !**