Vhodno izhodne naprave

Laboratorijska vaja 1 - VP 1
Uvod v VINProjekt, tipala,
TinkerCad simulacije

VIN projekt - VP1: Uvod, tipala, TinkerCad osnove

- Uvod v VIN projekt
- Tipala
- Spoznavanje TinkerCad-a
- Domača naloga (DN2-VP1)

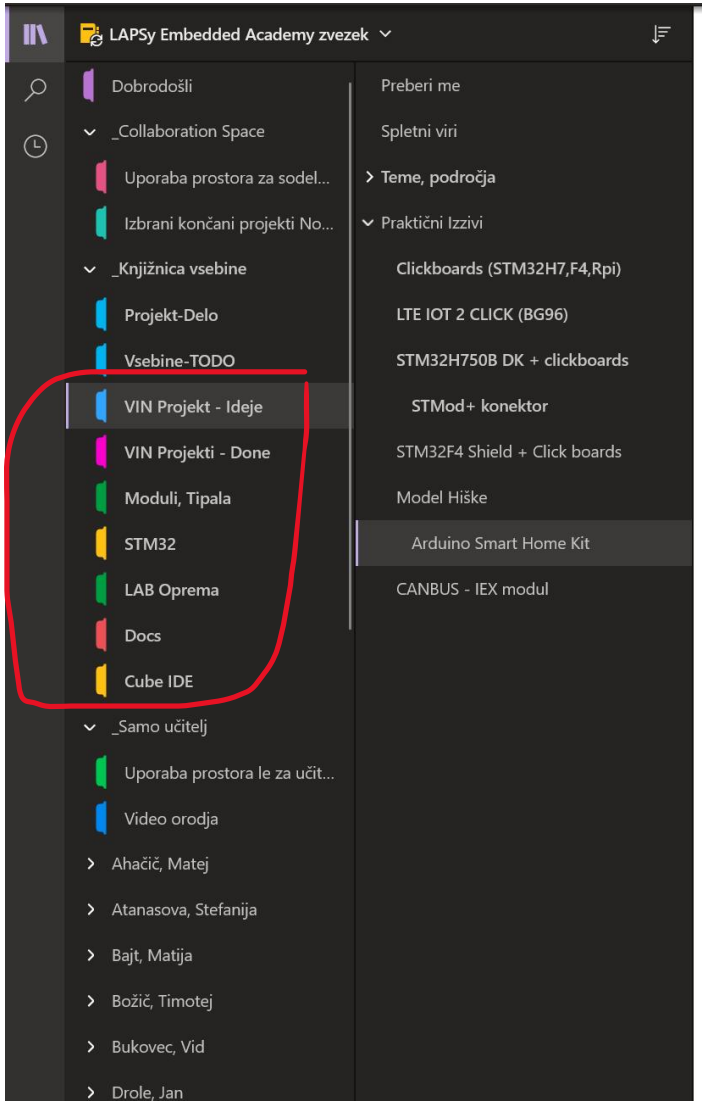
VIN projekt - VP1: Uvod, tipala, TinkerCad osnove

- Uvod v VIN projekt
- Tipala
- Spoznavanje TinkerCad-a
- Domača naloga (DN2-VP1)

VIN projekt

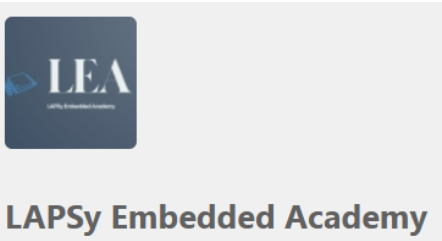
- Izhodišči
  - Spoznavanje delovanja vhodno izhodnih naprav
    - Povezave: Mikrokrmilnik, tipala, tipke, LED diode, …
  - Analiza/izvedba komunikacije med vgrajenimi sistemi oz. tipali
    - 1-Wire, SPI, I2C, RS232, CANBUS, RS485, MODBUS, …
- Metode:
  - Priprava (po potrebi): Tinkercad simulacija in priprava kode (po potrebi)
  - Izvedba na pravem sistemu
    - Osciloskop, STM32, tipala, „breadboard“, prototipi – npr. „pametna hiška“
- Predstavitev, poročilo:
  - (živa predstavitev 5min)
  - poročilo v obliki gradiva, objave na blogu (povzetek, poster, video)
  - video (do 2min) in grafična predstavitev („poster“, skica, miselni vzorec)

VIN Projekt – Delo MS Teams

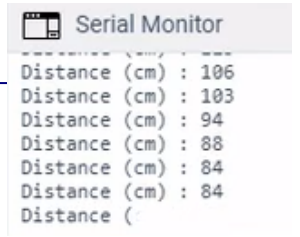


Še nekaj dodatnih izhodišč za tiste, ki vas delo z mikrokrmilniki in senzorji zanima (vsako opravljeno in dokumentirano delo se tudi šteje kot dodatne naloge):

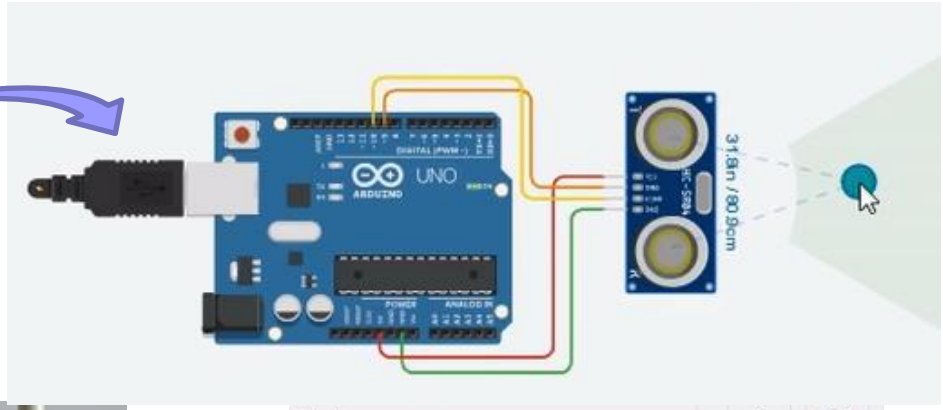
- Preveri delovanje IR senzorja razdalje GP2D12 (razdaljo sporoča preko analognega izhoda – torej z vrednostjo napetosti:
  - https://www.swanrobotics.com/projects/gp2d12_project/
  - https://engineering.purdue.edu/ME588/SpecSheets/sharp_gp2d12.pdf
- Za mikrokrmilnik obstaja cela zbirka različnih senzorjev (37) in je na voljo v priročnem kompletu. Kar nekaj senzorjev lahko priključite na krmilnik Arduino, ali pa se seveda lahko inspirirate z objavljenimi projekti na spletu. Gradiv je res veliko.
- Še veliko več vseh ostalih virov najdete v MS Teams ekipi
  - LAPSy Embedded Academy group:
    - MS Teams
      - Koda za vstop: **ty5qjm9**

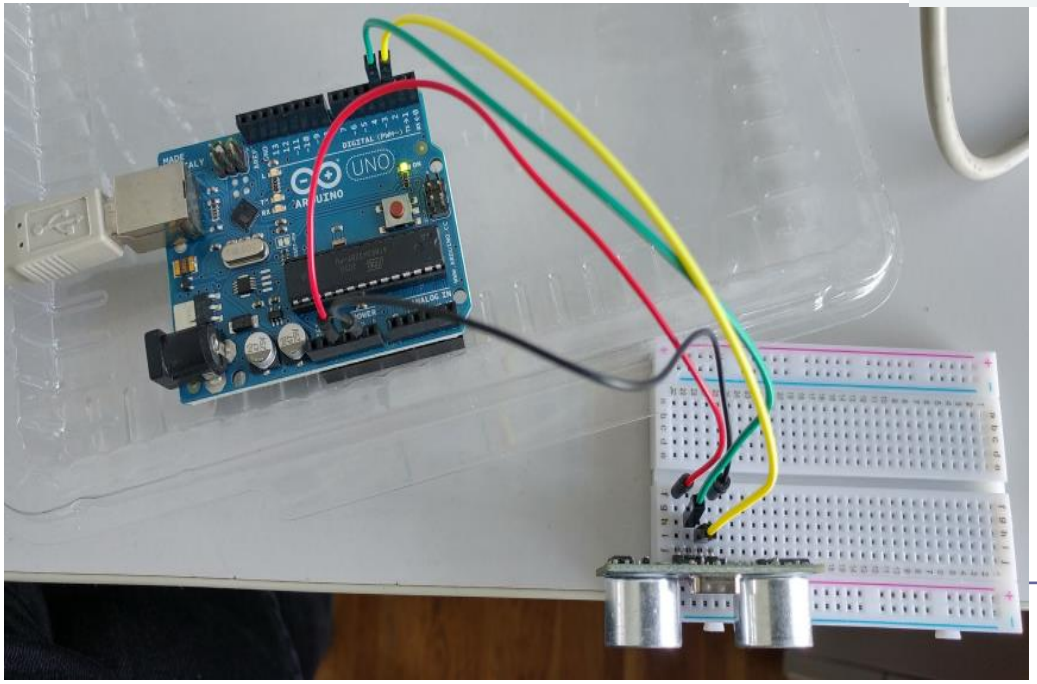


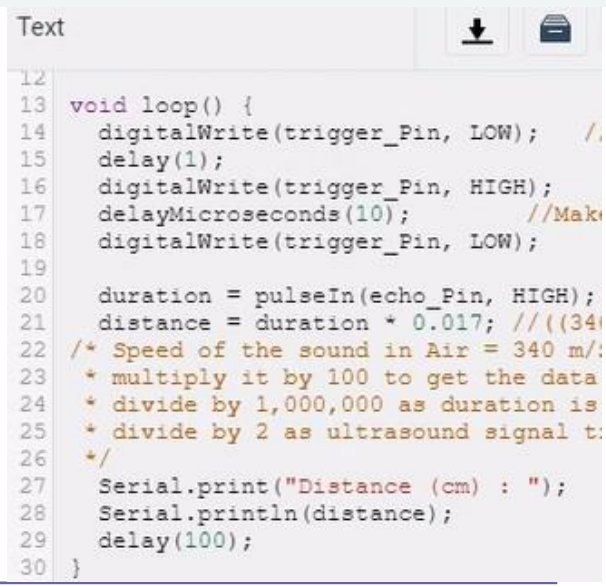
Simulacija: TinkerCad



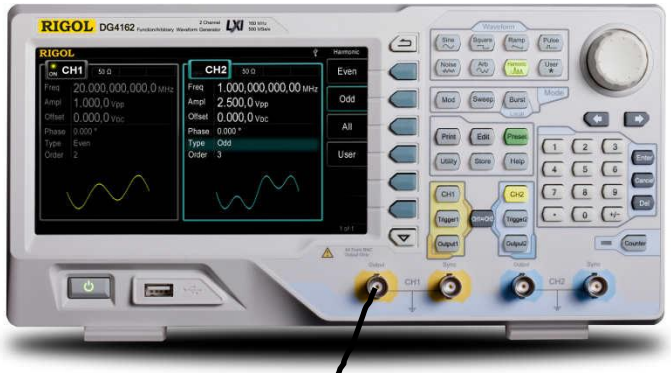
https://www.tinkercad.com/

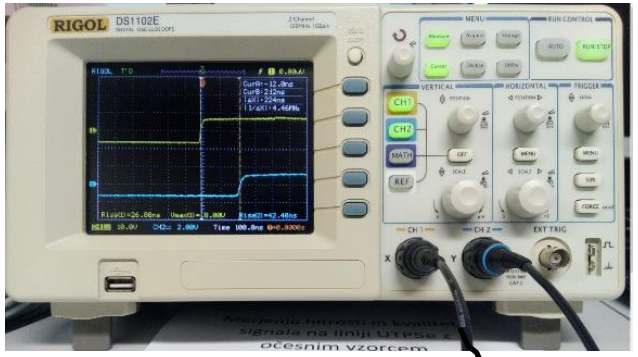


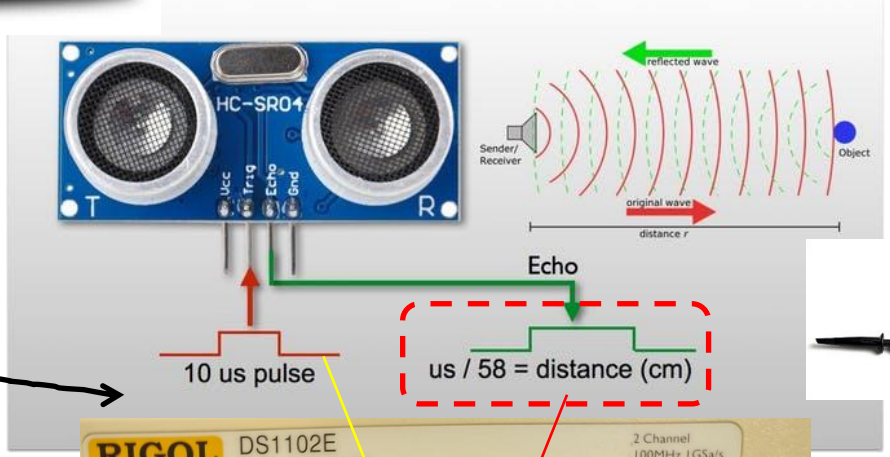


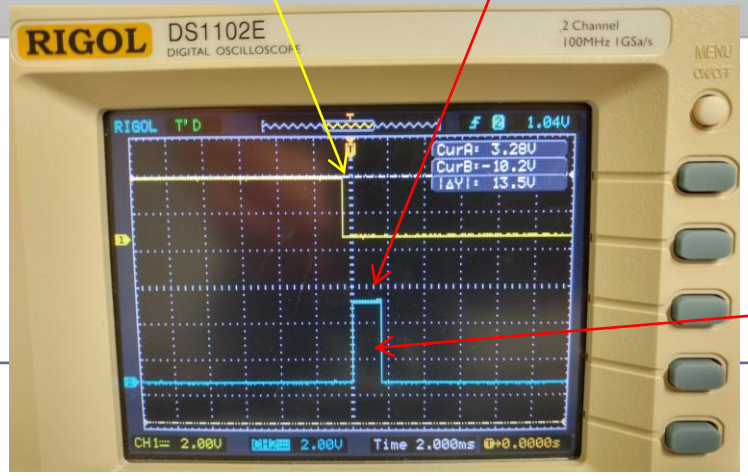


Praktična izvedba (meritev)





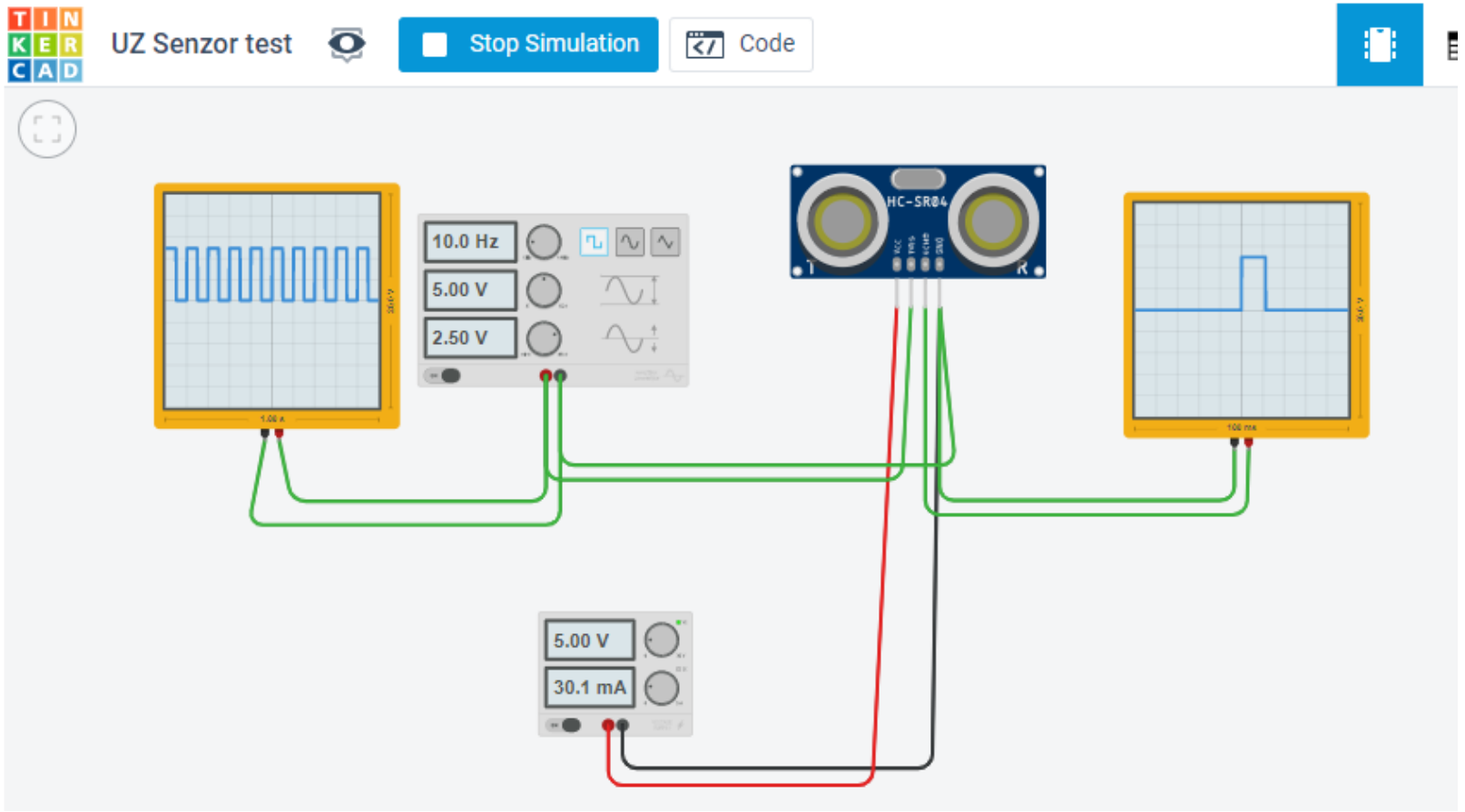




Osciloskop - nastavitev
Measure -> Time-> Width

Simulacija (meritev)

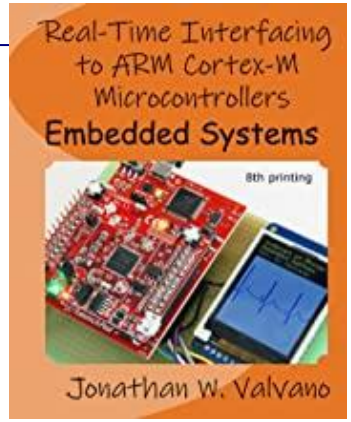
UZ Senzor test



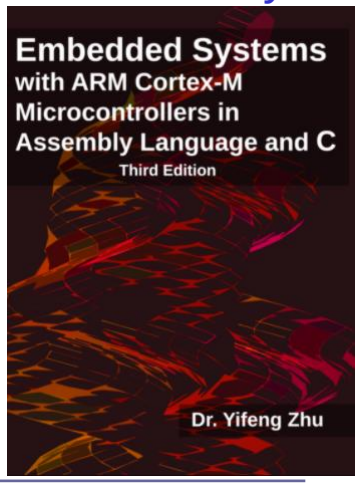
Predlog pristopa k VIN projektu :

- Raziščem delovanje osnovnih senzorjev (literatura), lahko DN1
  - Primer:
    - https://www.circuito.io/blog/arduino-sensors-explained/
- Naredim nekaj poskusnih projektov v TinkerCadu (po potrebi, DN2-VP)
  - spoznam se z okoljem
  - preizkusim nekaj osnovnih povezav
  - preizkusim napredne projekte s komunikacijo (mikrokrmilnik <-> tipalo)
- Fokusiram temo za svoj projekt
  - Iskanje po spletu, pregled izpostavljenih zanimivih projektov
  - Osnovna ideja sistema:
    - Načrt: mikrokrmilnik (STM32) kot centralni del sistema
    - Izvedba: STM32, povezan na nekaj tipal in komunicira ali prikazuje rezultate (USB, LCD, serijski vmesnik, …)
  - Nadgradnje sistema (neobvezno)
    - Veliko idej, več mikrokrmilnikov, komunikacijski sistem (RS485, Canbus), povezava s PC (in naprej), …
- Izvedba projekta (TinkerCad, CubeIDE), poročilo in predstavitev

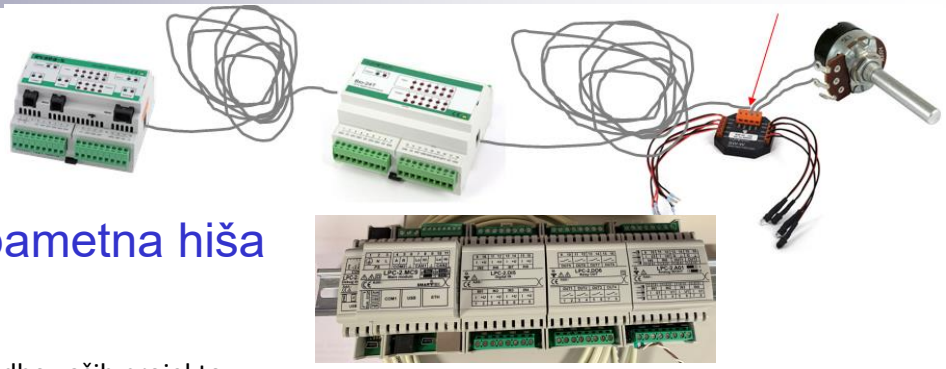
Literatura (za praktično delo):



- Valvano: Embedded Systems - Shape The World
  - knjiga (tudi PDF)
  - spletne vsebine:
    - EdX course :
      - https://www.edx.org/course/embedded-systems-shape-world-utaustinx-ut-6-03x
      - https://www.edx.org/course/embedded-systems-shape-the-world-multi-threaded-in
    - Ebook:
      - http://users.ece.utexas.edu/~valvano/Volume1/E-Book/
- Zhu: Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C
  - Knjiga
  - Spletne vsebine (tudi youtube tutoriali) :
    - https://web.eece.maine.edu/~zhu/book/



VIN projekt – izzivi



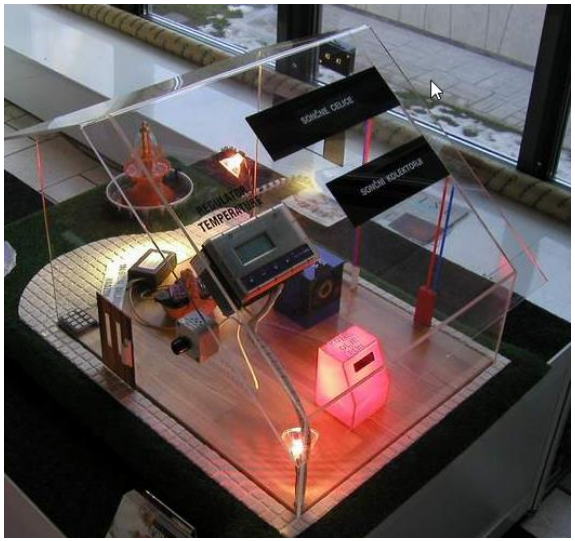
- Praktična realizacija projektov:
  - Npr. CANBus, Smarteh LPC, pametna hiša
- Praktični projekti – hiška :

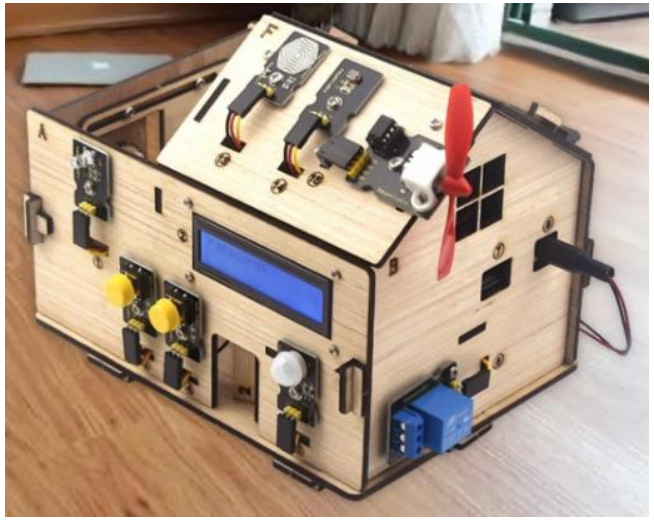
Model je mišljen predvsem kot ena od idej za praktično izvedbo vaših projektov.
Hiška je na poti na fakulteto in bo prisotna v našem laboratoriju.

Nabavil sem nekaj miniaturnega pohištva, da bo zgledalo bolj realno.

Ideja je hiško osvežiti, dodati nove naprave (razsvetljava, tipala) in narediti nek demo projekt/model pametne hiše

Nekaj slik :





VIN projekt – izzivi

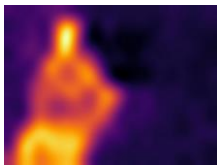
Multi-tipala

- LIR2 – Smarteh

Vin projekt

Detekcija ljudi s senzorjem LIR2

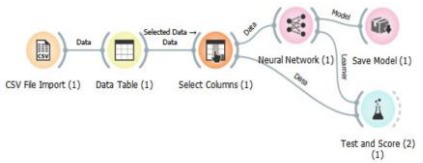
Jakob Jelovčan



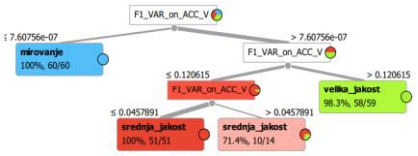
- SensorTile.box

Bernard Kuchler

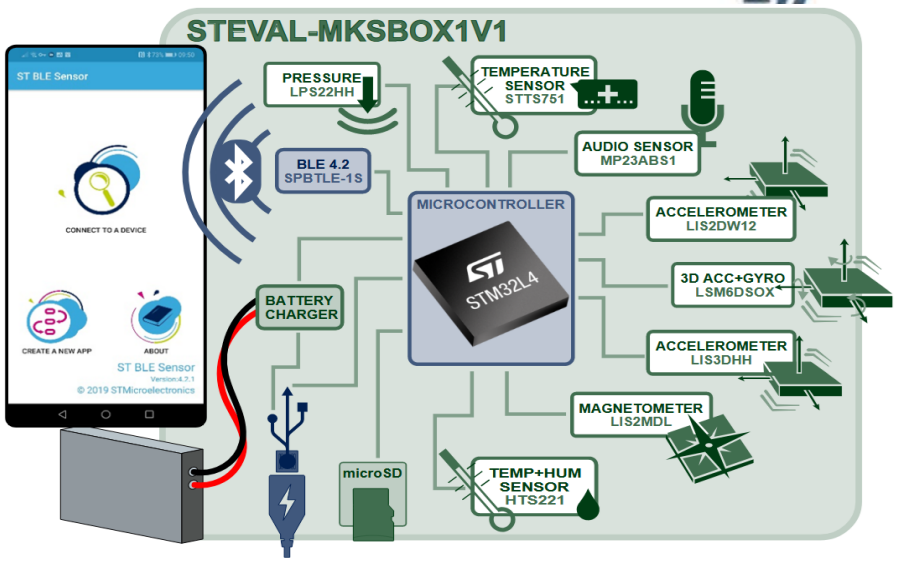
Uporaba modelov strojnega učenja v vgrajenih sistemih



Slika 5.6: Povezava gradnikov v okolju Orange za izdelavo modela NN.

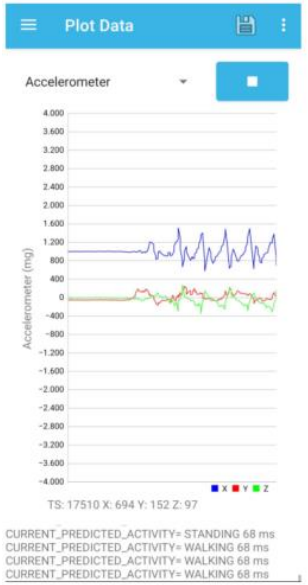


Plug and play module for learning and developing
Ready to connect to Microsoft IoT services



Jan Renar

Zaznavanje človeških aktivnosti s kombinacijo tipal na razvojni plošči Sensortile.box



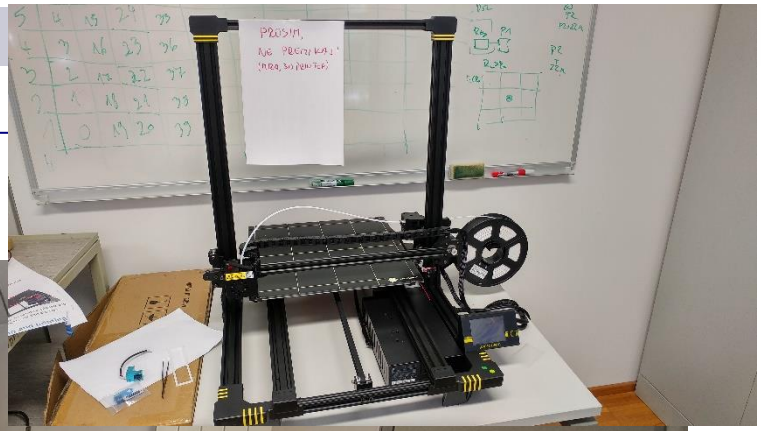
VP1: Uvod v VIN projekt

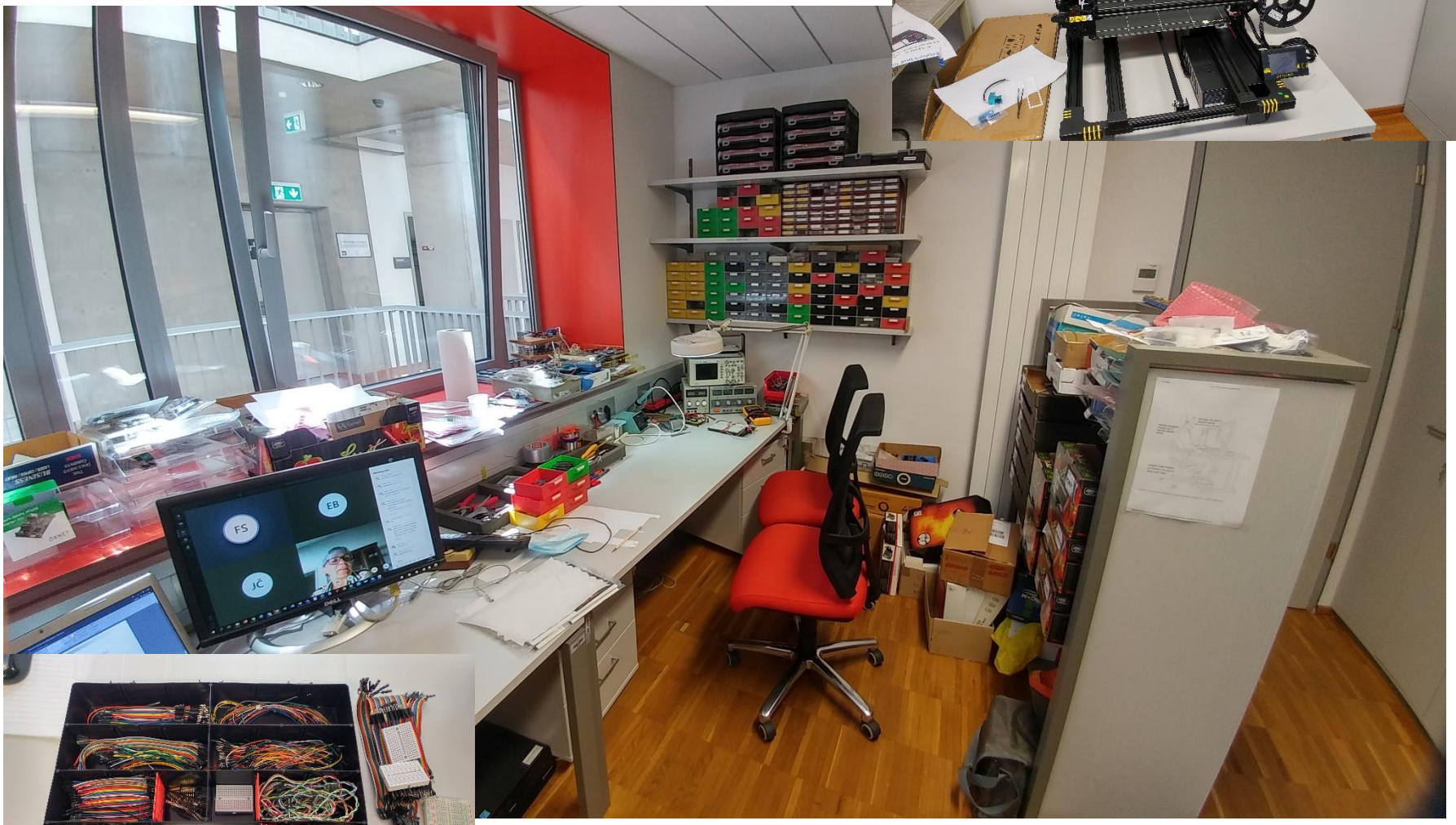
Predstavitev LAB-a

VIN projekt - P4: LAPS

VIN projekt - P4: LAPS

Predstavitev LAB-a





VP1: Uvod v VIN projekt – FRI Frižider

FRIžider – Arduino platforme

FRIžider - Tipala

VIN projekt - VP1: Uvod, tipala, TinkerCad osnove

- Uvod v VIN projekt
- Tipala
- Spoznavanje TinkerCad-a
- Domača naloga (DN2-VP1)

Tipala

Namen :

- Temperaturna tipala
- Tipala oddaljenosti
- Tipala svetlobe
- Tipala dotika/pritiska

Tehnologija :

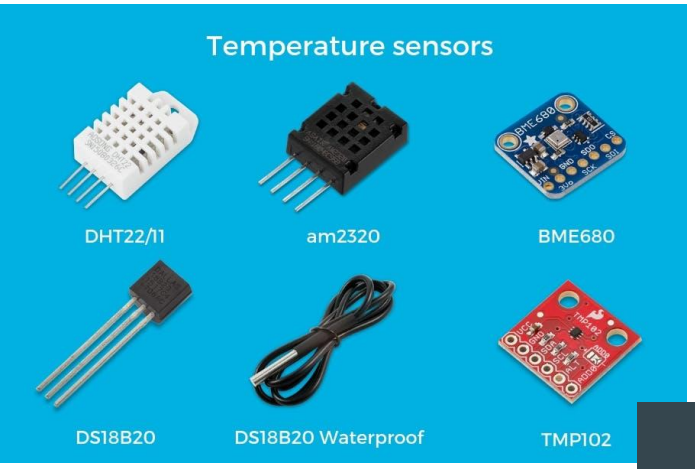
- Tipala MEMS (Micro-Electro Mechanical Systems)

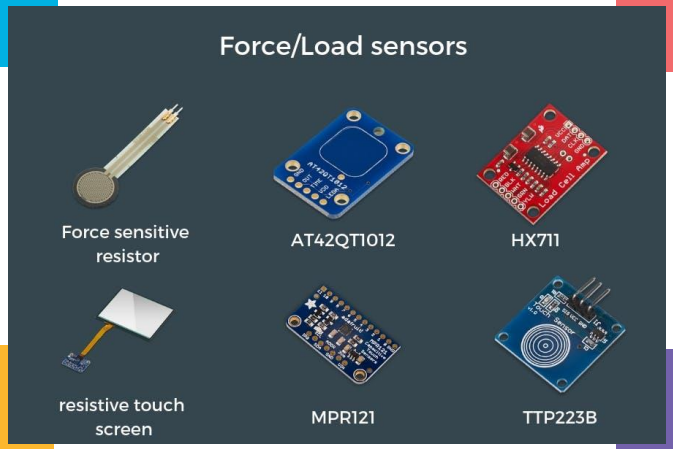
Priključitev :

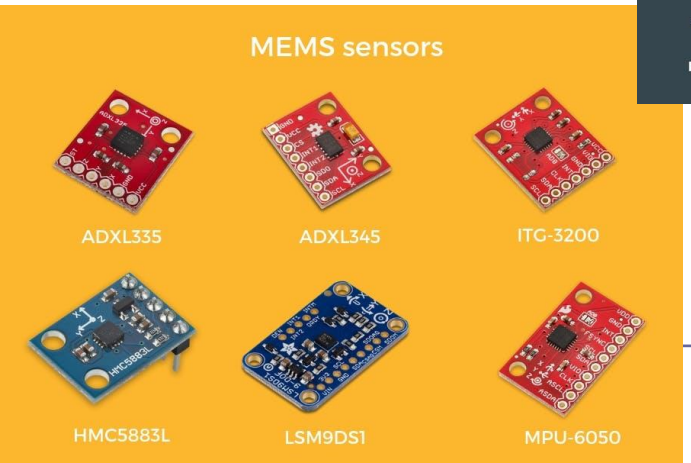
- Analogni (uporovni, napetostni, tokovni)
- Digitalni:
  - 1/0, on/off (tipka, PIR, Reed, Tilt, …)
  - Krmilnik + komunikacijski vmesnik (I2C, SPI, WiFi, 1-Wire, …)

HOW ARDUINO SENSORS ACTUALLY WORK

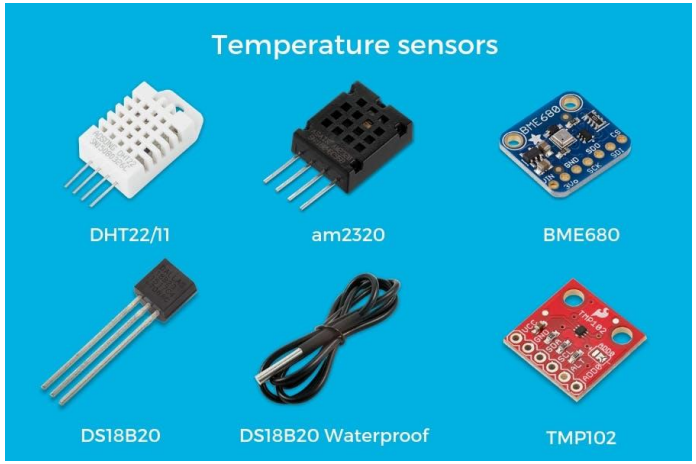
https://www.circuito.io/blog/arduino-sensors-explained/







VIN projekt - VP1: Temperaturna tipala



Vrste :

- Termistorji
  - temp. odvisnost (snov)
- „Thermocouples“
  - Spoji kovin
  - Večji razpon, manjša natančnost
- RTD („Resistance Temp. Detector)
  - Navitje prevodnega (temperaturno odvisnega) materiala

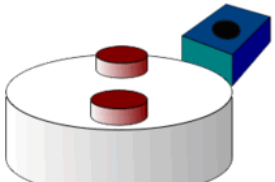
Priključitev :

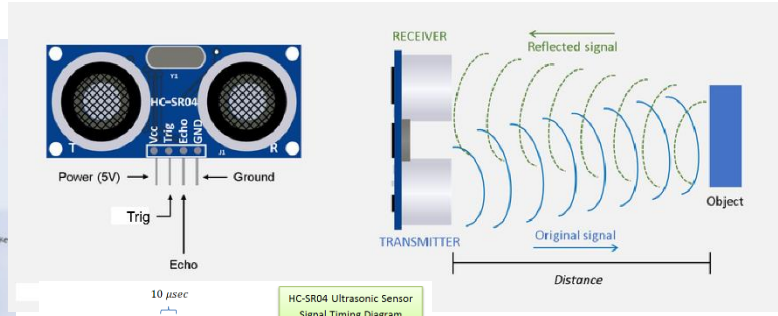
- Analogni (uporovni)
- Digitalni:
  - komunikacija (I2C, SPI, 1-Wire, …)

VIN projekt - VP1: Tipala oddaljenosti

Vrste :

- LIDAR
  - laser
- UZ tipala
  - Ultrazvok (npr. HC-SR04)
- IR (LED) tipala
  - IR svetloba, manjše razdalje
- Hall
  - Bližina magneta (brezkontaktni)





Priključitev :

- Analogni (Hall)
- Digitalni:
  - TOF (Time-of-Flight) meritev časa

VIN projekt - VP1: Tipala MEMS

Vrste :

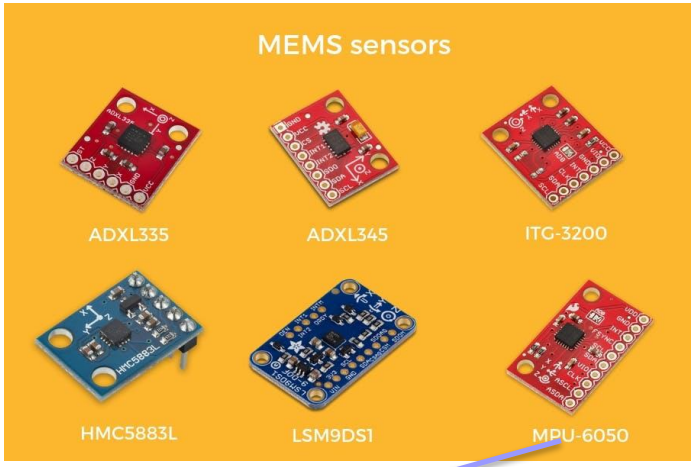
- Pospeškometri
  - Merijo pospeške v oseh
- Žiroskopi („Gyro sensors“)
  - Spremembe v kotni hitrosti (izračun kotov)
- Magnetometri
  - Merijo magnetno polje v 3 oseh

Priključitev :

- Analogni
- Digitalni
  - Protokoli (I2C,SPI, …)

Pogosto skupaj:

- IMU („Inertial Measurement Unit“)
  - pospeškometer + žiroskop



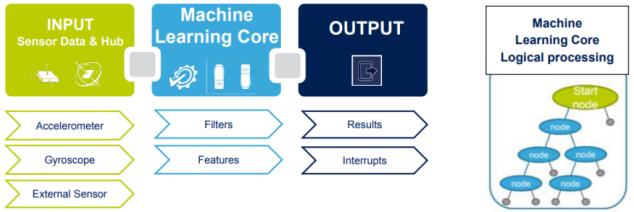
How does an Accelerometer work? | 3D Animation

LSM6DSOX

LSM6DSOX vsebuje 3D MEMS merilnik pospeška in 3D MEMS žiroskop. S pomočjo strojnega učenja lahko zmanjša porabo in izboljša zaznavanje. Poraba čipa je samo 0,55 mA.

Lastnosti

- Smart FIFO do 9 kbyte
- Združljiv z Androidom
- ±2/±4/±8/±16 g polni obseg
- ±125/±250/±500/±1000/±2000 dps polni obseg
- Analogna napajalna napetost: 1,71 V do 3,6 V
- Neodvisno napajanje I/O (1,62 V)
- Velikost 2,5 mm x 3 mm x 0,83 mm



Slika 6 Jedro strojnega učenja v LSM6DSOX

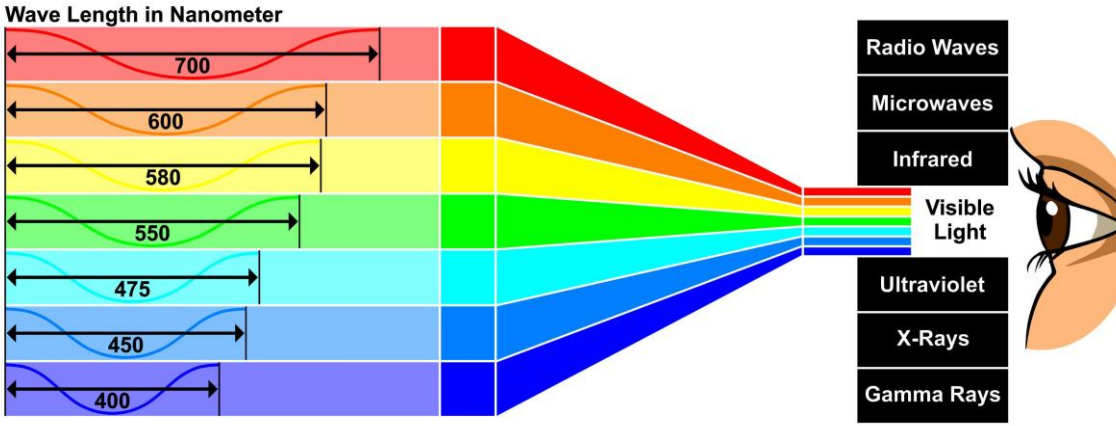
VIN projekt - VP1: Tipala svetlobe

Vrste :

- LDR
  - Uporovno tipalo
- RGB
  - Meri „barvo“ odboja
- Specifične meritve
  - Npr. „vidni“ ali drugi spektri

Priključitev :

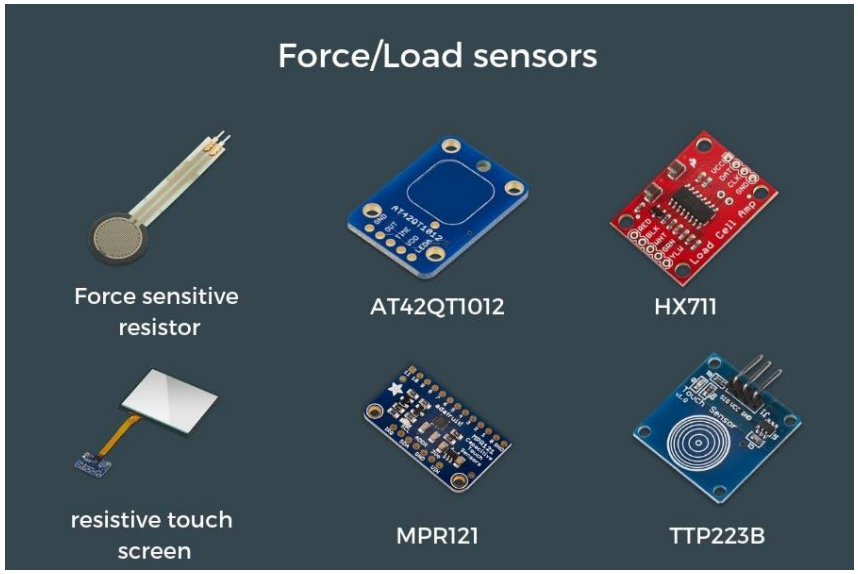
- Analogni (upornost, napetost)
- Digitalni
  - Protokoli (I2C,SPI, …)



VIN projekt - VP1: Tipala dotika/pritiska

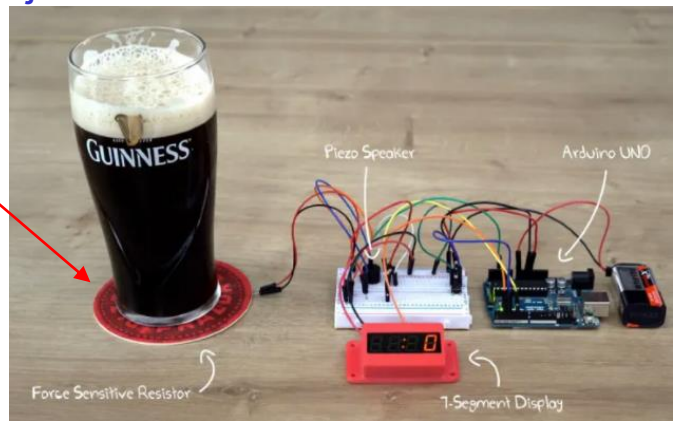
Vrste :

- Površine „na dotik“
  - uporovne
  - kapacitivne
- FSR („Force Sensing Resistor)
  - Prevodna „goba“
    - večji pritisk –> večja prevodnost
- „Load Cell“
  - bolj natančne, večji razpon obremenitev, dražje

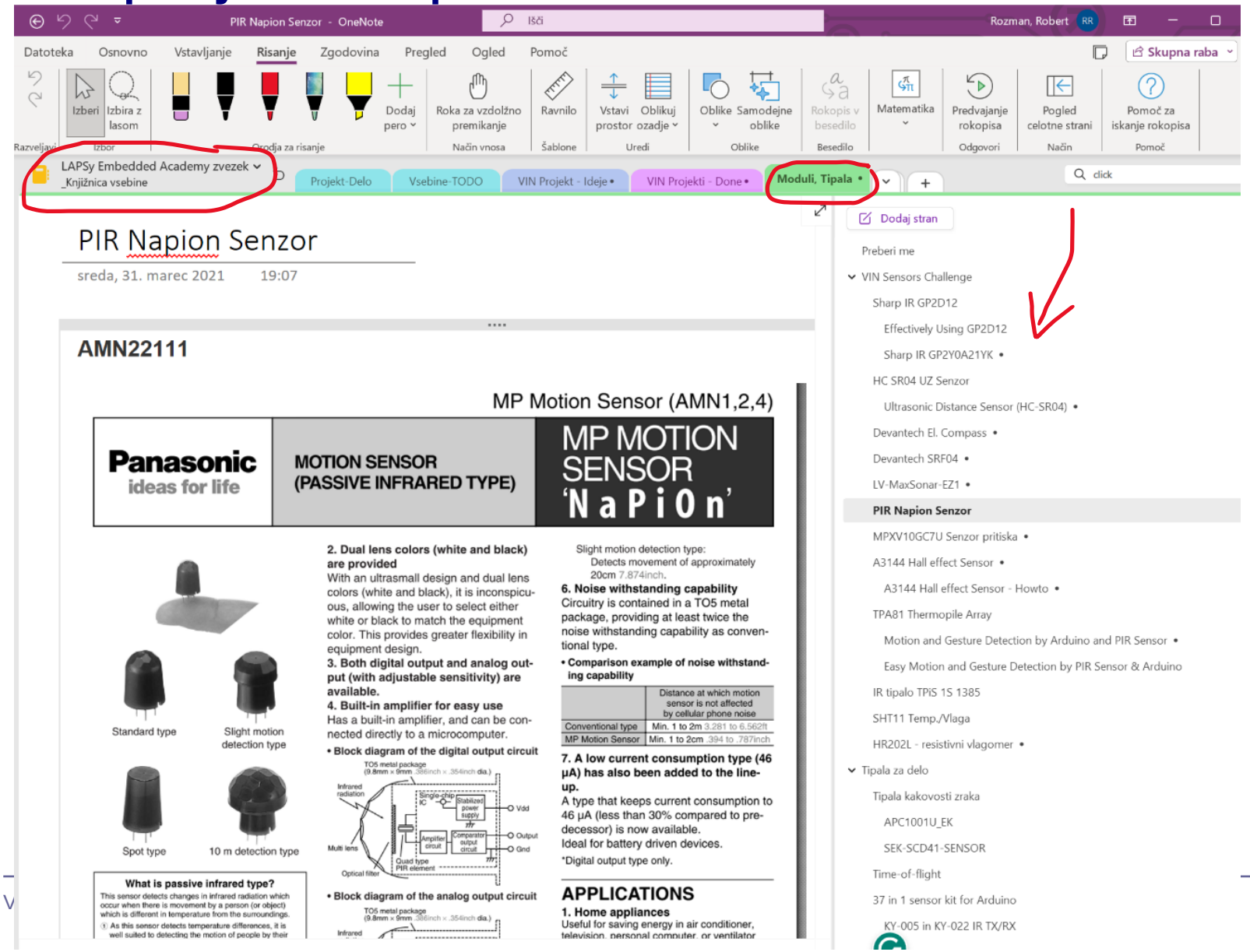


Priključitev :

- Analogni
- Digitalni
  - Protokoli (I2C,SPI, …)



VIN projekt – tipala v LAPS



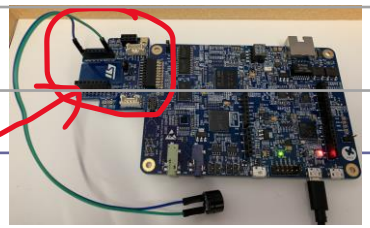
VIN projekt – Clickboards (STM32H7,F4, Rpi)

Oznaka	Količ.	Namen	Komunikacija	Opis	URL
BEE	2	Zigbee Transc.	GPIO,SPI	MRF24J40MA	*https://www.mikroe.com/bee-click*
UV 3	1	I2C UV tipalo	I2C	VEML6070	https://www.mikroe.com/uv-3-click
NFC Tag 4	1	NFC Tag	I2C	16Kb EEPROM	https://www.mikroe.com/nfc-tag-4-click
Light Mix-sense	1	Prox.+color+ light sense	I2C	TMD37253	https://www.mikroe.com/blog/light-mix-sens-click https://www.mikroe.com/light-mix-sens-click
BLE 6	2	ST:BLE+BQE Cert.	Analog,GPIO,I2C,SPI,UART	BlueNRG-M2	https://www.mikroe.com/ble-6-click
RS485 5	1	Rs-485 Transc.	UART	MAX485	https://www.mikroe.com/rs485-5-click
Environment 2	2	Temp/Hum/VOC	I2C	SHT40 and SGP40	https://www.mikroe.com/environment-2-click
LightRanger 8	1	ST: Time-Of-Flight	I2C	VL53L3CX	https://www.mikroe.com/lightranger-8-click
Temp&Hum 15	2	Temp.&Humidity	I2C	SHT40,	https://www.mikroe.com/temphum-15-click
Pi Click Shield	2	RPi razširitev			https://www.mikroe.com/pi-click-shield-connectors-soldered
STM32F4 Shield	5	F4 razširitev			https://www.mikroe.com/stm32f4-discovery-click-shield
STM32H750				Direktna priključitev	

Click Boards (1290)

- Wireless Connectivity (142)
- Sensors (429)
- Interface (123)
- Display & LED (56)
- Miscellaneous (28)
- Mixed Signal (85)
- Storage (45)
- Motor Control (88)
- Audio & Voice (40)
- HMI (63)
- Clock & Timing (30)
- Power Management (87)
- Click Bundles (17)
- Click Shields (39)
- Legacy (20)

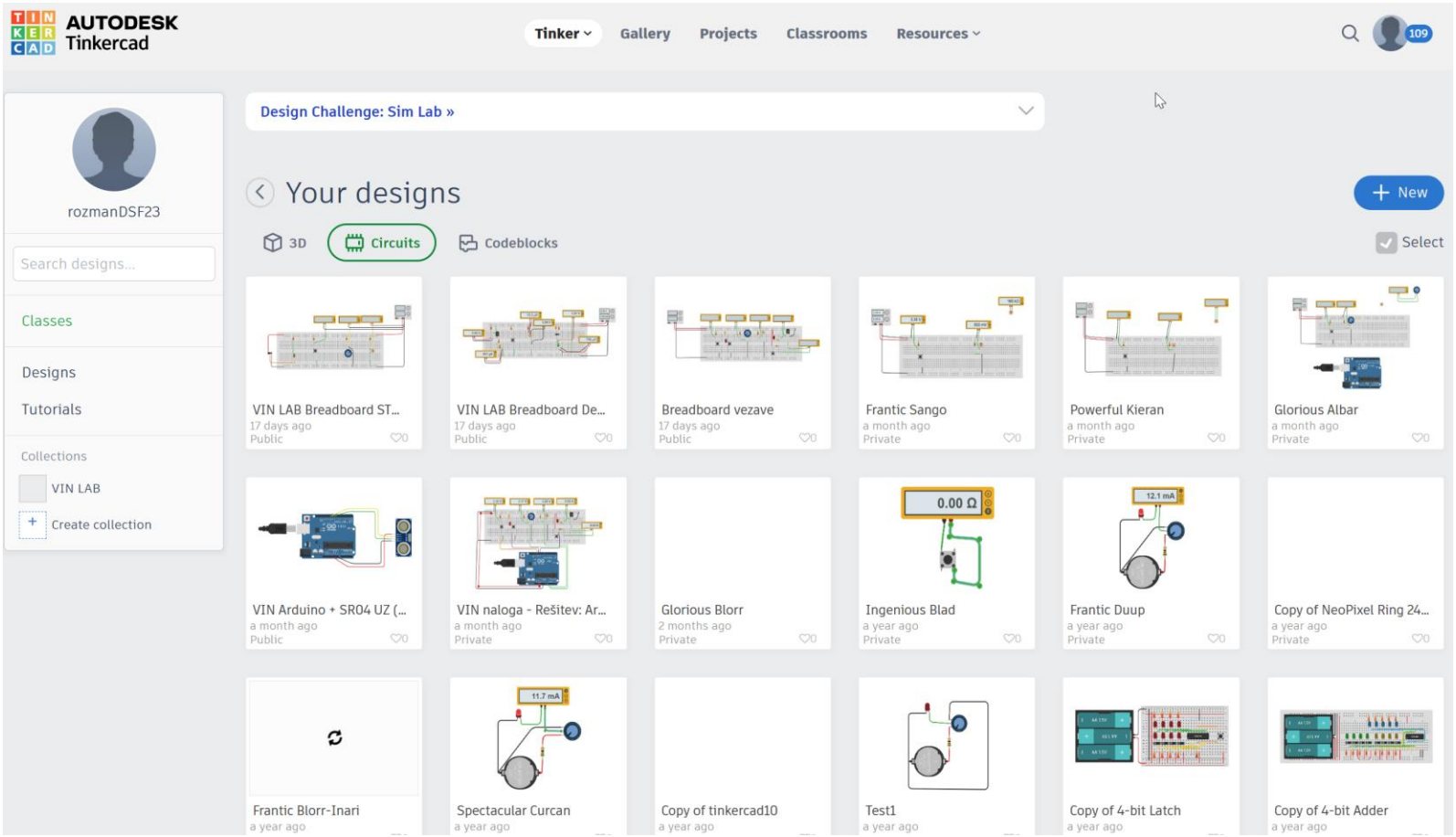
From <https://www.mikroe.com/click>



VIN projekt - VP1: Uvod, tipala, TinkerCad osnove

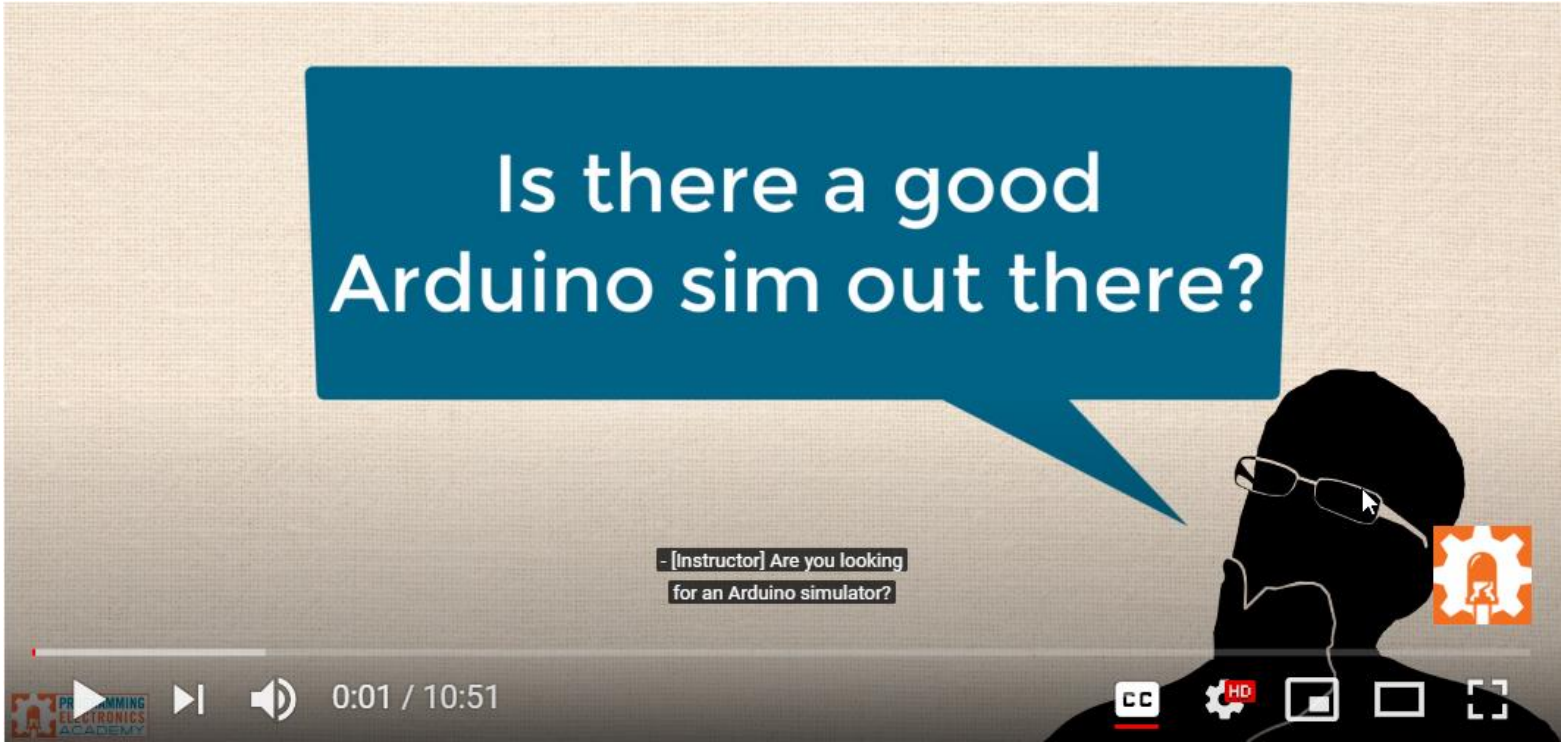
- Uvod v VIN projekt
- Tipala
- Spoznavanje TinkerCad-a
- Domača naloga (DN2-VP1)

TinkerCad: izdelajte svoj račun



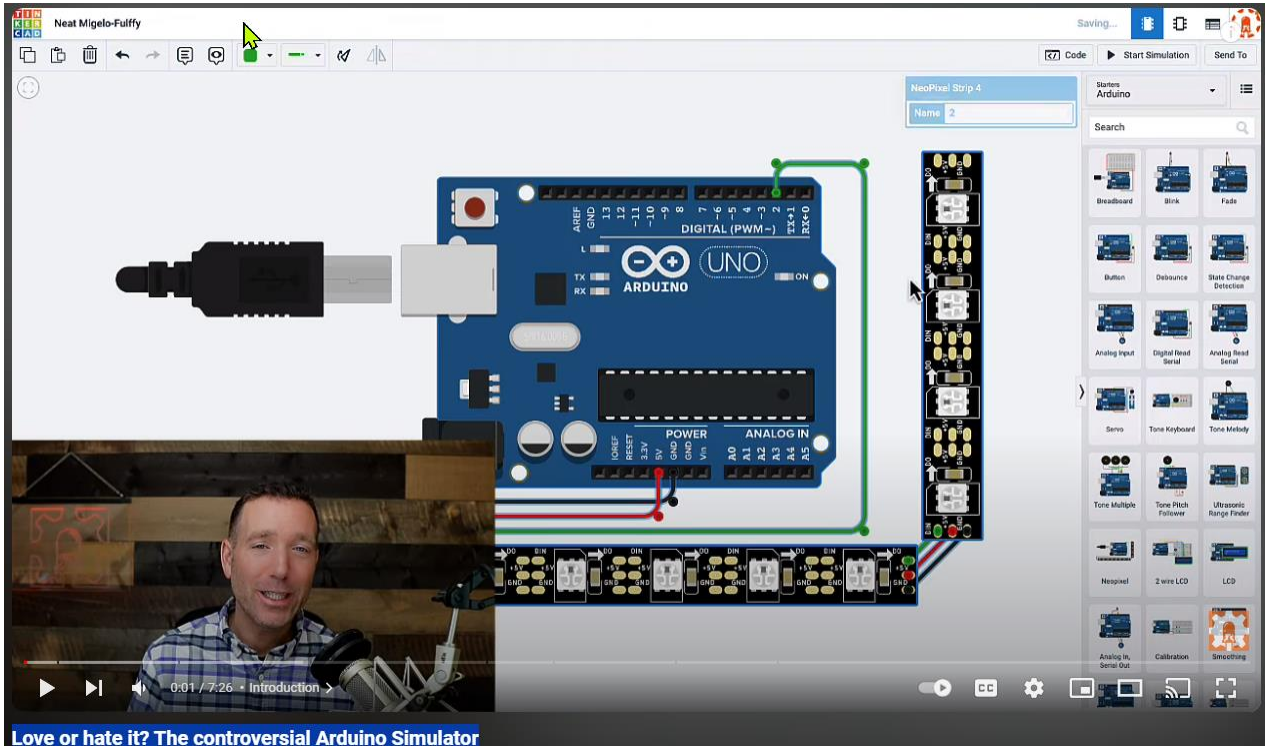
https://www.tinkercad.com/

TinkerCad: the Arduino Simulator you've been looking for!



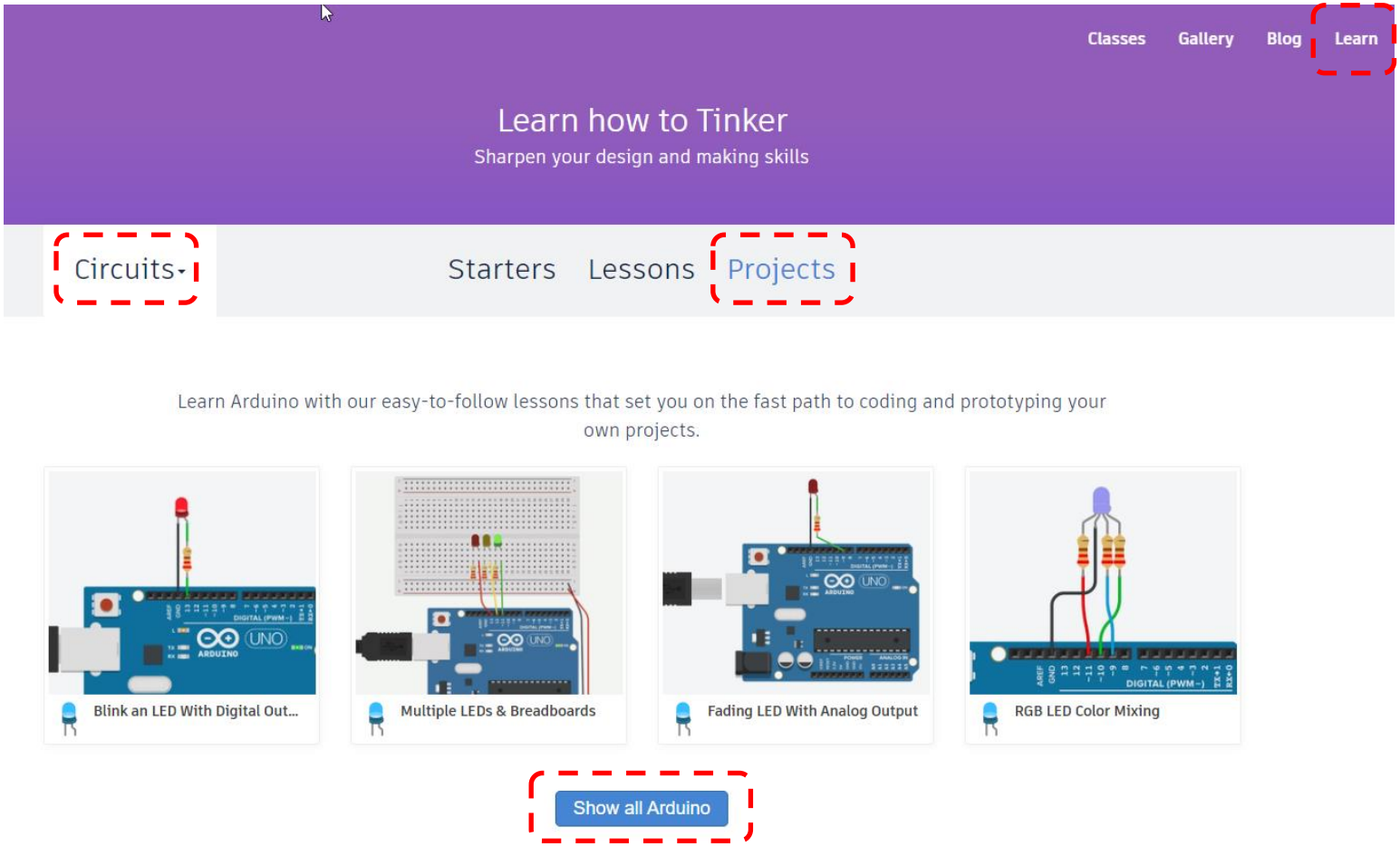
Z naslova <https://www.youtube.com/watch?v=6uz1sCA9joc>

Prednosti, slabosti TinkerCad simulacij :
Love or hate it? The controversial Arduino Simulator



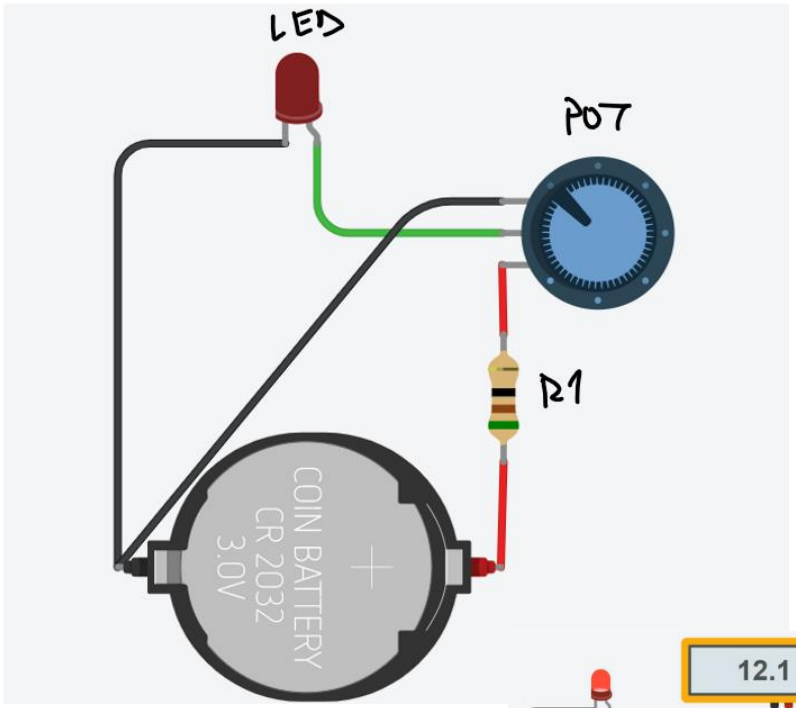
Z naslova <https://www.youtube.com/watch?v=2gHxgwoWPjw&ab_channel=ProgrammingElectronicsAcademy>

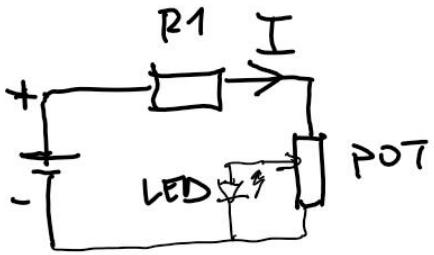
TinkerCad – učenje, primeri

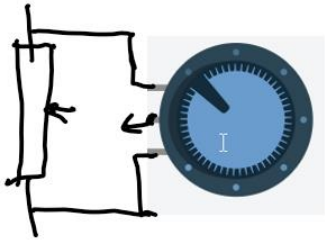


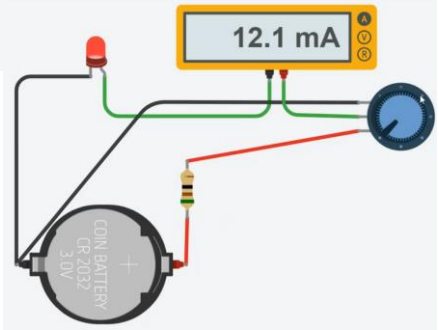
VIN projekt: TinkerCad

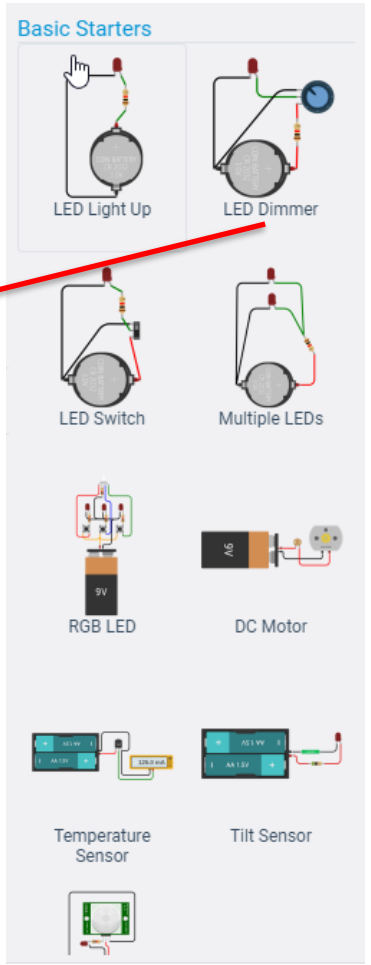
Osnovni elementi in preproste vezave



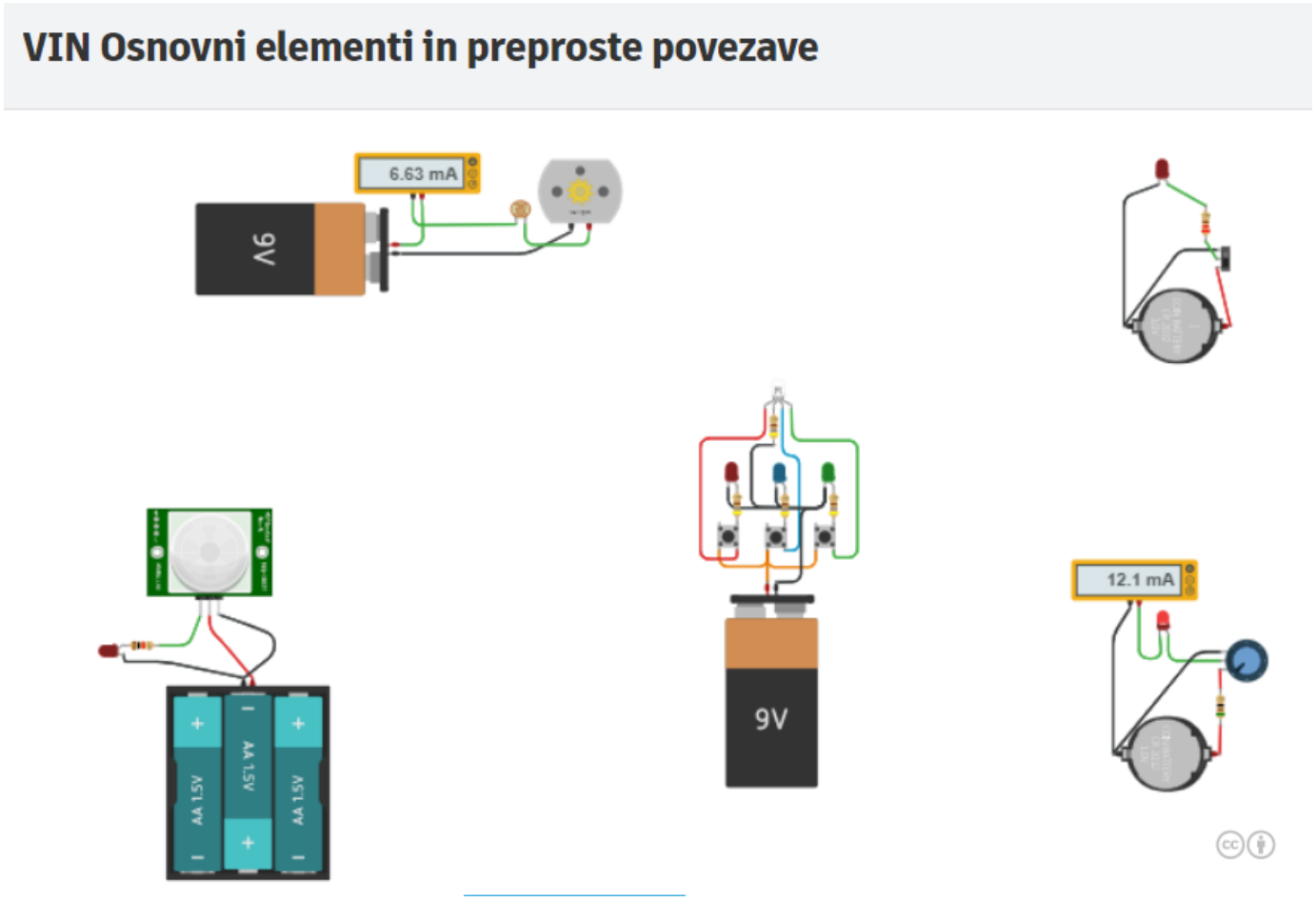


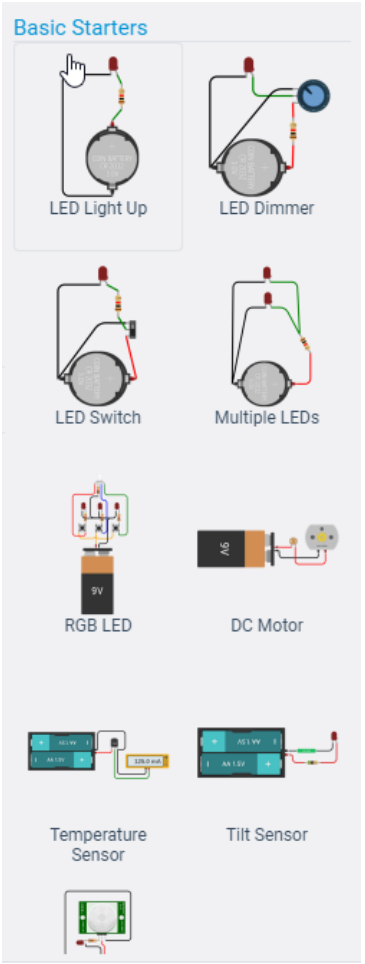






VIN projekt: TinkerCad
Osnovni elementi in preproste vezave

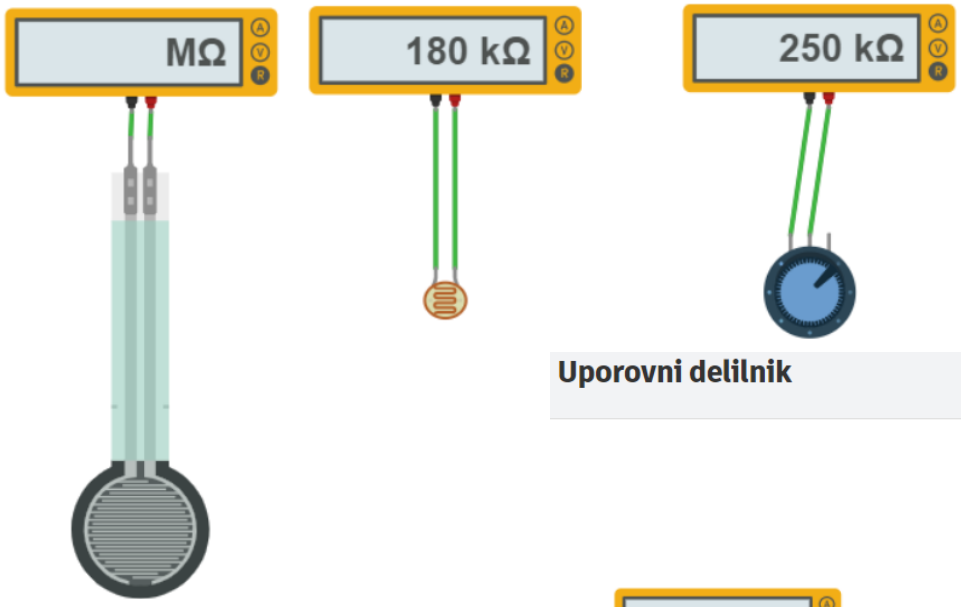




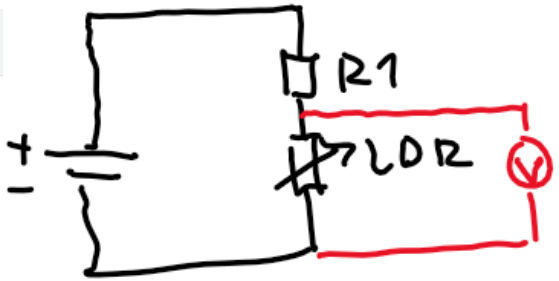
Z naslova <https://www.tinkercad.com/things/aVrm76VMZSV-vin-osnovni-elementi-in-preproste-povezave>

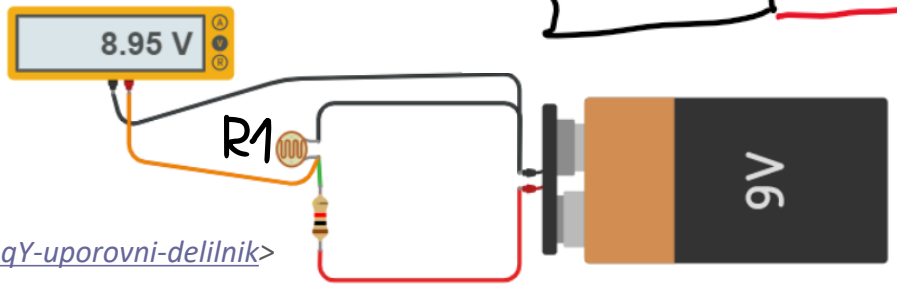
VIN projekt : TinkerCad
Uporovna tipala in delilnik napetosti

Uporovna tipala *Z naslova <https://www.tinkercad.com/things/gRnhGlsvr0z-uporovna-tipala>*



Uporovni delilnik

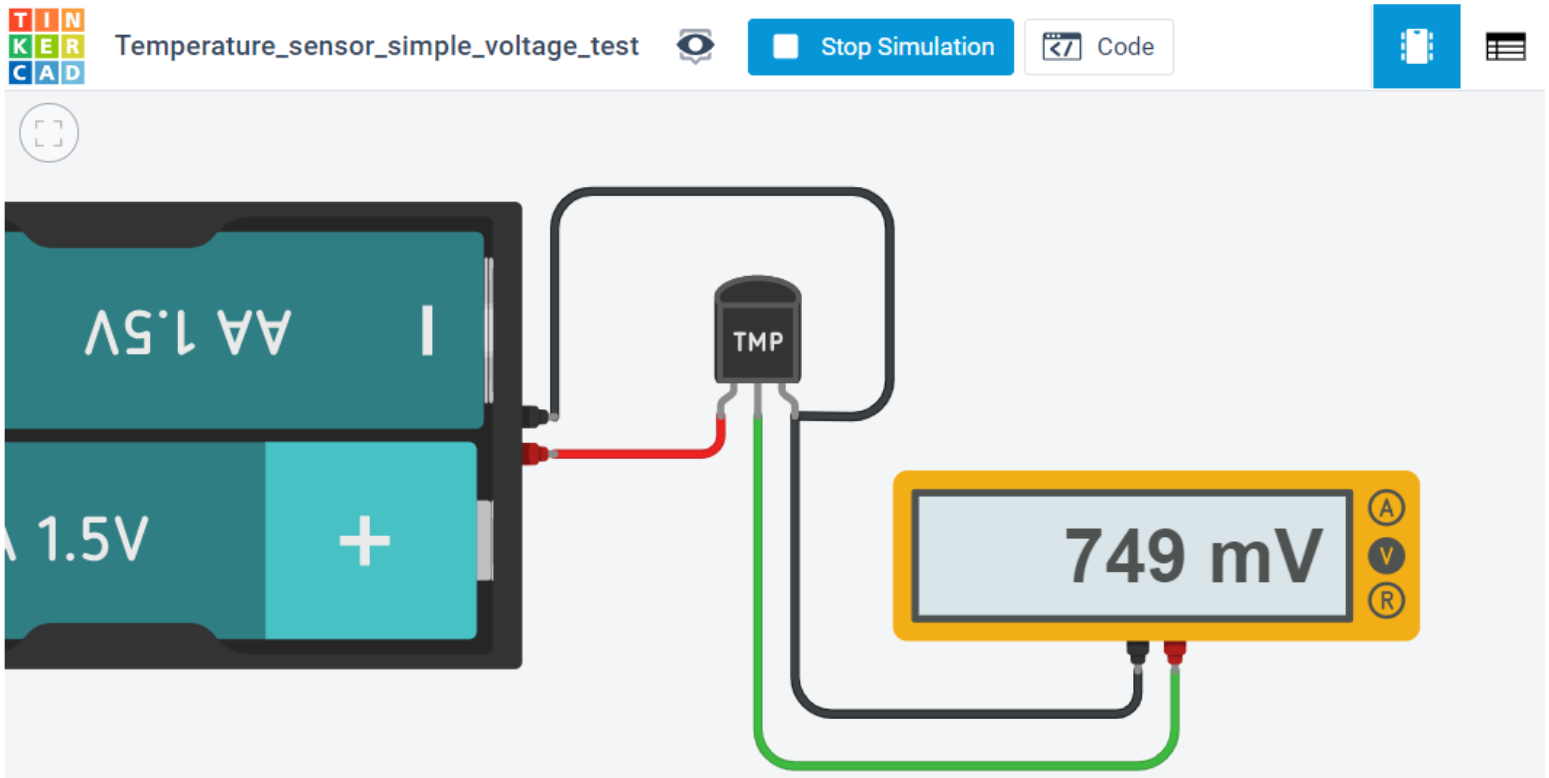




<https://www.tinkercad.com/things/eqKLw5MkQqY-uporovni-delilnik>

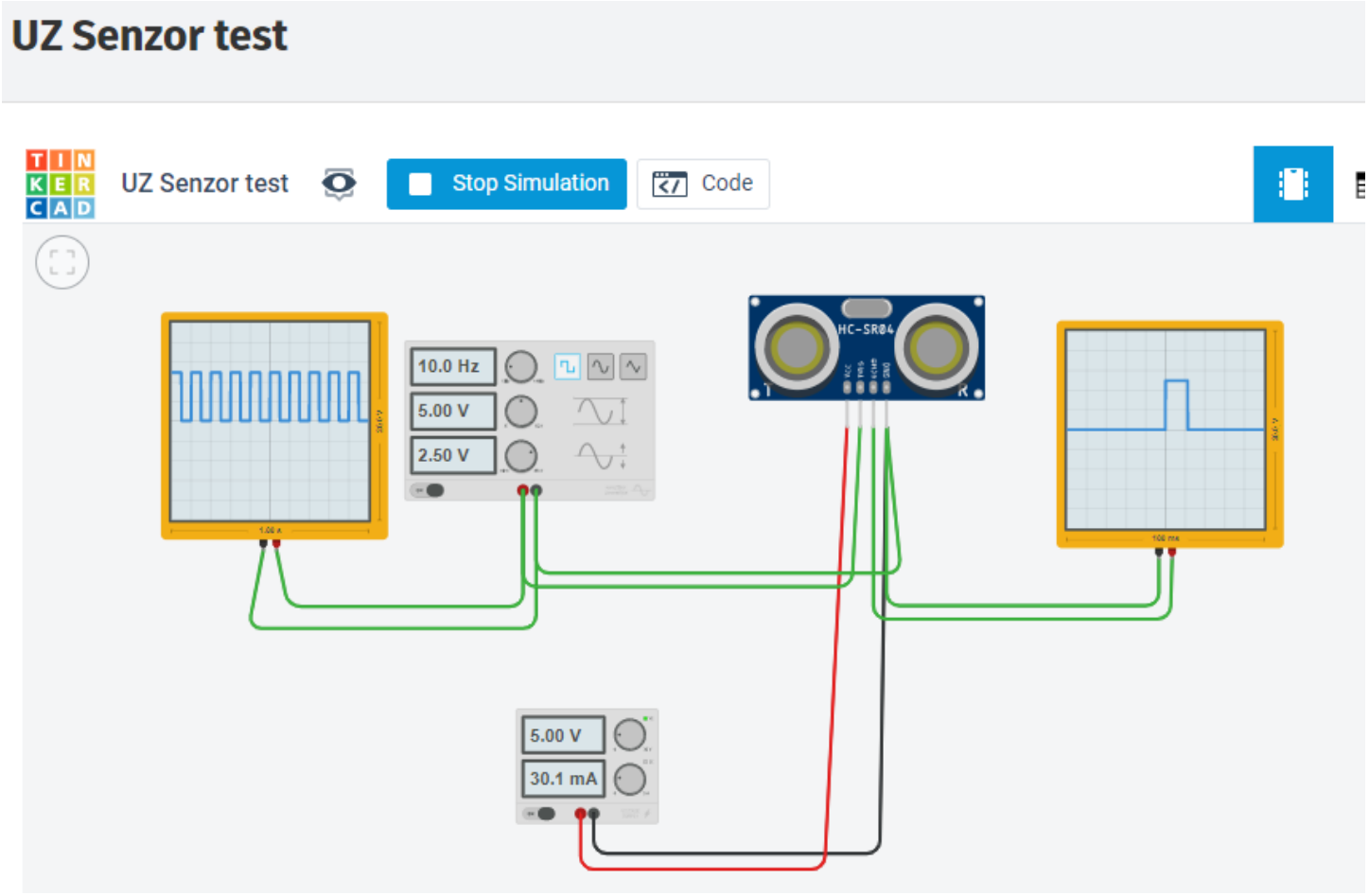
VIN projekt : TinkerCad
Uporovna tipala in delilnik napetosti

Temperature_sensor_simple_voltage_test



Z naslova <https://www.tinkercad.com/things/bTyCYtnzEi4-temperaturesensorsimplevoltagetest>

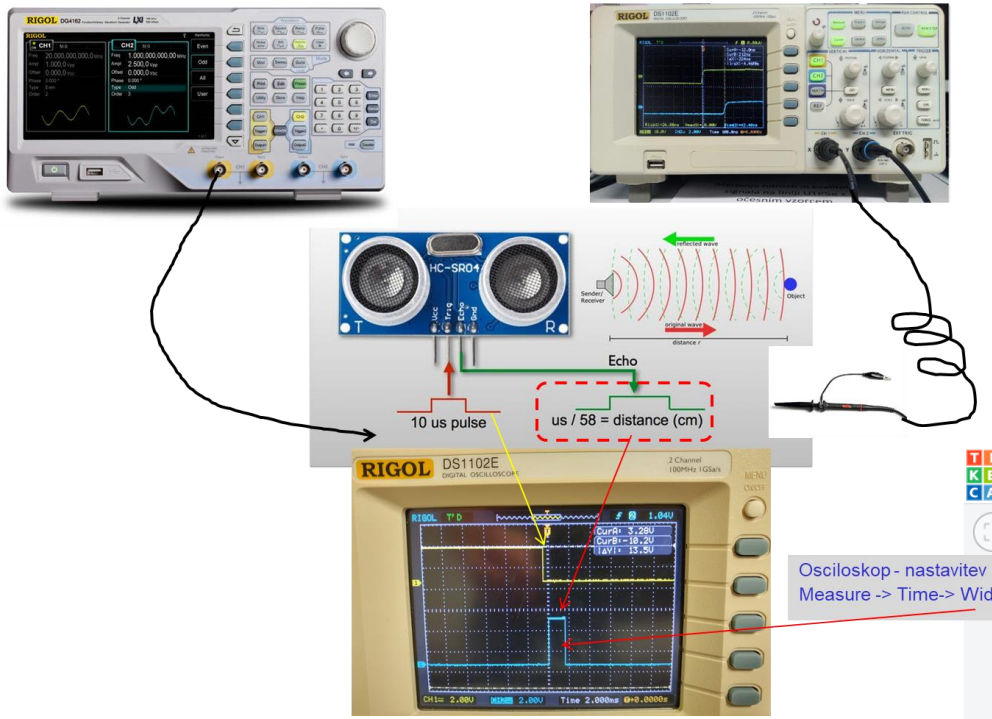
VIN projekt : TinkerCad
UZ tipalo



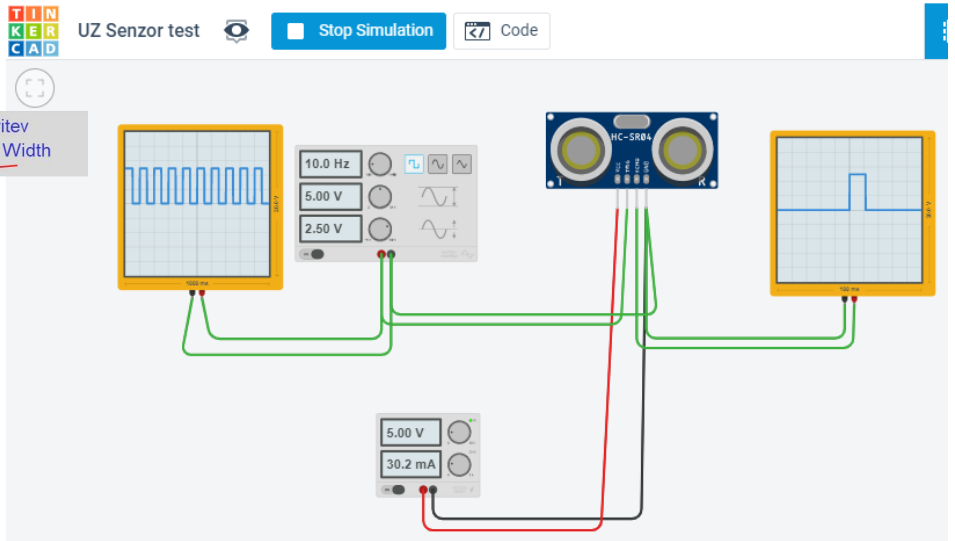
Z naslova <https://www.tinkercad.com/things/k6it1PauvwW-uz-senzor-test>

UZ senzor in HC-SR04

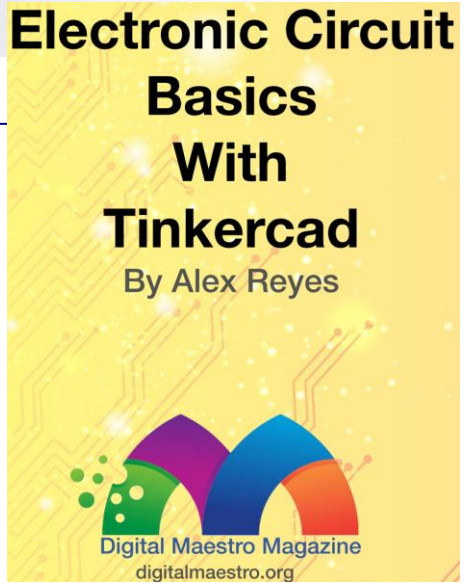
LAB Preizkus



Simulacija - TinkerCad



TinkerCad – viri :



- **Learn how to Tinker**
  - Sharpen your design and making skills
  - Circuits
    - Starters
    - Lessons
    - Projects
  - *From <https://www.tinkercad.com/learn/circuits/learning>*

- **Learn how to use Tinkercad to design, build, and test simple circuits.**

  From <https://maker.pro/custom/tutorial/how-to-design-and-simulate-circuits-in-tinkercad>

- **How to design and simulate circuits using Tinkercad | Beginner Level**

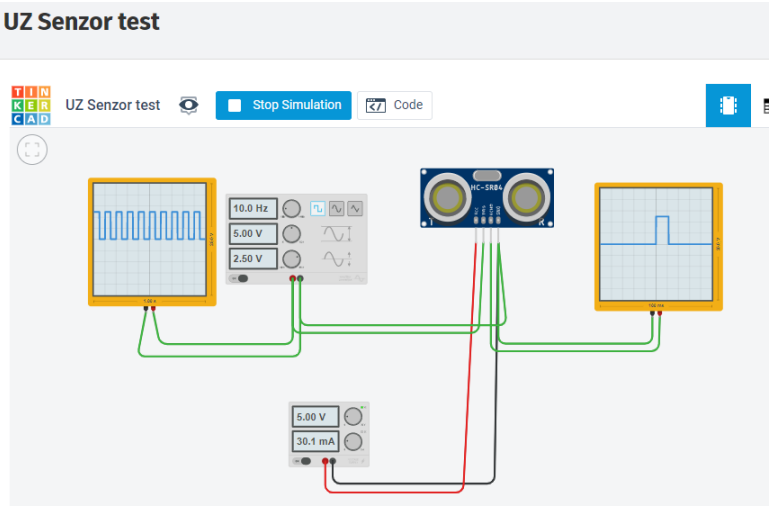
  From <https://fullyelectronics.com/how-to-design-and-simulate-circuits-using-tinkercad-beginner-level/>

- **Electronic Circuit Basics with TinkerCAD 2 (energiazero.org)**

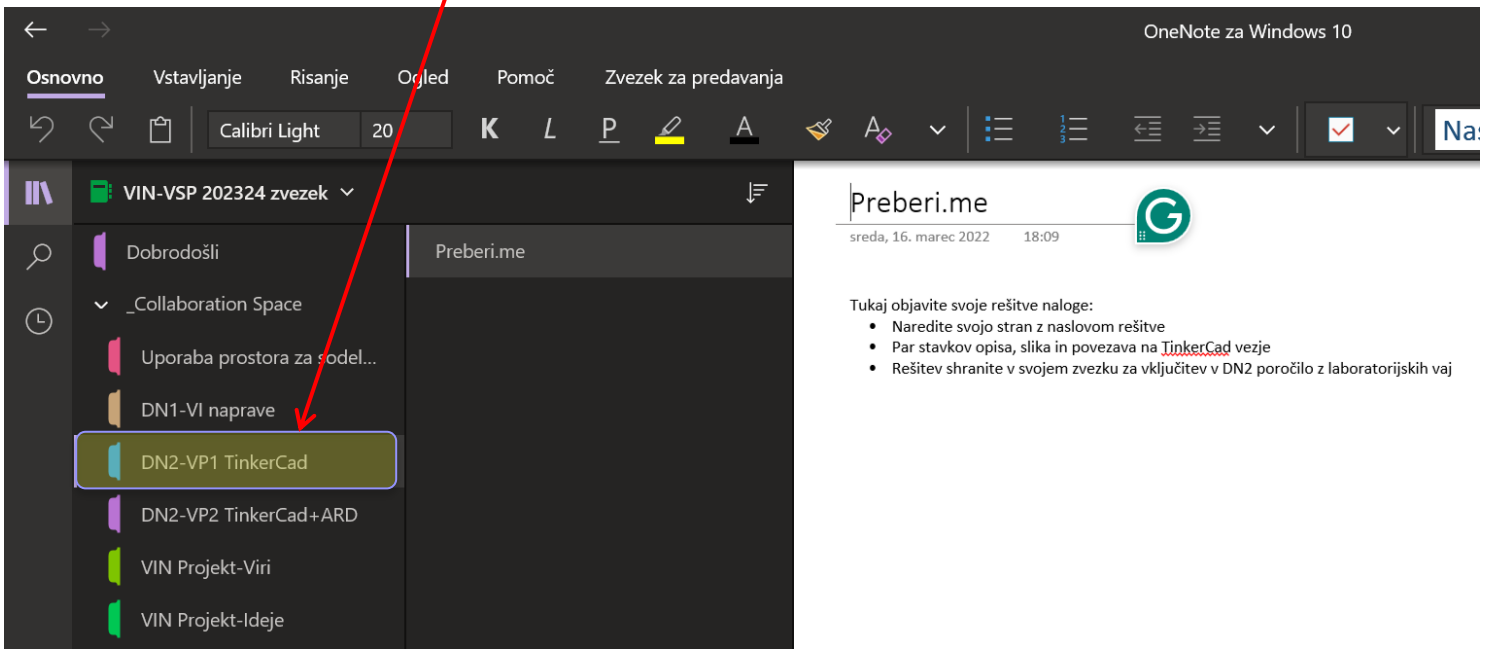
VIN projekt - VP1: Uvod, tipala, TinkerCad osnove

- Uvod v VIN projekt
- Tipala
- Spoznavanje TinkerCad-a
- Domača naloga (DN2-VP1)

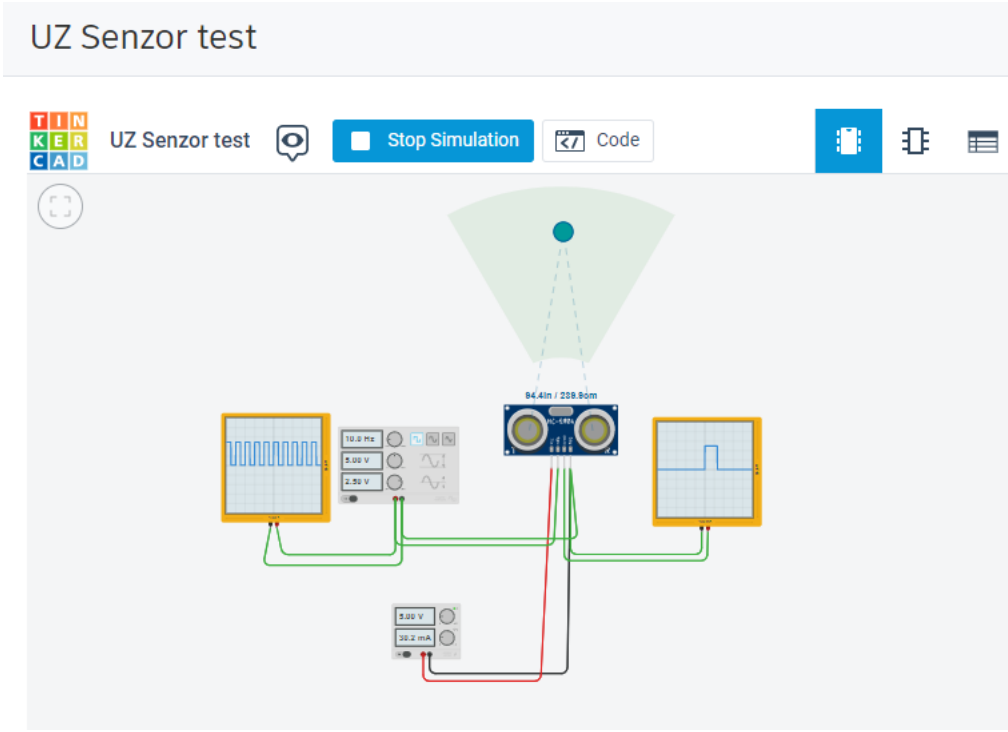
TinkerCad – DN2-VP1 :



- Spada v sklop poročila z LAB vaj (DN2)
- Naredite sebi zanimivo osnovno vezje(a),
  - še brez uporabe mikrokrmilnika (Arduino)
- Objavite v OneNote delovnem zvezku
  - _Prostor za sodelovanje, razdelek DN2-VP1 TinkerCad_Osnova



TinkerCad – DN2-VP1: Primer zapisa (objave)



Preprosto vezje za preizkus delovanja UZ tipala razdalje

Sestavni deli:

- Napajalnik skrbi za napajanje tipala
- Generator pravokotnega signala proži Trigger vhod tipala, da sproži oddajo UZ signala
- Osciloskop prikaže izhod tipala, ki s širino pulza ponazarja oddaljenost objekta oziroma čas potovanja signala do objekta in nazaj

Opis delovanja:

Interaktivno se lahko z miško spreminja pozicija oziroma oddaljenost objekta, kar se odrazi na širini impulza na izhodu UZ tipala (osciloskop).

https://www.tinkercad.com/things/k6it1PauvwW

