UNIVERSITY OF TWENTE.

LEGO MINDSTORMS & ARDUINO

PRACTICAL SESSION 3

Part of SmartProducts

LEGO MINDSTORMS & ARDUINO

PRACTICAL SESSION 2

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

- Using Arduino modules: displays, sensors
- Communication using Wifi module
- Arduino programming - part 3
- Assignment

slides @ vanslooten.com/appdev

LAST TUESDAY

Quite a lot of problems, like with Color Sensor, EvShield, Arduino Nano

Some of you were able to make progress and solve problems

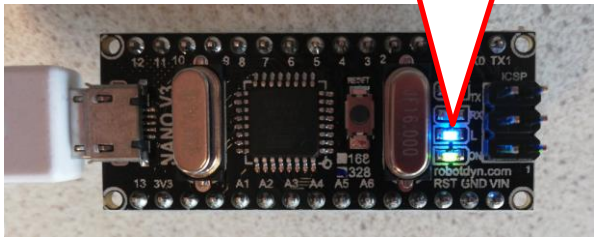
- Today we take a step back, tutorial for this assignment should be easier

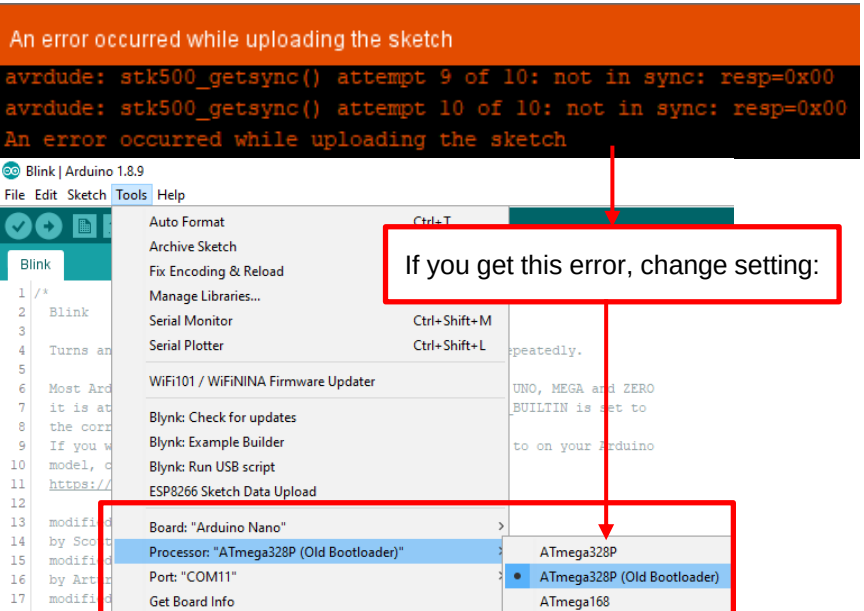
Tips:

- 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

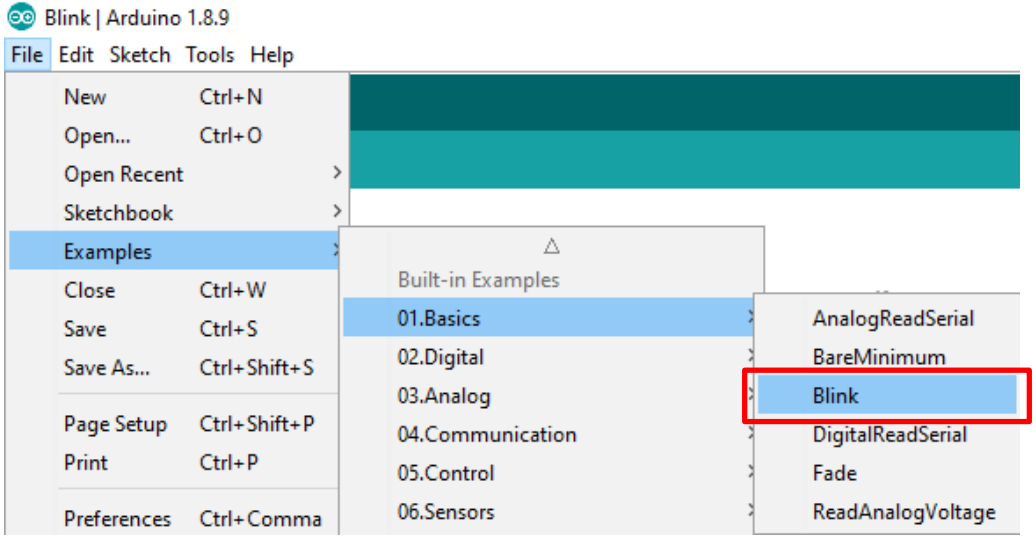
TROUBLESHOOTING

- Trouble connection/uploading sketch?
  Start with a basic sketch, e.g. Blink:
- Check connection settings





If you get this error, change setting:



LCD DISPLAY
WITH I2C BACKPACK

2 lines of text, bright backlight, blue screen, white text

Adjust backlight with small knob on back

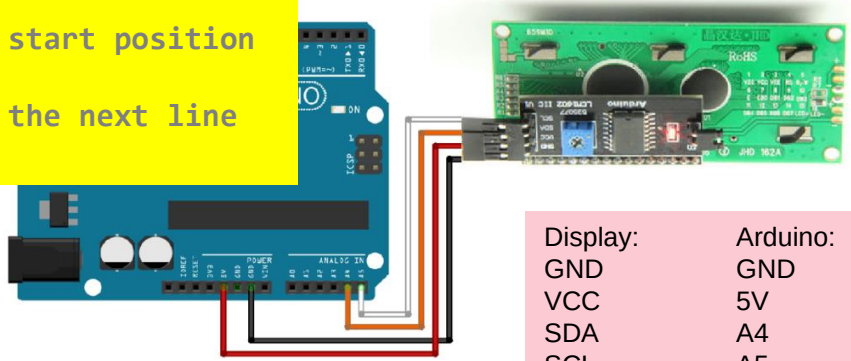
Examples that come with this library do not work out-of-the-box

- Library: New LiquidCrystal
- Example: *LCD_HD44780_i2c_hello_world_example.ino*
- Change address: 0x27, 0x3F or 0x38

Type: HD44780

```
LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7);
// first parameter is address, can be 0x27, 0x3F or 0x38

lcd.home();                    // go to start position
lcd.print("Hello, world!");
lcd.setCursor(0,1);            // go to the next line
lcd.print("AppDev example");
```



Shares i2c connector (A4,A5) with EVShield, but works fine!

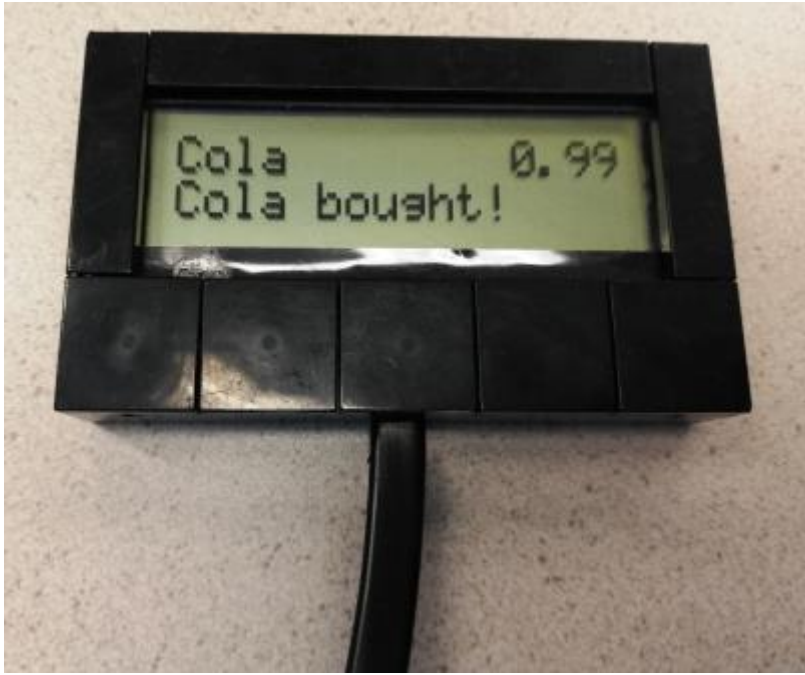
Display:	Arduino:
GND	GND
VCC	5V
SDA	A4
SCL	A5

More: display-guide

LEGO LED DISPLAY

CONNECT TO EVSHIELD

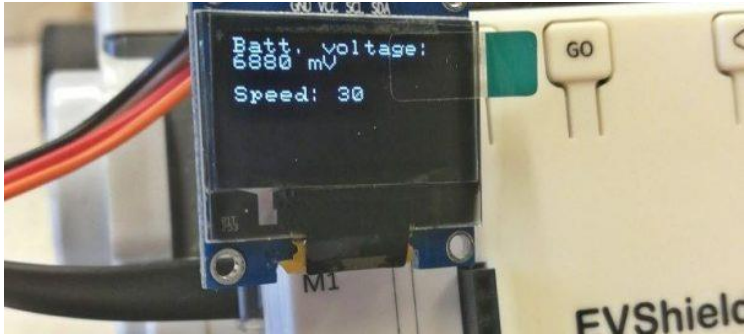
- 2 lines of text
- Connects to sensor port of EVShield (e.g. BAS1)
- Example: evshield_lego_display.ino (requires added class **EVs_Display**, in version as distributed in zip-file AppDev)



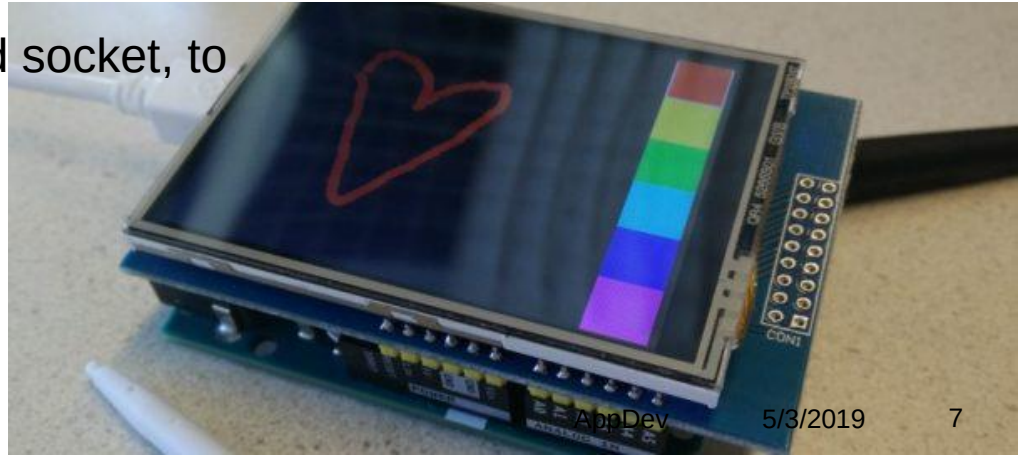
More: display-guide

MORE DISPLAYS
CAN BE BORROWED

- Small OLED screen
- Color TFT Touch screen
- Both can be combined with EVShield

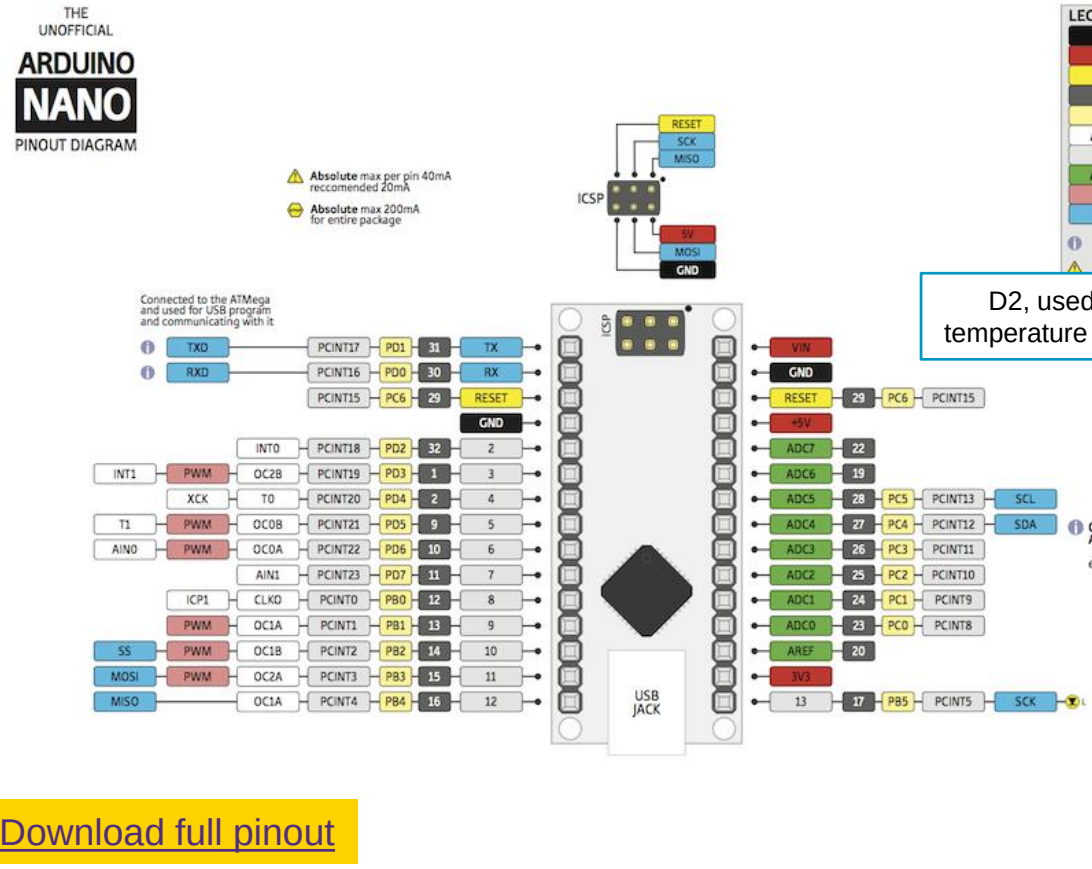


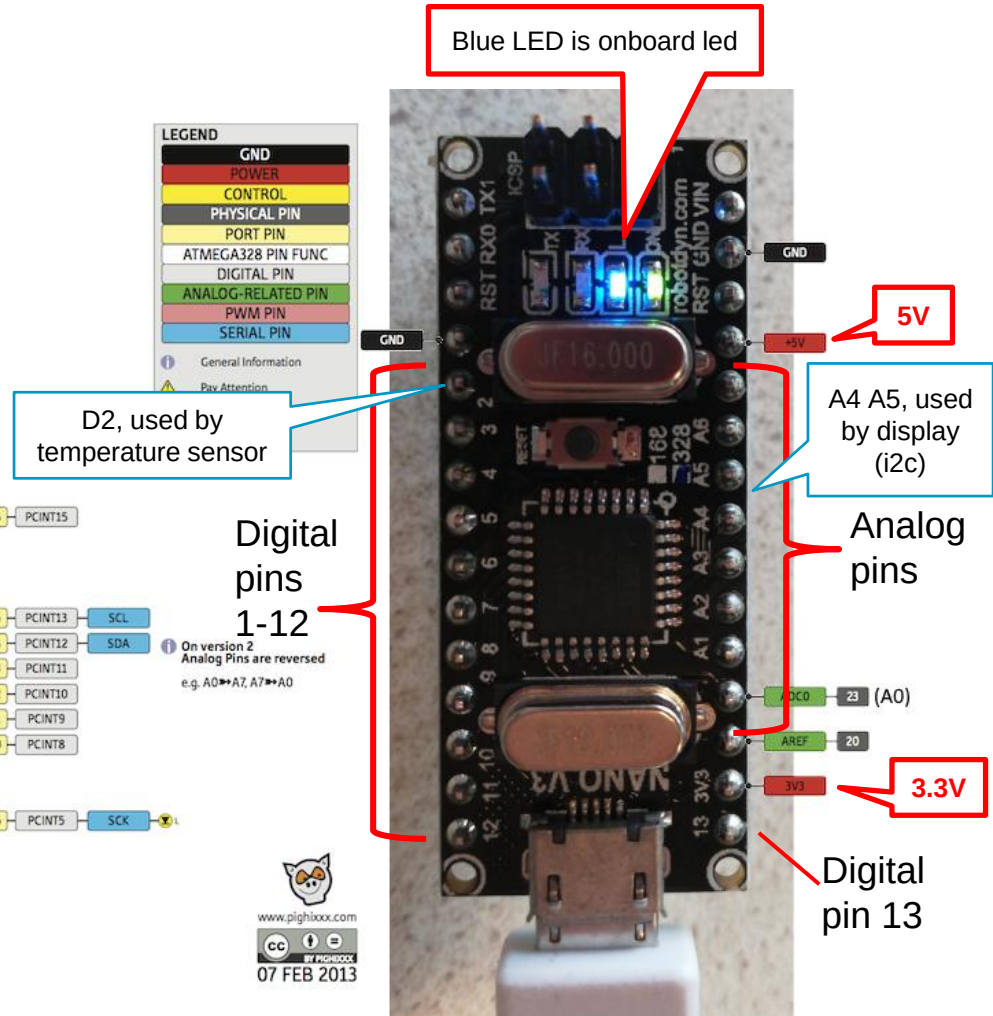
- Touch screen has SD card socket, to store data (e.g. images)



More info & touch screen examples

NANO PINOUT

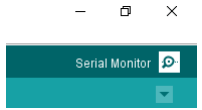




[Download full pinout]

TEMPERATURE & HUMIDITY

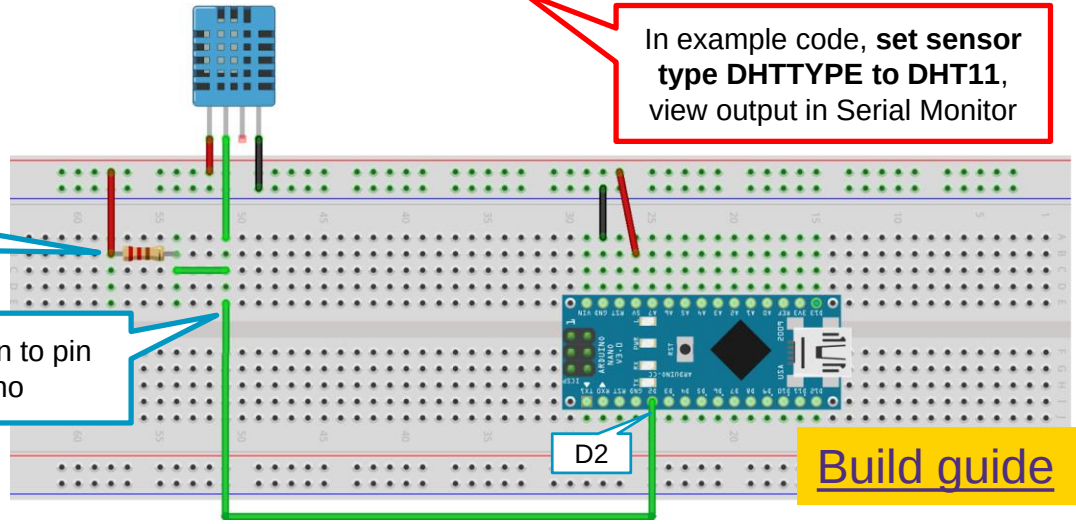
- DHT11 sensor
- If not installed yet, install 2 libraries: "Adafruit Unified Sensor" and "DHT library" (via *Sketch* > *Include Library*, search for the name)
- Example: *File* > *Examples* > *DHT sensor library*, "DHT_Unified_Sensor"
- Circuit:



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

10K resistor between power (5V) and signal pin

connect signal pin to pin D2 of Arduino



UNIVERSITY OF TWENTE.

Build guide

TEMPERATURE & HUMIDITY

SHOW OUTPUT ON DISPLAY

- Start with example “DHT_Unified_Sensor”
- Add display code

at top:

```
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,2,1,0,4,5,6,7); // first parameter is I2C bus address,
// this can be: 0x27, 0x3F or 0x38 (try all values if it does not work)
```

in setup():

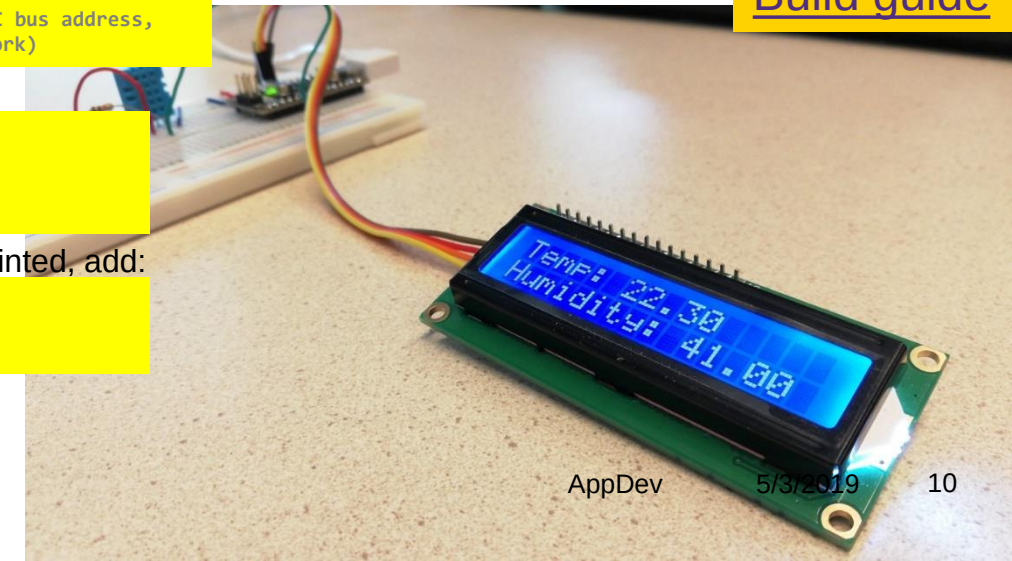
```
// activate LCD module
lcd.begin(16,2); // for 16 x 2 LCD module
lcd.setBacklightPin(3,POSITIVE);
lcd.setBacklight(HIGH); // turn on backlight
```

in loop(): find spot where temperature is printed, add:

```
lcd.home(); // set cursor to 0,0
lcd.print("Temp: ");
lcd.print(event.temperature);
```

… repeat for humidity

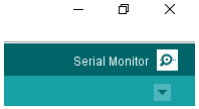
Build guide



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 Appendix of Java assignment 3
- Wired (via pins) to another device (e.g. another Arduino)
  - Using RX/TX pins (also used by USB!)
  - Using any other pins
- Wireless e.g. via Wifi or Bluetooth module

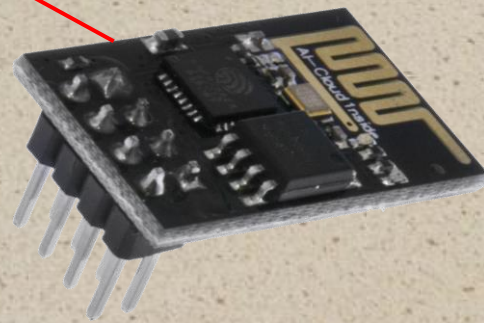
WIFI MODULE

ESP8266

Wifi network: “**mspot**”

With password as written on whiteboard

ESP8266 module

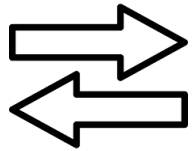


- Connect a Wifi module to any circuit

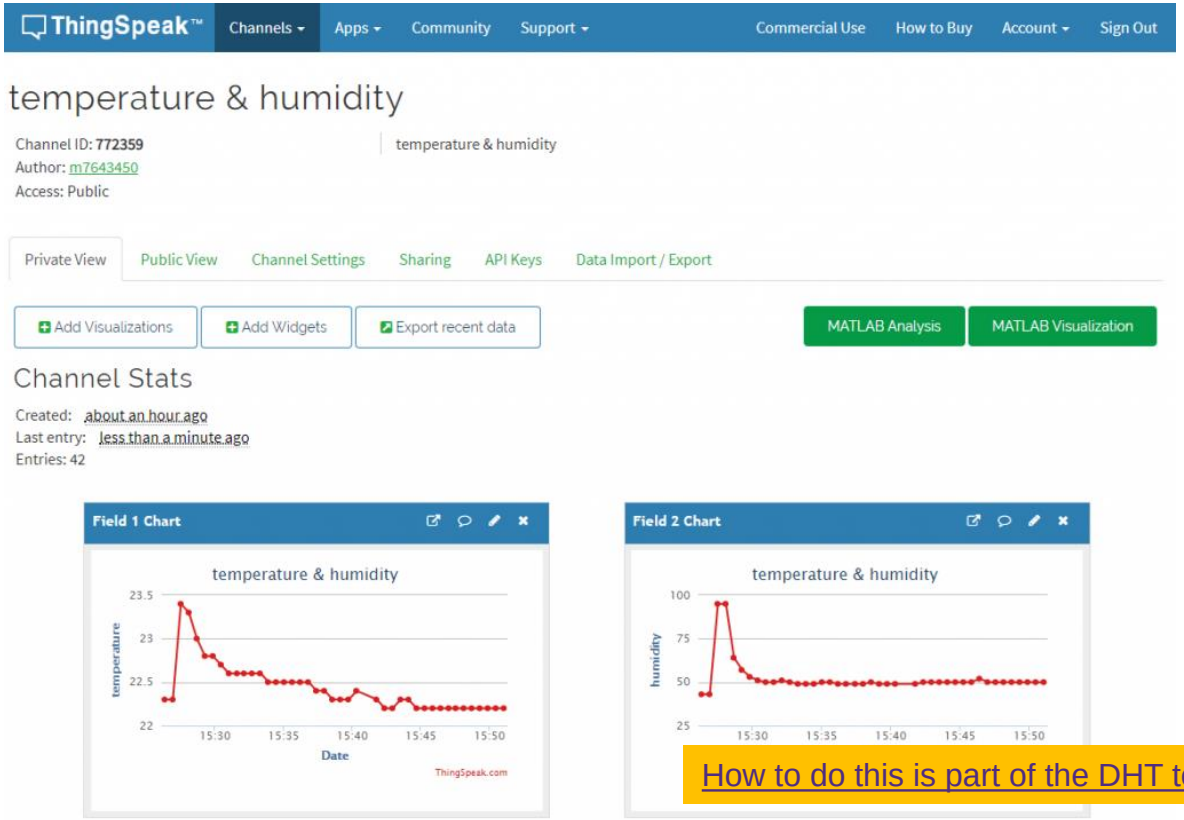
How to do this is part of the DHT temperature & humidity tutorial

PUBLISH SENSOR VALUES ONLINE

USING WIFI MODULE & THINGSPEAK



Send (or read) data to/from the cloud

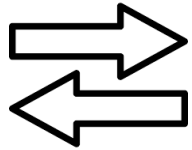


Java + ThingSpeak.com + IFTTT ifthisthenthat

How to do this is part of the DHT temperature & humidity tutorial

CONNECT TO AN APP: BLYNK

SIMILAR TO DABBLE BUT MORE POSSIBILITIES



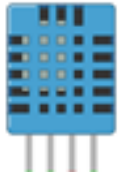
Two-way interaction

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

[Learn more: docs.blynk.cc](docs.blynk.cc)

Blynk

[Read more about Blynk here]

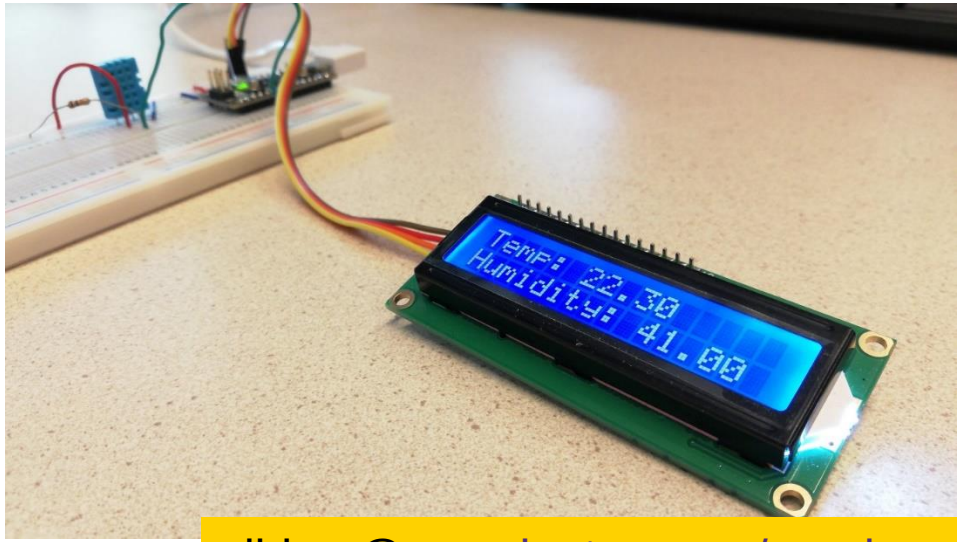


ASSIGNMENT

FOR TODAY'S PRACTICAL SESSION

- Build a connected temperature & humidity sensor

- Do this in groups of 3 (split project group in two teams)
- You can do this assignment with any Arduino (Nano or Uno)
- If you use the Uno, you can add EVShield + Lego Display
- 1 temperature sensor in Arduino kit: get more from teacher
- You have 2 displays (per project group): LCD display & Lego display, need more? get more from teacher



slides @ vanslooten.com/appdev

If your kit is missing pieces/materials, you can get replacements from teacher!

ASSIGNMENT: CHALLENGES

1. Build a temperature sensor with a display (follow tutorial)
2. Connect the Arduino to laptop (USB cable): display temperature & humidity in the Java App you made this morning (details in Appendix of Assignment 3)
3. Add a Wifi module and publish values online (on ThinkSpeak)
4. Create a warning if the temperature reaches a limit (e.g. 24°).
   Can be:
   - A LED on the breadboard (add a LED)
   - Warning in the Java app

slides @ vanslooten.com/appdev