

UNIVERSITY OF TWENTE.

ARDUINO & ELECTRONICS PRACTICAL

PRACTICAL SESSION 2



Part of **SmartProducts**



ARDUINO & ELECTRONICS PRACTICAL

PRACTICAL SESSION 2

- Using Arduino modules: display, sensors
- Communication (Serial & Bluetooth)
- Arduino programming - part 2
- Assignment

slides @ Canvas

UNIVERSITY OF TWENTE.

Fjodor van Slooten
W241 (*Horst-wing West*)
f.vanslooten@utwente.nl



Assistants:

Hilke van den Born
Tim van der Kooi
Daniël Kooyman van Guldener
Filip van der Kroft
Luc Notenboom
Jannick Siderius

LAST WEEK



Problems with Port not available/recognized and/or uploading/connecting to Arduino failed

→ [Use trouble shooting guide](#), some cases: [CH340 driver must be installed](#)



Most of you were able to make progress and solve problems



Tutorial for today's assignment is on same level, but now you already have some experience

Tips:

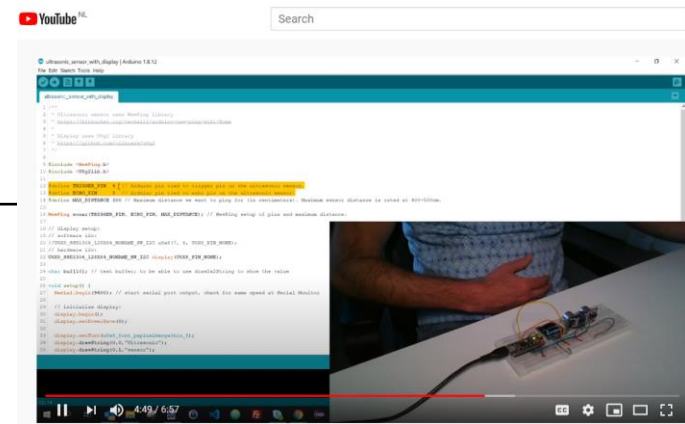
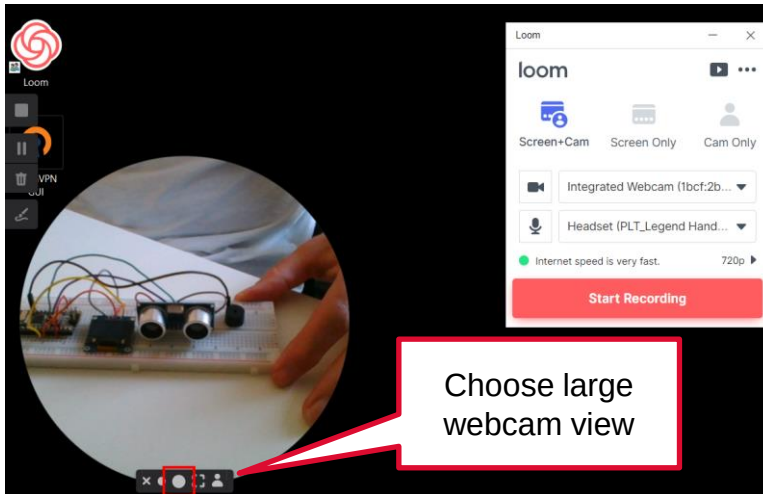
- If you download an example, open it in Arduino IDE, then **first do File > Save As**, to save it in your **Documents\Arduino** folder
- Always **disconnect power** when connecting circuits!!
- **Double-check connected wires & pins** before you connect the Arduino
- More tips in [the troubleshooting guide](#)

RECORDING A VIDEO

SHOW BREADBOARD PROPERLY

- Use large webcam window
- Tilt lid of your laptop to bring electronics into view
- Webcam view is resizable
- OBS Studio: [Add a scene](#) (with different size/views)

Loom: Use largest webcam view:



AppDev1 practical demo 2

<https://youtu.be/orzEMRrpHaM>



<https://youtu.be/orzEMRrpHaM>

BROKEN PARTS?



Possible solutions:

- Collect a spare part (we have them with us)
- Do assignment in a different way (ask us!)
- Broken Nano? Use the other (there are 2 in the kit!)
- Buy a new part yourself, [shop-links are in the checklist](#)

PARTS FOR PROJECT...?

BORROW PARTS FROM TEACHER

[Check out what is in the kit here](#)



- Lego Mindstorms kits including EVShield
- Sensors: color, RFID, ...
- Displays: touch screen
- Actuators: servo's, [MP3 module + speaker](#)
- Advanced: Raspberry Pi Pico, ESP32 Modules

Tip: [search Fjodor's site](#) for a component. If there is a tutorial, Fjodor probably has that component!

Page with [electronics kit contents](#) also lists components that can be borrowed!

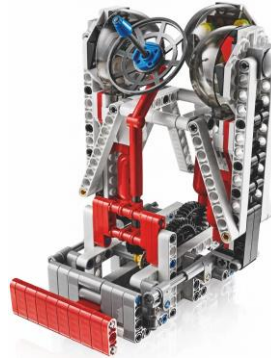
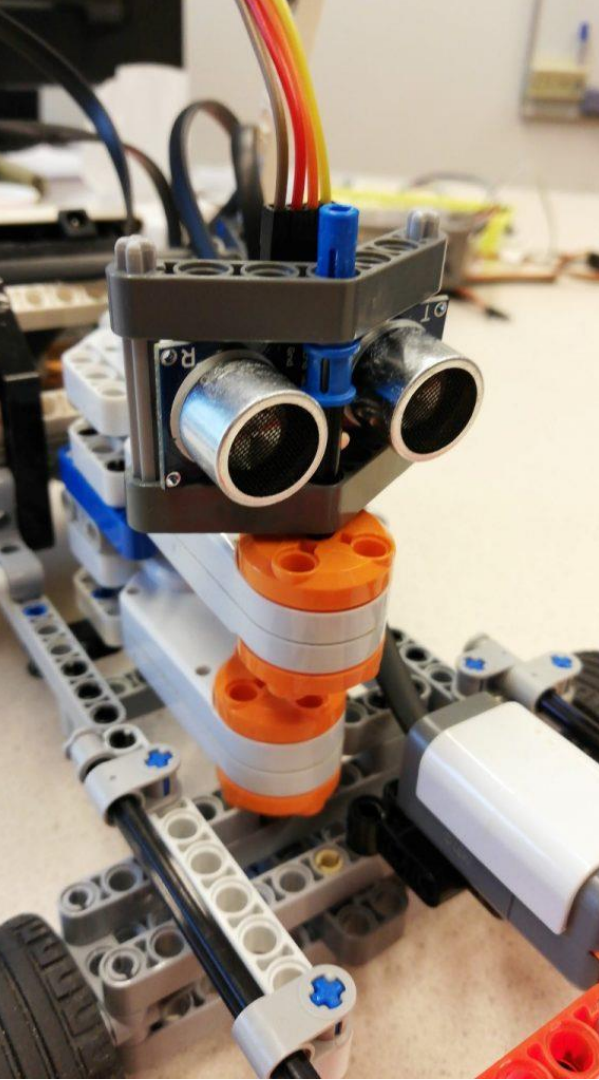
Extra components that can be borrowed

Of some there are only 1 or a few, so make sure to let me know well in advance if you need something! The

- [Mp3 player module with micro-sd card slot](#) [tutorial/more info]
- [Various speakers and buzzers](#) [tutorial/more info]
- [Various stepper motors](#) [tutorial/more info]
- Microprocessors
 - [Lolin32 Lite/ESP32-WROVER-IE dev kit](#) ESP32 module (like Arduino Nano, but with Wifi & Bluetooth)
 - [Raspberry Pi Pico](#) can be programmed in either Arduino or [Python](#)
- [Various displays and touch screens](#) [tutorial/more info]
- [Joystick module](#) [tutorial/more info]
- Radio communication
 - [HM10 BLE Bluetooth module](#) (warning: the Arduino Nano BLE which is in the base kit already has)
 - [RF Transceiver 2,4GHz NRF24L01+](#) [tutorial/more info]
- [GPS module Ublox NEO6MV2](#) [tutorial/more info]
- [RFID reader + card & dongle](#) [tutorial/more info]
- Sensors:
 - [TCS3200 color sensor](#) [tutorial/more info]
 - [Infrared distance sensor](#) [tutorial/more info]
 - [TOF laser distance sensor](#) [tutorial/more info]
- Power:
 - [Breadboard power module](#) [tutorial/more info]
 - [9V battery clips](#) [tutorial/more info]
 - [Various battery holders](#) [tutorial/more info]
- Lego Mindstorms
 - [Lego mindstorms kit](#) (approx. 15 kits available) [tutorial/more info]
 - [EV-shield Lego controller shield](#) (Control Lego motors and sensors via Arduino) [tutorial/more info]

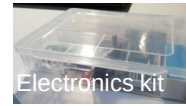
USE LEGO FOR PROJECT?

Borrow a Lego
Mindstorms set



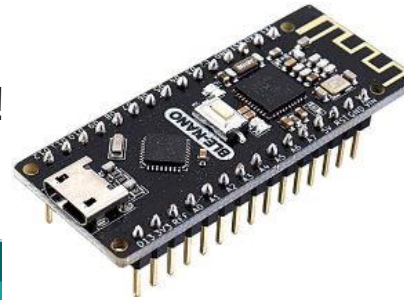
Lego: Build remote controlled
Rover car with **Arduino brain**

DIFFERENCE NANO AND BLE-NANO

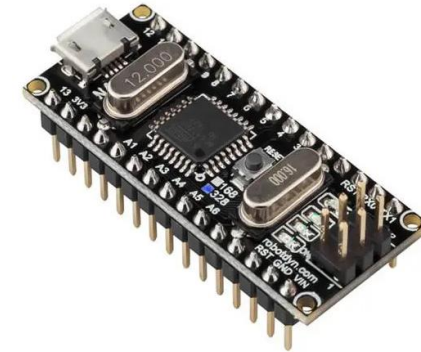


What is in the Electronics kit?
[Check it here](#)

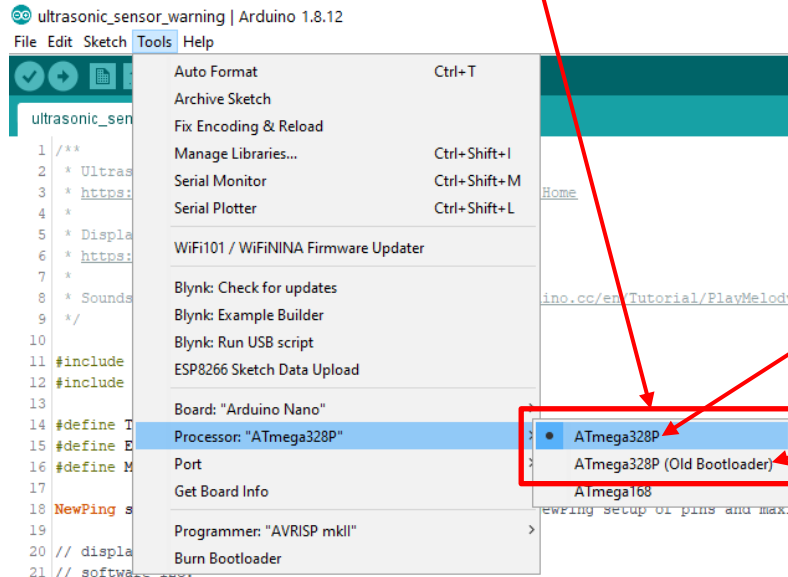
- Pins are the same
- Processor is different!!



BLE-Nano
with Bluetooth
(or newer Nano with
USB-C)
Use programmer:
ATmega328P



Nano
(Robodyn)
Use programmer:
ATmega328P (Old Bootloader)



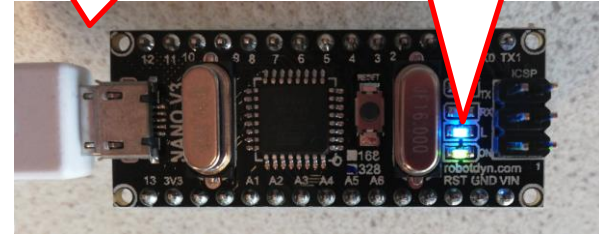
Need help? Check [troubleshooting guide](#)

TROUBLESHOOTING

- Trouble connection/uploading sketch?
Start with a basic sketch, e.g. Blink:
- Follow troubleshooting steps

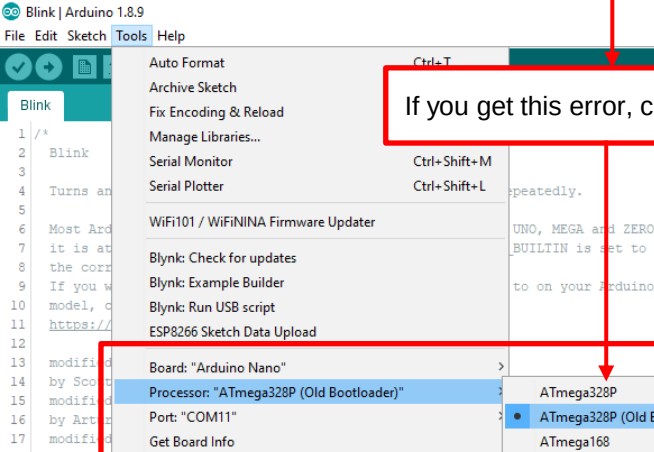
Remove Nano from breadboard, then test, e.g. with Blink example :

Blue LED is onboard led which should blink (in other models, can be other LED)

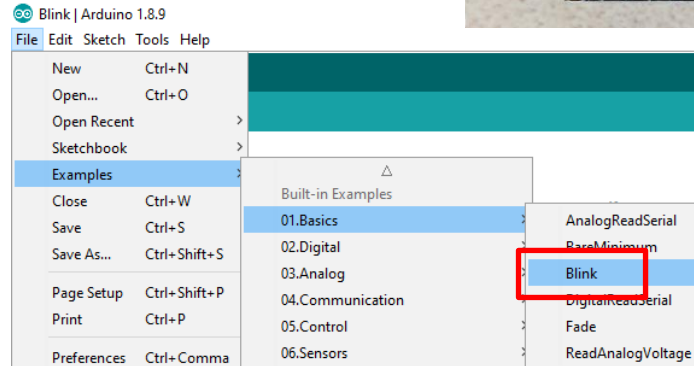


An error occurred while uploading the sketch

```
avrdude: stk500_getsync() attempt 9 of 10: not in sync: resp=0x00
avrdude: stk500_getsync() attempt 10 of 10: not in sync: resp=0x00
An error occurred while uploading the sketch
```



If you get this error, change setting:

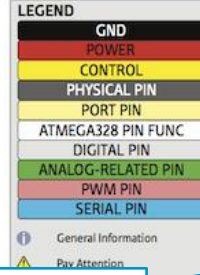
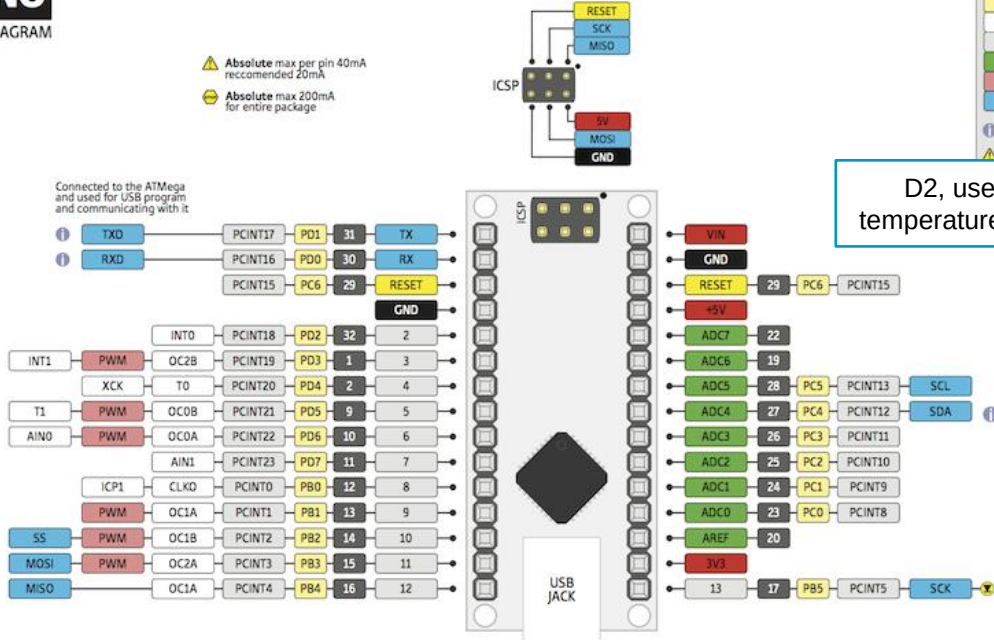


NANO PINOUT

THE
UNOFFICIAL
**ARDUINO
NANO**
PINOUT DIAGRAM

- ⚠ Absolute max per pin 40mA
recommended 20mA
- ⚠ Absolute max 200mA
for entire package

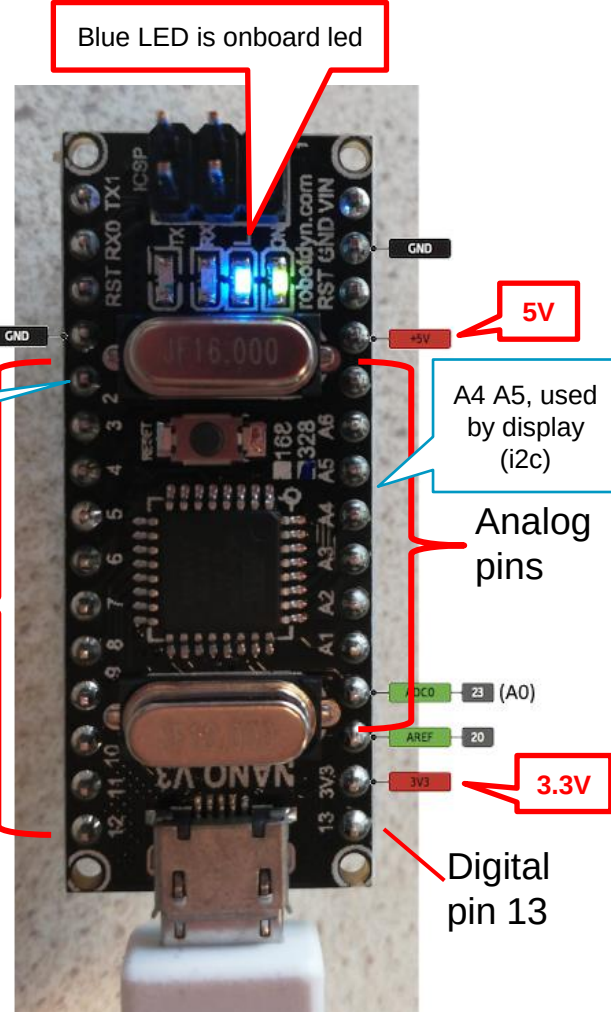
Connected to the ATmega
and used for USB program
and communicating with it



D2, used by
temperature sensor

Digital
pins
1-12

On version 2
Analog Pins are reversed
e.g. A0 ↔ A7, A7 ↔ A0

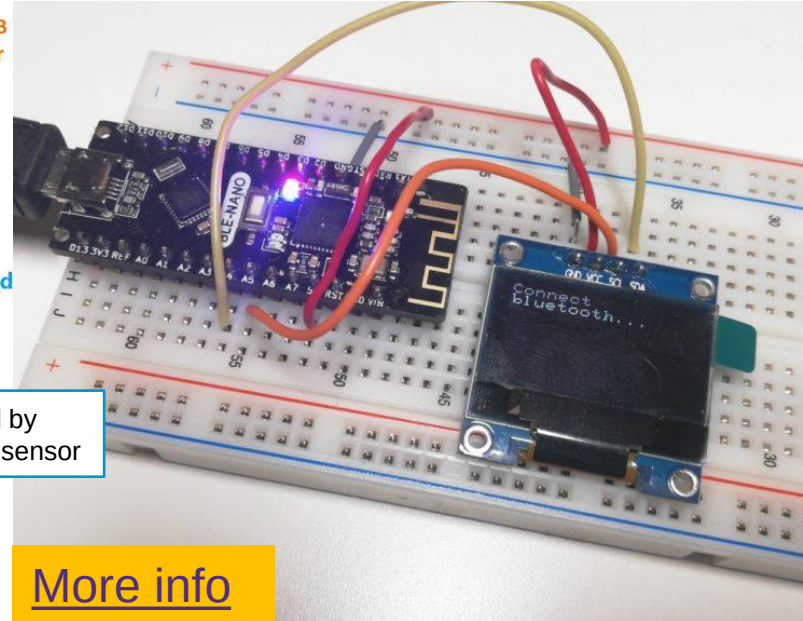
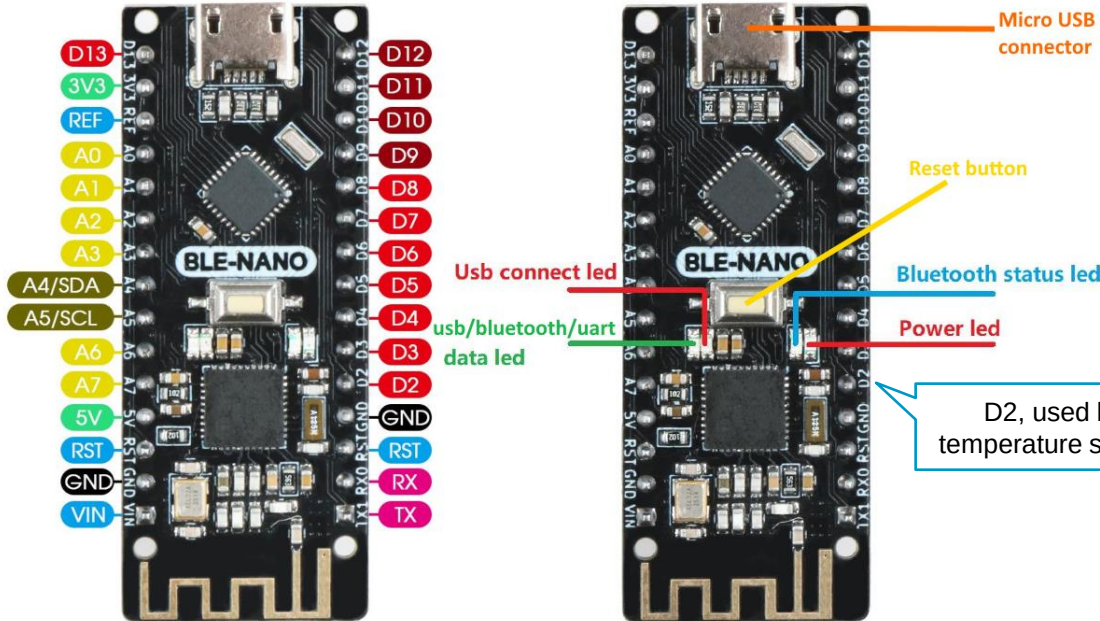


[Download full pinout](#)

BLE-NANO PINOUT



[Introduction to the Arduino BLE Nano](#)



[More info](#)

- Arduino
- Power
- SPI
- Analog
- BLE 4.0
- PWM
- I2C
- Serial

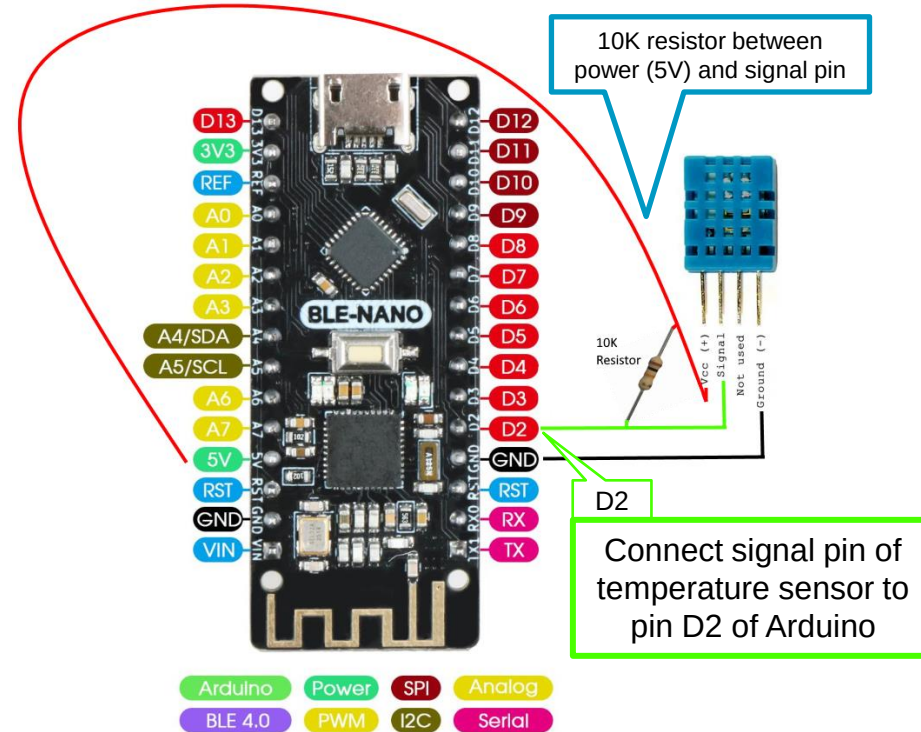
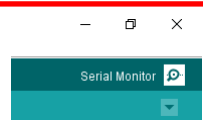
UNIVERSITY OF TWENTE.

Using BLE-Nano in a crowded lecture room?
[Change its name, otherwise it will be hard to find!](#)
 (all BLE-Nano's will have the same name: BLE-Nano)

TEMPERATURE & HUMIDITY

- DHT11 sensor
- If not installed yet, install 2 libraries: "Adafruit Unified Sensor" and "DHT library" (via *Sketch > Include Library*, search for the name)
- Example: *File > Examples > DHT sensor library*, "DHT_Unified_Sensor"

In example code, **set sensor type DHTTYPE to DHT11**, view output in Serial Monitor



TEMPERATURE & HUMIDITY

SHOW OUTPUT ON OLED DISPLAY

[More on OLED display](#)

- Start with example “DHT_Unified_Sensor” (*File > Examples > DHT sensor library*)
- Add display code:

1) at top:

```
#include <U8g2lib.h>

// display setup:
U8X8_SSD1306_128X64_NONAME_HW_I2C display(U8X8_PIN_NONE);

char buf[10]; // text buffer; to be able to use draw2x2String to show value
```

2) in setup():

```
// initialize display:
display.begin();
display.setPowerSave(0);
display.setFont(u8x8_font_pxplusibmcgathin_f);

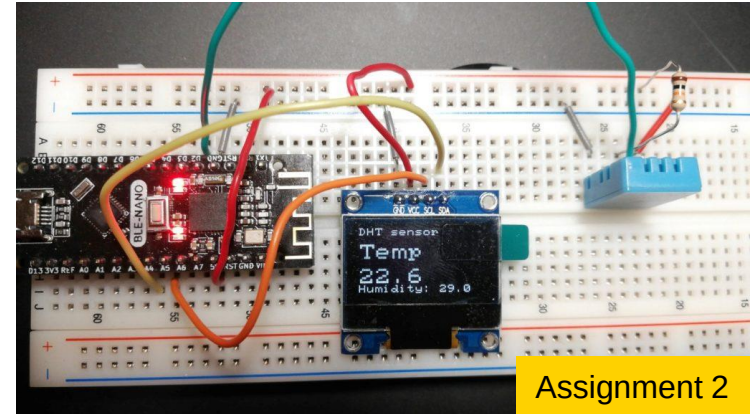
// show texts that do not change:
display.drawString(0,0,"DHT sensor");
display.draw2x2String(0,2,"Temp");
display.drawString(0,7,"Humidity:");
```

3) in loop():

find spot where temperature is printed, add:

```
// display temperature on display:
dtostrf(event.temperature, 3, 1, buf); // print float like XXX.X
display.draw2x2String(0,5,buf);
```

... repeat last step for humidity

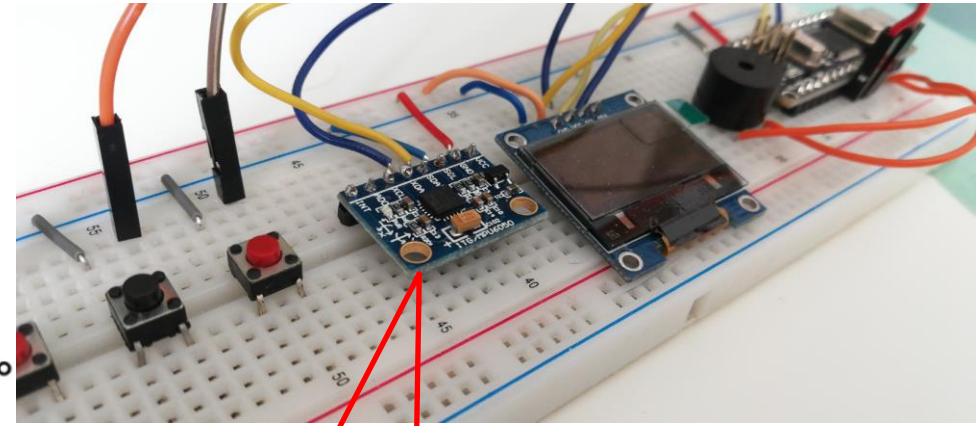
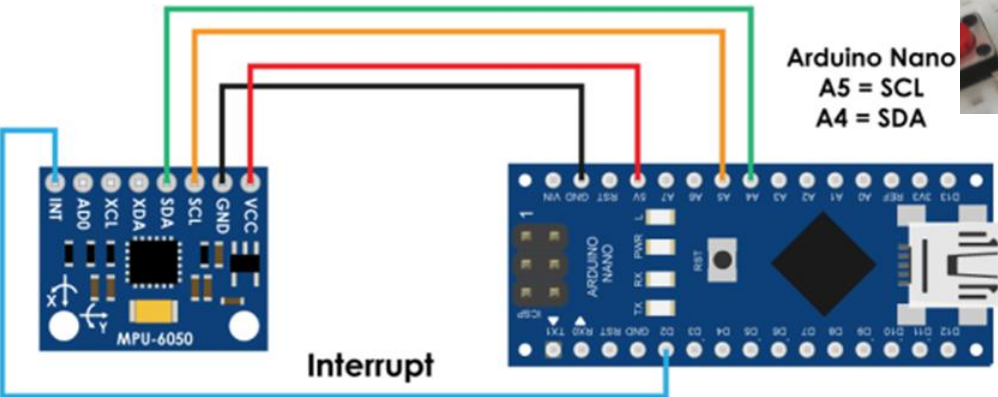


Assignment 2

ACCELEROMETER & GYROSCOPE SENSOR

ITG/MPU6050

- Detects movements in 3d
- Example sketch: [mpu6050 basic test.ino](#)
- Outputs movements to Serial Monitor, can for instance be the base of a Wii - style game controller



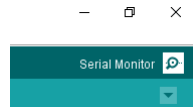
ITG/MPU6050
Accelerometer &
Gyroscope sensor

COMMUNICATION: SERIAL CONNECTION

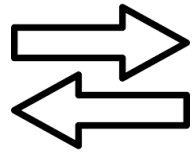
Speed, can be
115200 or other

```
Serial.begin(9600);  
Serial.print("Temperature: "); Serial.println(temp);
```

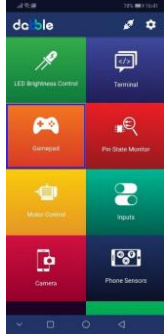
- USB cable
 - Serial Monitor in Arduino IDE
 - Another App, e.g. your own Java App: Example in alternative step 3 of assignment
- Wired (via pins) to another device (e.g. another Arduino, Bluetooth module)
 - [Using RX/TX pins](#) (also used by USB!)
 - [Using any other pins](#)
- Wireless e.g. via Wifi or Bluetooth module



REMOTE CONTROL



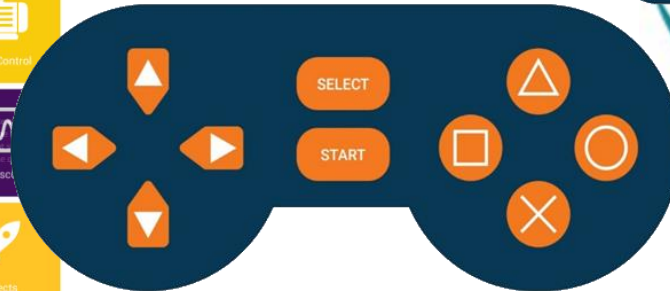
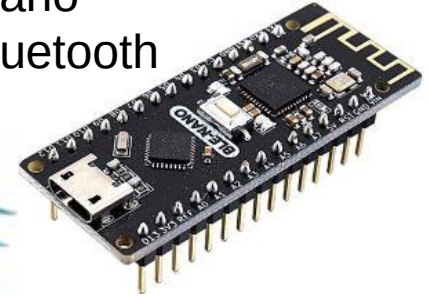
Two-way interaction



- Bluetooth module built in BLE-Nano wireless communication for Arduino
- Dabble, Serial Bluetooth Terminal

BLE-Nano
with Bluetooth

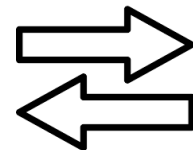
4.0 Bluetooth®



Getting started with Dabble App + BLE-Nano

CONNECT TO AN APP: BLYNK

LIKE DABBLE BUT MORE FLEXIBLE USERINTERFACE BUILDER



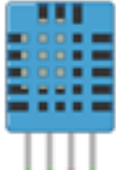
Two-way interaction



- Connect via Wifi or Bluetooth to an App
- Two-way connection
- Control your electronics and read sensors
- You can define the Userinterface of the App yourself

[Learn more: docs.blynk.io](https://docs.blynk.io)





PRACTICAL ASSIGNMENT #2

FOR TODAY'S PRACTICAL SESSION

Build a connected temperature & humidity sensor

- Using BLE-Nano in a crowded lecture room? [Change its name](#), otherwise it will be hard to find! (all BLE-Nano's will have the same name: BLE-Nano)
- As a backup, it is possible to use the regular Nano also, but then you can not do step 3 (as it has no Bluetooth). In that case, do the alternative that is provided

