

Vhodno izhodne naprave

Laboratorijska vaja 3 - VP 3
Uvod v VINProjekt in tipala,
TinkerCad, Breadboard, vezave

VIN projekt - VP3: Uvod, tipala, TinkerCad, Breadboard, vezave

- Uvod v VIN projekt
- Tipala
- Spoznavanje TinkerCad-a
- Breadboard – osnovne vezave
- DN2.1 – VP3
- Dodatek: Vezja v TinkerCad z Arduinom

VIN projekt - VP3: Uvod, tipala, TinkerCad, Breadboard, vezave

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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:

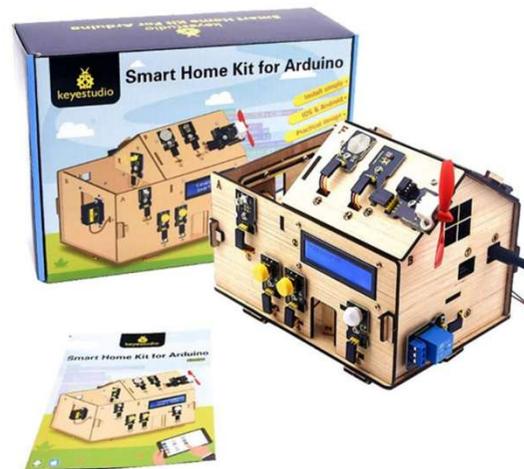
- **(živa predstavitev 5min – do konca semestra)**
- **poročilo** v obliki gradiva, objave na blogu (povzetek, poster, video)
- **video (do 2min), grafična predstavitev („poster“, skica, miselni vzorec) in povzetek**

VIN Projekt – Delo MS Teams

The screenshot shows the Microsoft Teams interface. On the left is a navigation pane with a search icon at the top. Below it are several expandable sections: 'Dobrodošli', '_Collaboration Space', 'Uporaba prostora za sodel...', 'Izbrani končani projekti No...', '_Knjižnica vsebine', 'Projekt-Delo', 'Vsebine-TODO', 'VIN Projekt - Ideje' (highlighted with a red circle), 'VIN Projekti - Done', 'Moduli, Tipala', 'STM32', 'LAB Oprema', 'Docs', 'Cube IDE', '_Samo učitelj', 'Uporaba prostora le za učit...', 'Video orodja', and a list of names: 'Ahačič, Matej', 'Atanasova, Stefanija', 'Bajt, Matija', 'Božič, Timotej', 'Bukovec, Vid', and 'Drole, Jan'. On the right side, there is a list of items: 'Preberi me', 'Spletni viri', 'Teme, področja', 'Praktični Izzivi', 'Clickboards (STM32H7,F4,Rpi)', 'LTE IOT 2 CLICK (BG96)', 'STM32H750B DK + clickboards', 'STMod+ konektor', 'STM32F4 Shield + Click boards', 'Model Hiške', 'Arduino Smart Home Kit' (highlighted), and 'CANBUS - IEX modul'.

Arduino Smart Home Kit

torek, 02. marec 2021 10:43



Assembling and testing - Keyestudio Smart Home Kit for Arduino

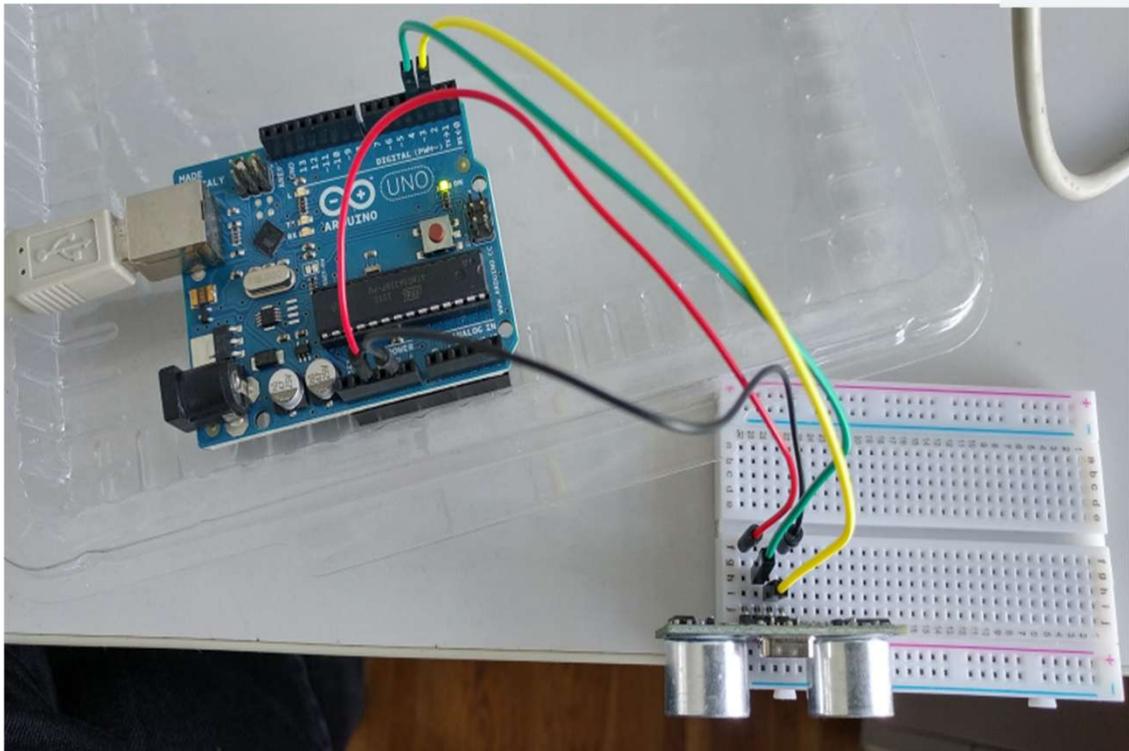
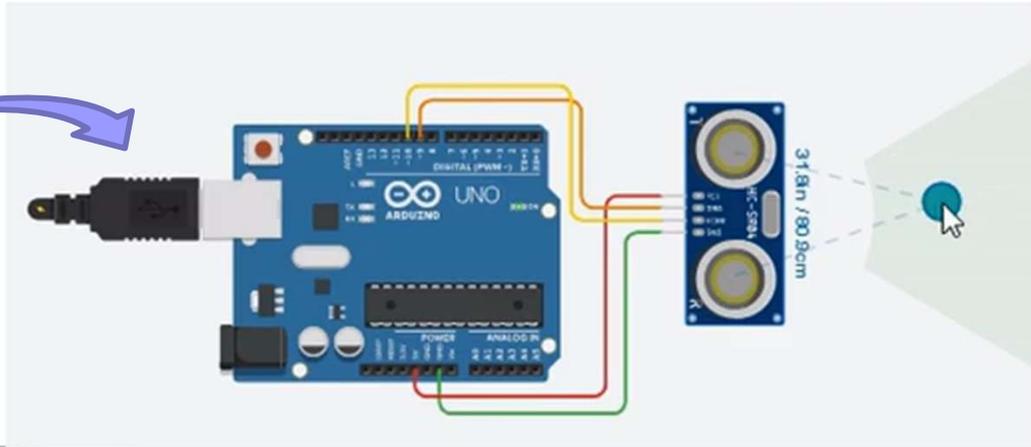
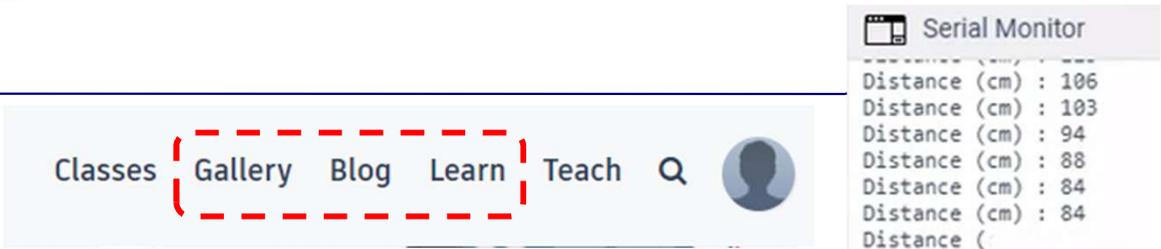
1,410 views
• Dec 12, 2020
292 SHARES/SAVE

Z naslova <https://www.youtube.com/watch?v=-W1pS159afc&ab_channel=HendrixxWorkshop>



Simulacija: TinkerCad

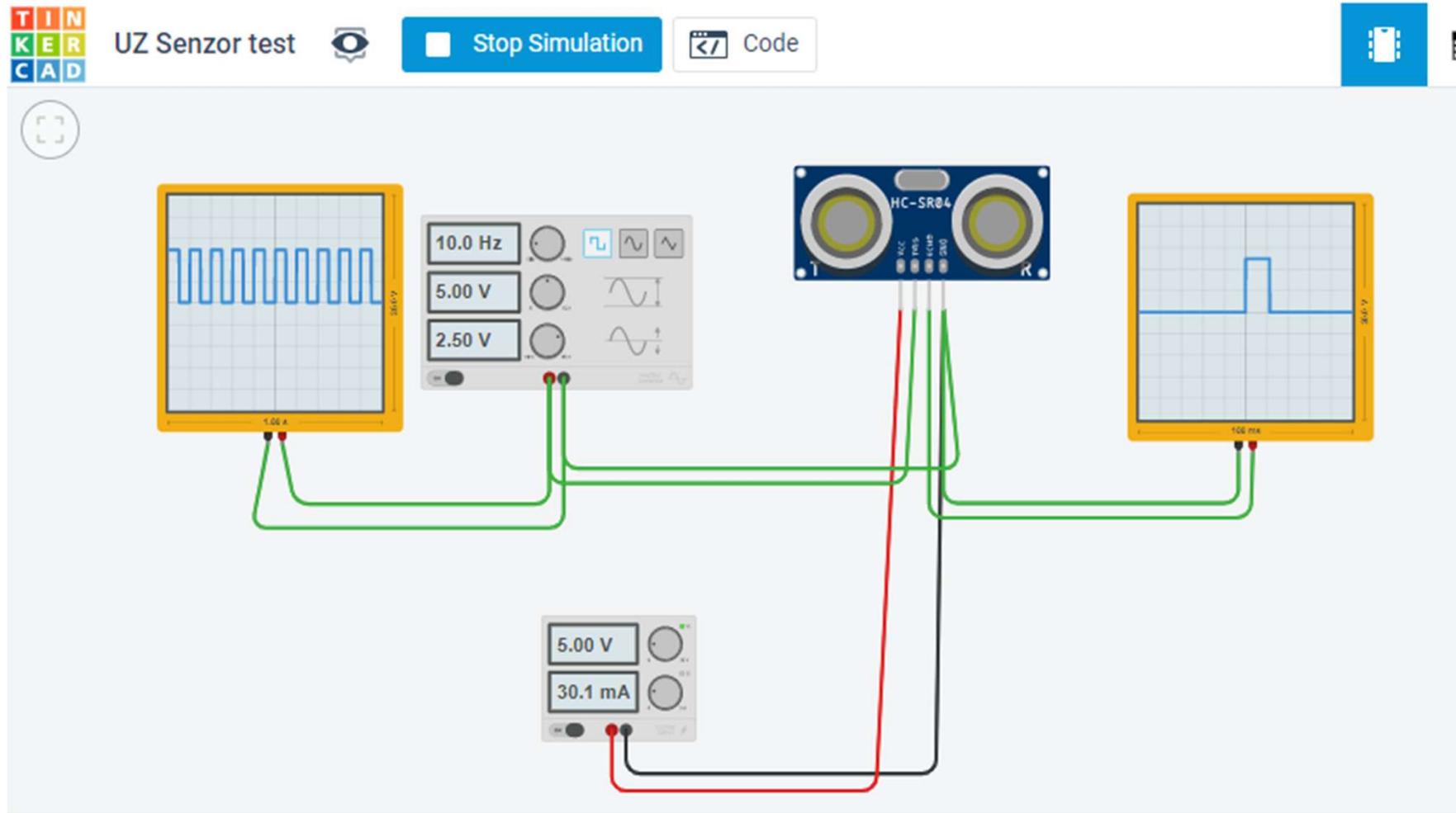
<https://www.tinkercad.com/>



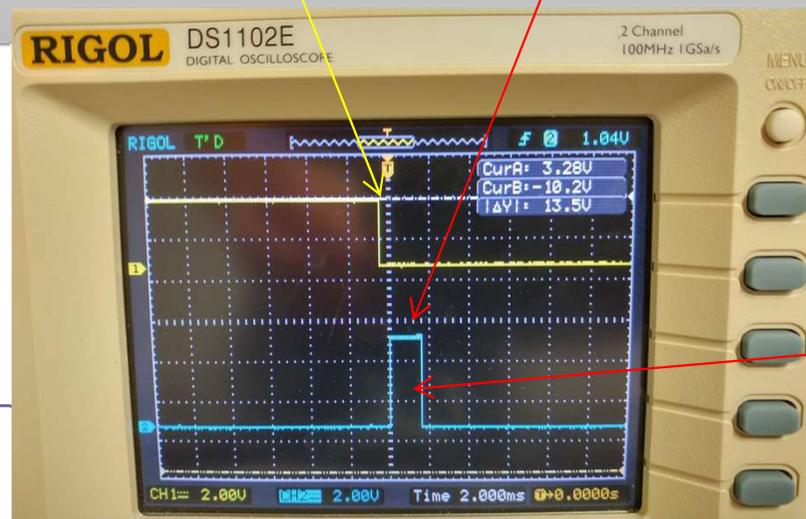
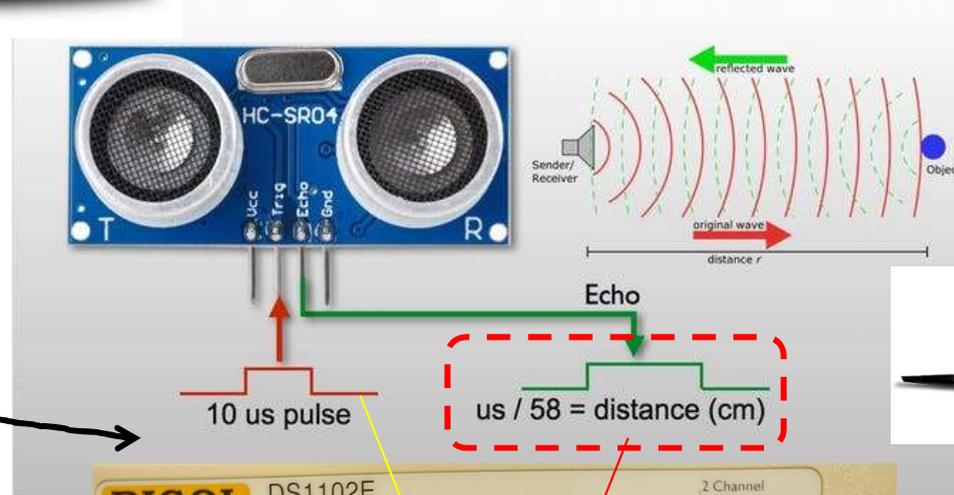
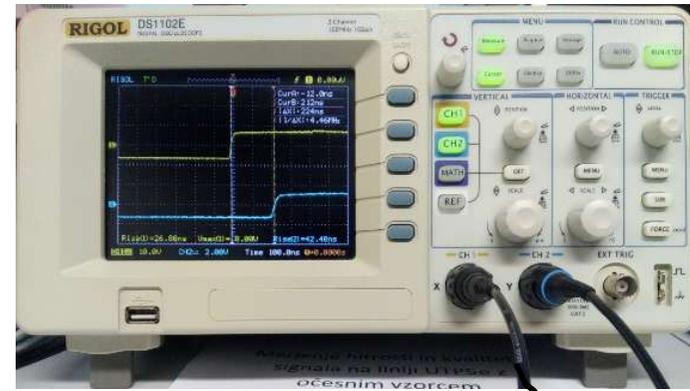
```
Text
12
13 void loop() {
14   digitalWrite(trigger_Pin, LOW); //
15   delay(1);
16   digitalWrite(trigger_Pin, HIGH);
17   delayMicroseconds(10); //Mak
18   digitalWrite(trigger_Pin, LOW);
19
20   duration = pulseIn(echo_Pin, HIGH);
21   distance = duration * 0.017; //((34
22   /* Speed of the sound in Air = 340 m/
23   * multiply it by 100 to get the data
24   * divide by 1,000,000 as duration is
25   * divide by 2 as ultrasound signal t
26   */
27   Serial.print("Distance (cm) : ");
28   Serial.println(distance);
29   delay(100);
30 }
```

Simulacija UZ tipala razdalje (meritev v TinkerCad-u)

UZ Senzor test



Praktična izvedba (meritev UZ tipala razdalje)



Osciloskop - nastavitev
Measure -> Time-> Width

Predlog pristopa k VIN projektu :

- Raziščem delovanje osnovnih senzorjev (literatura), lahko DN1
 - Primer:
 - <https://www.circuito.io/blog/arduino-sensors-explained/>
 - <https://www.st.com/en/mems-and-sensors.html>
- Po potrebi naredim nekaj simulacijskih projektov v TinkerCadu
 - 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:

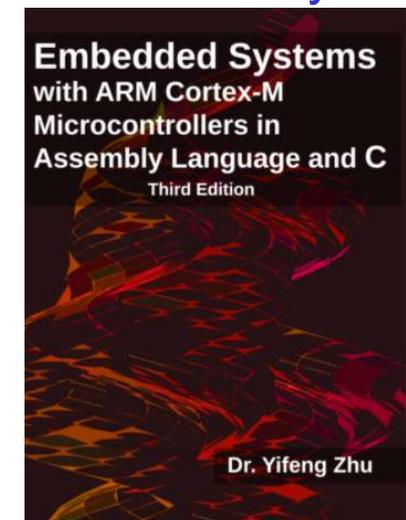
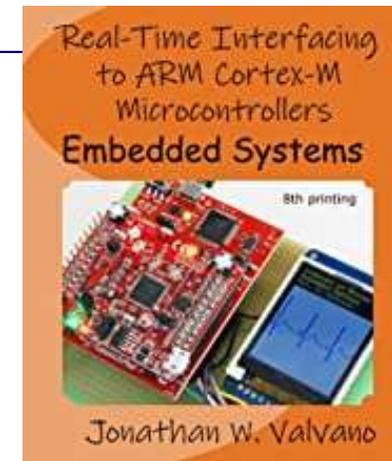
<http://users.ece.utexas.edu/~valvano/Volume1/E-Book/>

■ 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

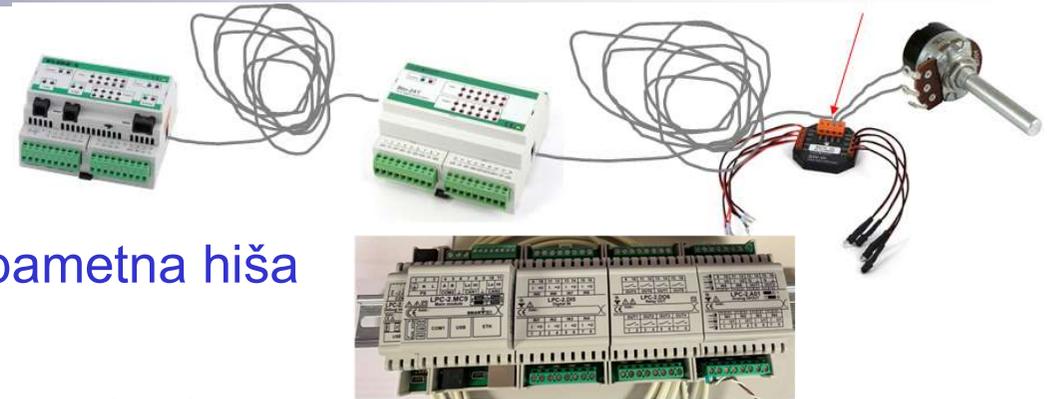
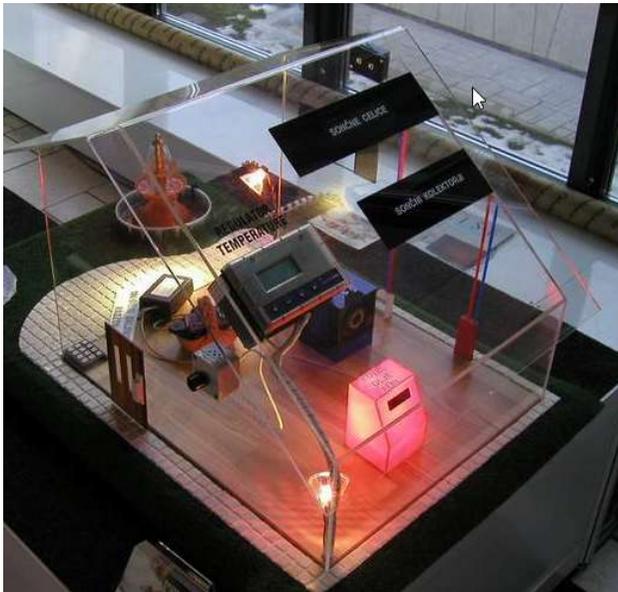
- Praktična realizacija projektov:
 - Npr. CANBus, Smarteh LPC, pametna hiša
- Praktični projekti – hiška :

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

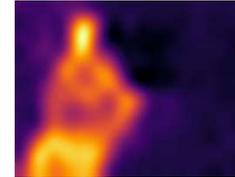
Multi-tipala

- LIR2 – Smarteh



Vin projekt
Detekcija ljudi s senzorjem LIR2

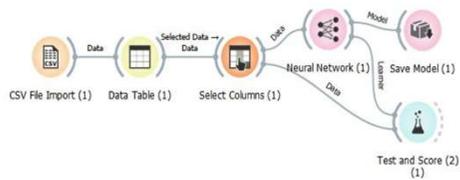
Jakob Jelovčan



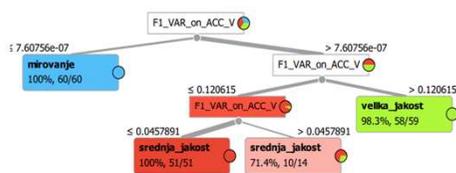
- SensorTile.box

Bernard Kuchler

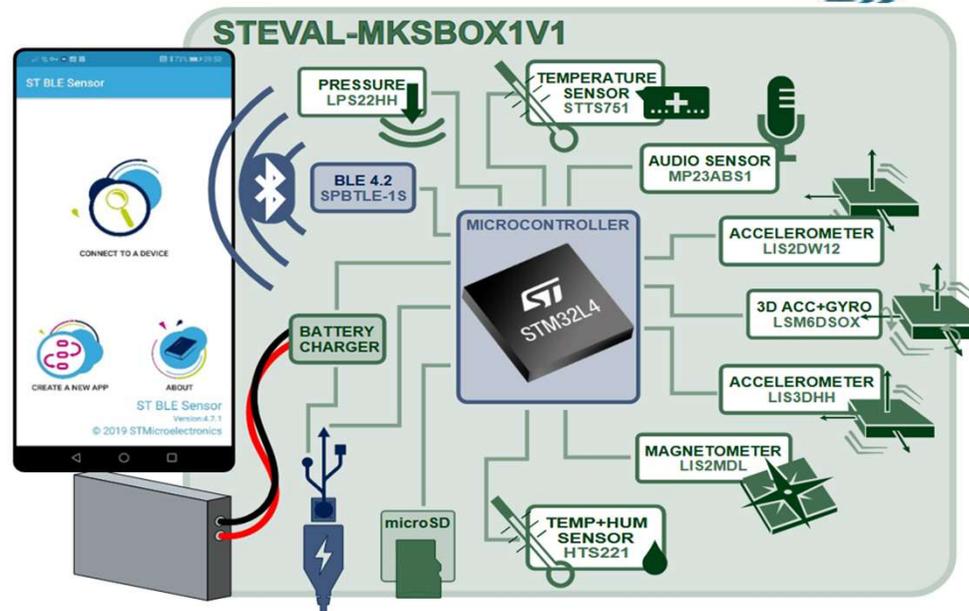
Uporaba modelov strojnega učenja v vgrajenih sistemih



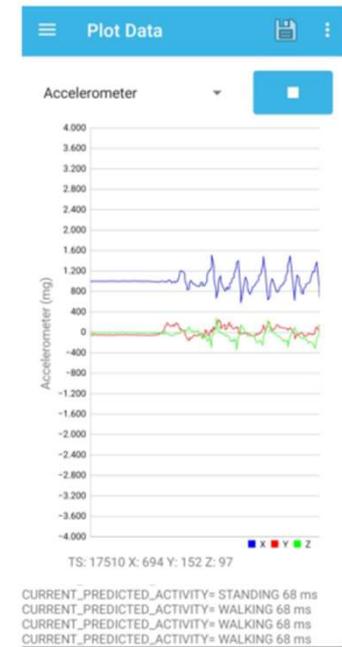
Slika 5.6: Povezava gradnikov v okolju Orange za izdelavo modela NN.

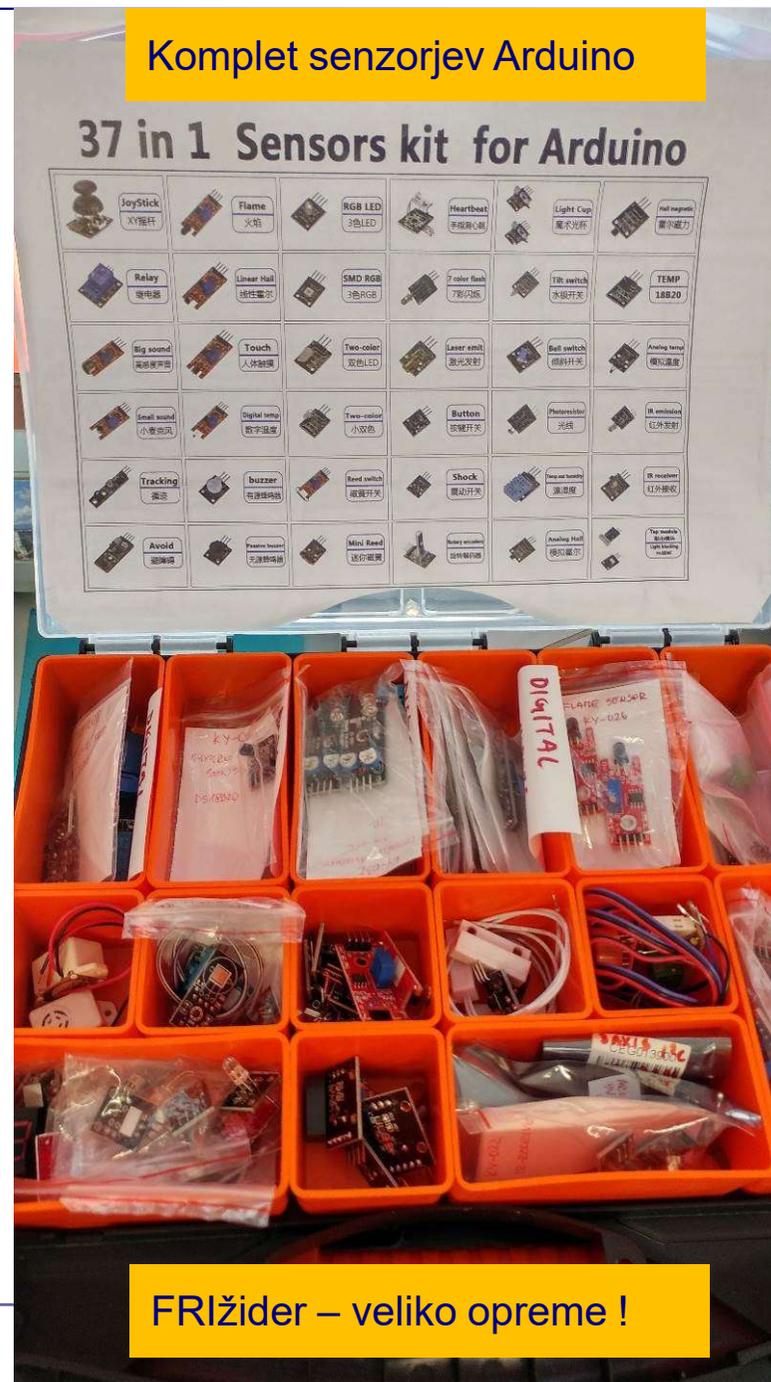
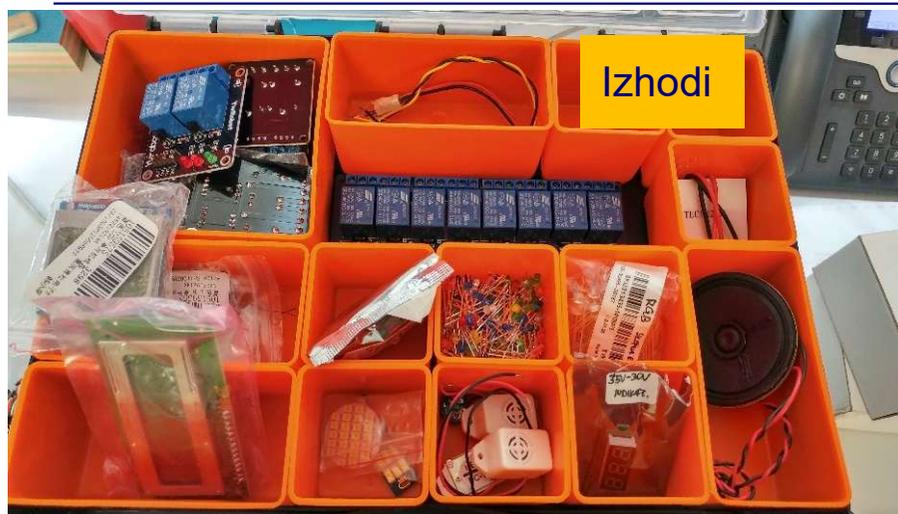


Plug and play module for learning and developing
Ready to connect to Microsoft IoT services



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









Predstavitev LAB-a



VP1: Uvod v VIN projekt – FRI Frižider



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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, ...)

ST: MEMS and Sensors

<https://www.st.com/en/mems-and-sensors.html>

Motion sensors



Accelerometers

3-axis accelerometers measure linear acceleration, inclination and vibration and enable features such as free-fall, tap recognition, activity detection, and 6D/4D orientation.

[Find products >](#)



Inertial measurement units (IMUs)

IMUs combine an accelerometer and a gyroscope in a 6-axis solution that enables gesture recognition, gaming, navigation, and augmented reality.

[Find products >](#)



Gyroscopes

3-axis analog and digital gyroscopes measure angular rate, delivering a high level of accuracy for motion-based applications.

[Find products >](#)



e-Compasses and magnetic sensors

ST's e-Compasses offer solutions combining a 3-axis digital accelerometer and magnetic sensor, as well as standalone 3-axis magnetic sensors for flexible PCB placement.

[Find products >](#)

Environmental sensors



Pressure sensors

ST's silicon pressure sensors use advanced MEMS technology to ensure high-pressure resolution in compact packages, including waterproof versions.

[Find products >](#)



Temperature sensors

We offer a comprehensive range of analog and digital temperature sensor ICs designed for a wide variety of applications.

[Find products >](#)



MEMS microphones

A MEMS microphone is an electro-acoustic transducer housing a MEMS sensor and an application-specific integrated circuit (ASIC) in a single package.

[Find products >](#)

HOW ARDUINO SENSORS ACTUALLY WORK

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

Temperature sensors



DHT22/11



am2320



BME680



DS18B20



DS18B20 Waterproof



TMP102

Distance sensors



LIDAR lite 3



HC-SR04



IR LED



MAX30105



A1302



GP2Y0A02YK0F

Force/Load sensors



Force sensitive resistor



AT42QT1012



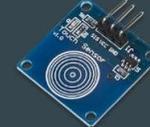
HX711



resistive touch screen



MPR121



TTP223B

MEMS sensors



ADXL335



ADXL345



ITG-3200



HMC5883L



LSM9DS1



MPU-6050

Light sensors



ISL29125



GUVA-S12SD



SI1145



LDR



ML8511

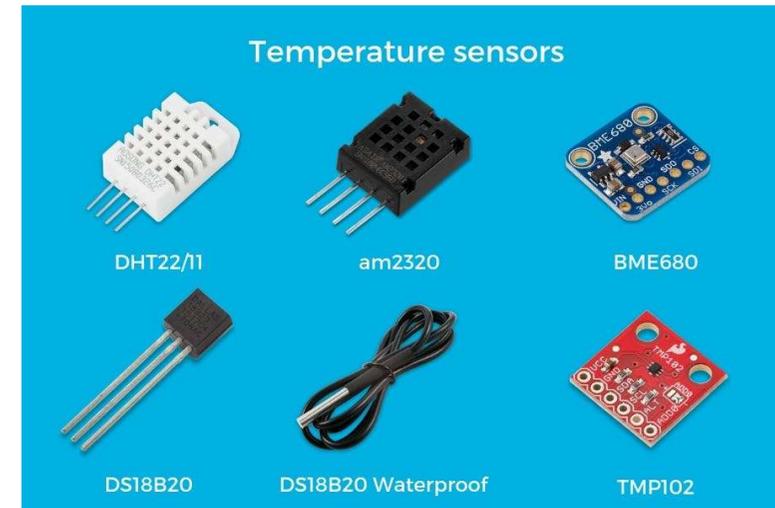


TCS34725

VIN projekt - VP: 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, ...)

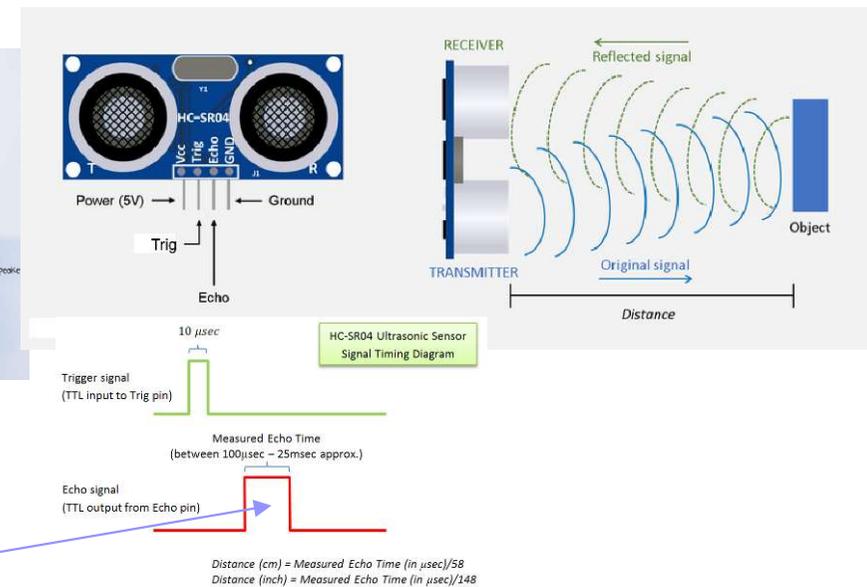
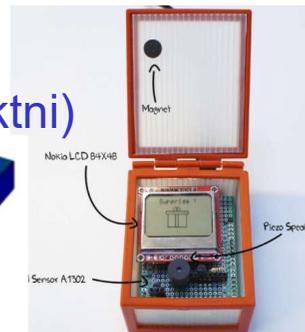
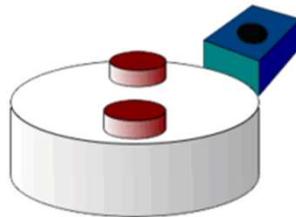
VIN projekt - VP: Tipala oddaljenosti

Vrste :

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

Priključitev :

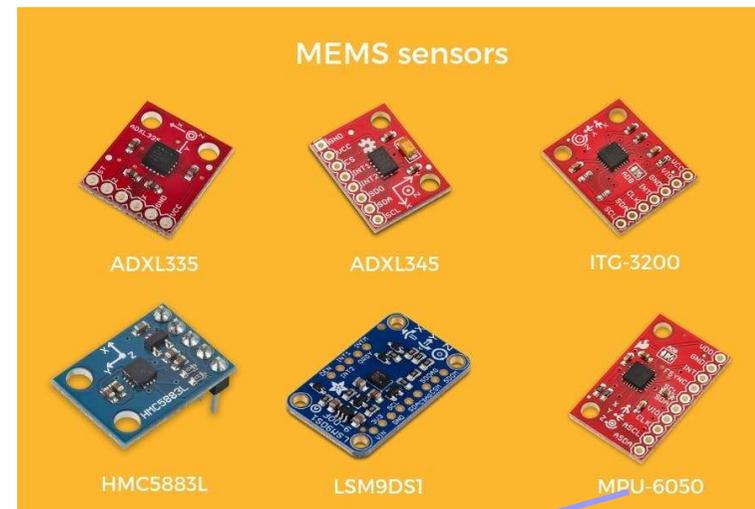
- Analogni (Hall)
- Digitalni:
 - TOF (Time-of-Flight) meritev časa



VIN projekt - VP: Tipala MEMS

Vrste :

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



[How does an Accelerometer work? | 3D Animation](#)

Priključitev :

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

Pogosto skupaj:

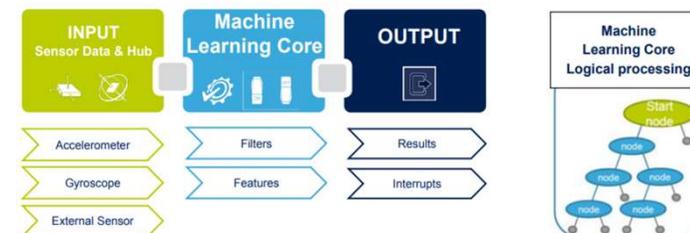
- IMU („Inertial Measurement Unit“)
 - pospeškometer + žiroskop

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
- $\pm 2/\pm 4/\pm 8/\pm 16$ g polni obseg
- $\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000$ 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

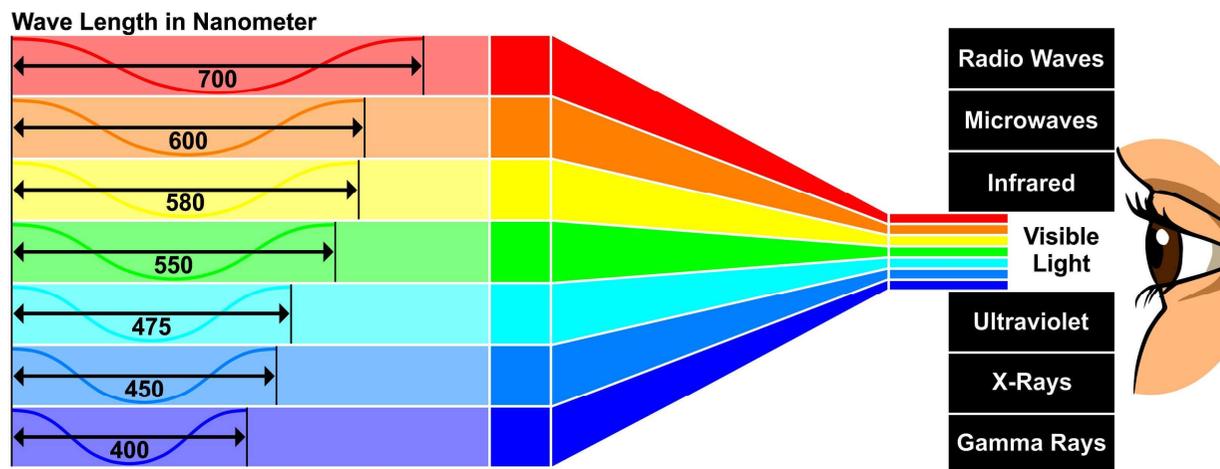
VIN projekt - VP: Tipala svetlobe

Vrste :

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

Priključitev :

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



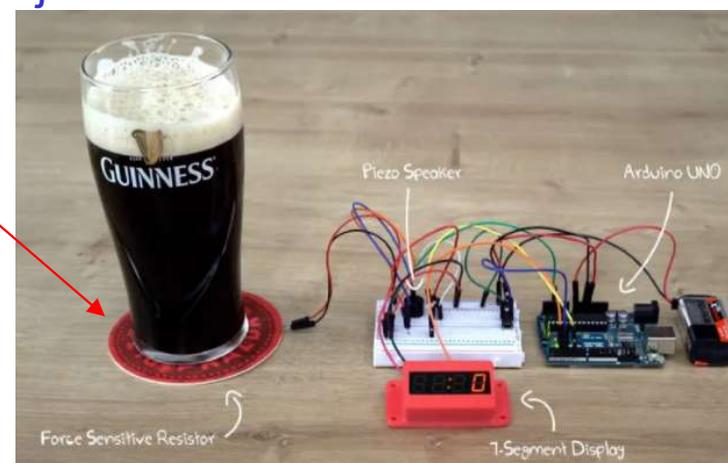
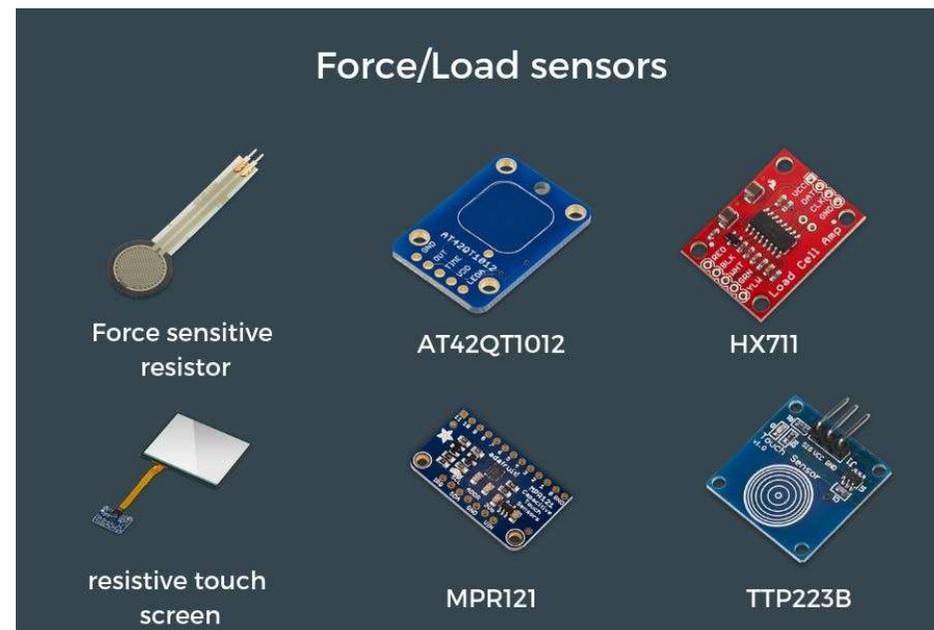
VIN projekt - VP: Tipala dotika/pritiska

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

PIR Napion Senzor
sreda, 31. marec 2021 19:07

AMN22111

MP Motion Sensor (AMN1,2,4)

Panasonic
ideas for life

MOTION SENSOR (PASSIVE INFRARED TYPE)

MP MOTION SENSOR 'Napion'

2. Dual lens colors (white and black) are provided
With an ultrasmall design and dual lens colors (white and black), it is inconspicuous, allowing the user to select either white or black to match the equipment color. This provides greater flexibility in equipment design.

3. Both digital output and analog output (with adjustable sensitivity) are available.

4. Built-in amplifier for easy use
Has a built-in amplifier, and can be connected directly to a microcomputer.

• Block diagram of the digital output circuit

• Block diagram of the analog output circuit

6. Noise withstanding capability
Circuitry is contained in a TO5 metal package, providing at least twice the noise withstanding capability as conventional type.

• Comparison example of noise withstanding capability

	Distance at which motion sensor is not affected by cellular phone noise
Conventional type	Min. 1 to 2m 3.281 to 6.562ft
MP Motion Sensor	Min. 1 to 2cm .394 to .787inch

7. A low current consumption type (46 µA) has also been added to the line-up.
A type that keeps current consumption to 46 µA (less than 30% compared to predecessor) is now available. Ideal for battery driven devices.
*Digital output type only.

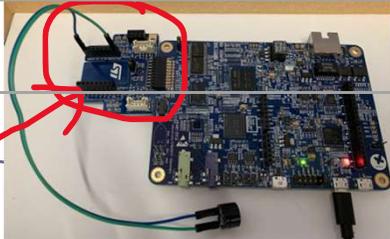
APPLICATIONS

1. Home appliances
Useful for saving energy in air conditioner, television, personal computer, or ventilator

Tipala za delo

- Tipala kakovosti zraka
 - APC1001U_EK
 - SEK-SCD41-SENSOR
- Time-of-flight
 - 37 in 1 sensor kit for Arduino
 - KY-005 in KY-022 IR TX/RX

VIN projekt – Clickboards I (STM32H7,F4, Rpi)

Oznaka	Količ.	Namen	Komunikacija	Opis	URL
BEE	2	Zigbee Transc.	GPIO,SPI	MRF24J40 MA	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/VO	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 \(20\)](#)

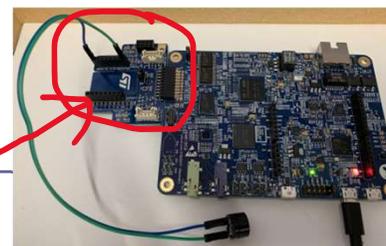
From <https://www.mikroe.com/click>



VIN projekt – Clickboards II (STM32H7,F4, Rpi)

Oznaka	Količ.	↑
BLE 8 <u>Click</u>	2	
Barometer 9 <u>Click</u>	2	
<u>Environment</u> 3 <u>Click</u>	2	
<u>mikroBUS</u> Shuttle 5pcs	2	
<u>mikroBUS</u> Shuttle 10	10	
Temp&Hum 15 <u>Click</u>	4	
Shuttle <u>Click</u> 4	4	
RS485 8 <u>Click</u>	4	
<u>Proximity</u> 16 <u>Click</u>	2	
Pi 4 <u>Click</u> Shield	4	
<u>Oximeter</u> 5 <u>Click</u>	2	
<u>LightRanger</u> 11 <u>Click</u>	2	
IR <u>Click</u> 4	4	
<u>Hydro Probe</u> <u>Click</u>	4	
Smart <u>Sens</u> 2	1	
Air <u>quality</u> 4	1	
RS485 <u>Isolator</u> 3	1	

- └ Click Boards (2019)
 - > Wireless Connectivity (262)
 - > Sensors (650)
 - > Interface (187)
 - > Display & LED (80)
 - > Miscellaneous (49)
 - > Mixed Signal (155)
 - > Storage (63)
 - > Motor Control (144)
 - > Audio & Voice (57)
 - > HMI (88)
 - > Clock & Timing (42)
 - > Power Management (158)
 - Click Bundles (22)
 - Click Shields (53)
 - Legacy (69)
 - > NECTO (2)
 - > Compilers (31)
 - > Development Boards (57)
 - > Starter Boards (73)
 - > Programmers and Debuggers (28)
 - > Smart Displays (119)
 - > MCU Cards (209)



VIN projekt - VP3: Uvod, tipala, TinkerCad, Breadboard, vezave

- Uvod v VIN projekt

- Tipala

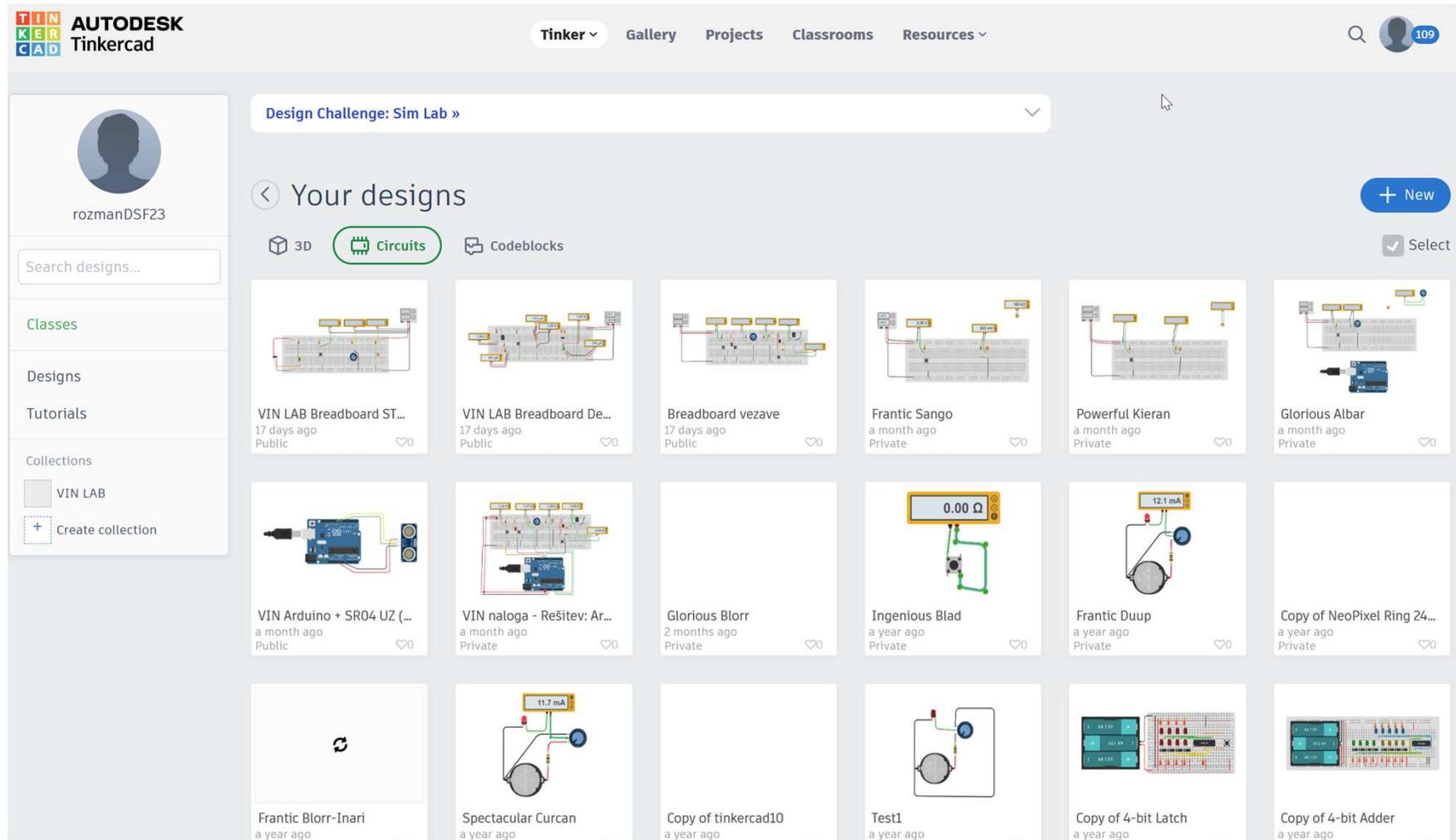
- Spoznavanje TinkerCad-a

- Breadboard – osnovne vezave

- DN2.1 – VP3

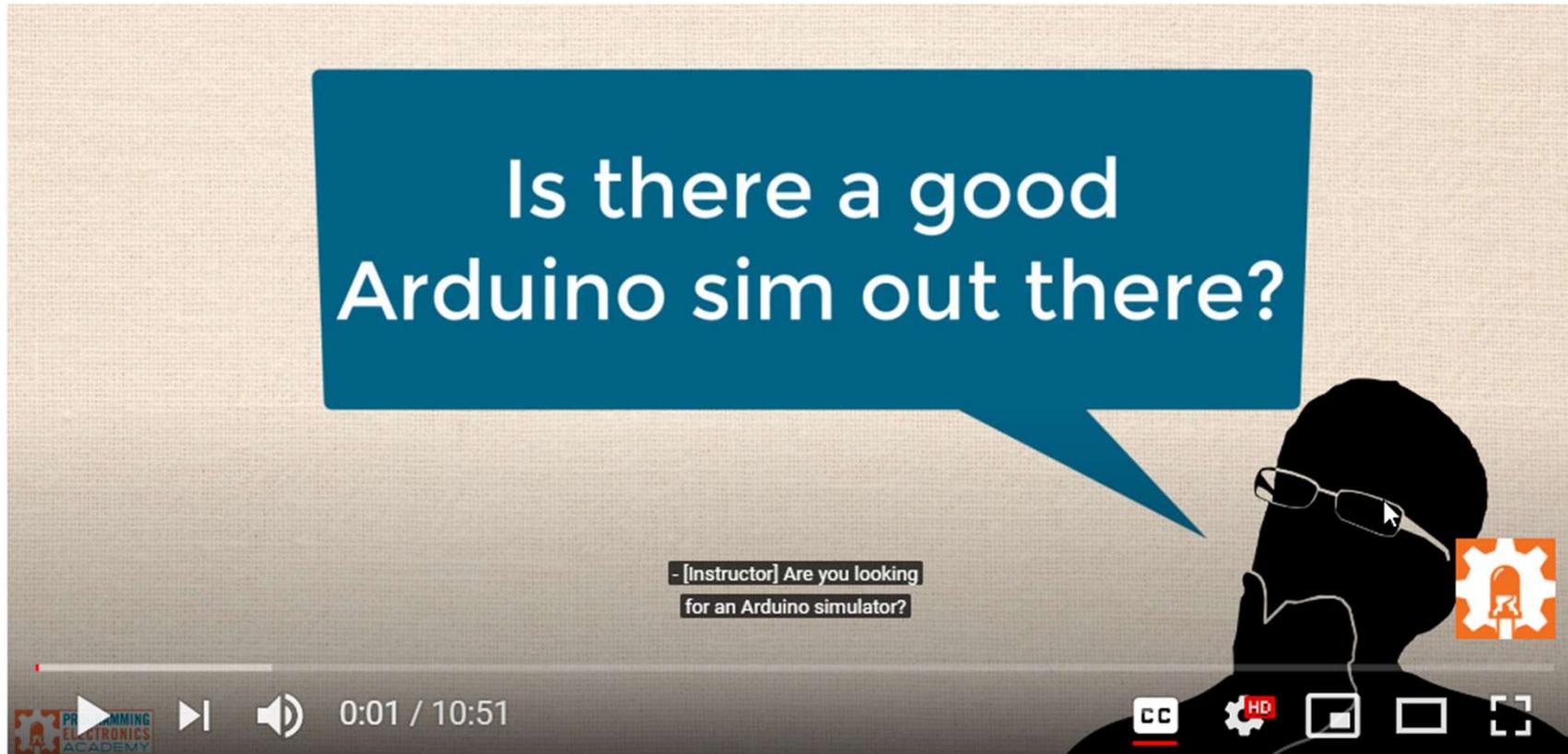
- Dodatek: Vezja v TinkerCad z Arduinom

TinkerCad: izdelajte svoj račun



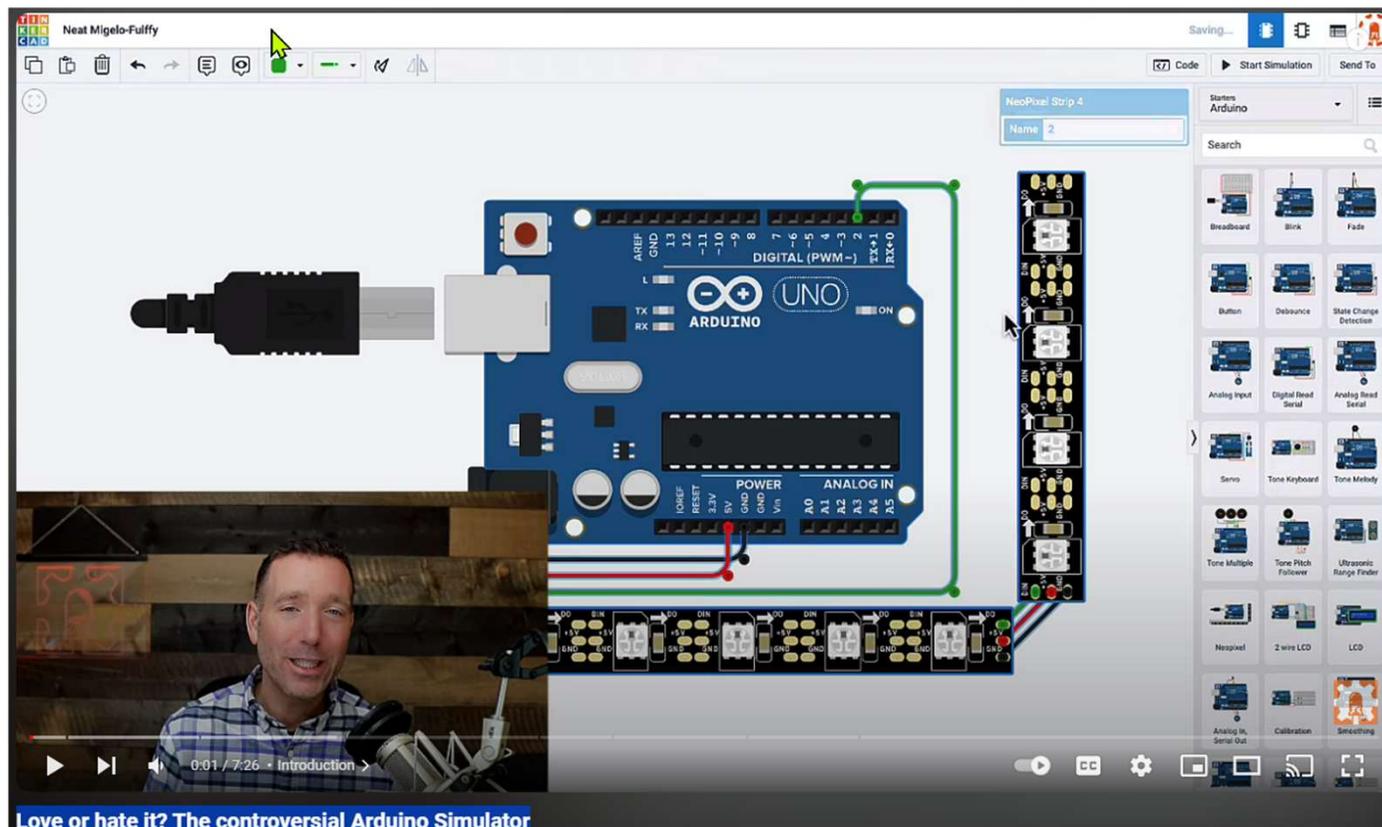
<https://www.tinkercad.com/>

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



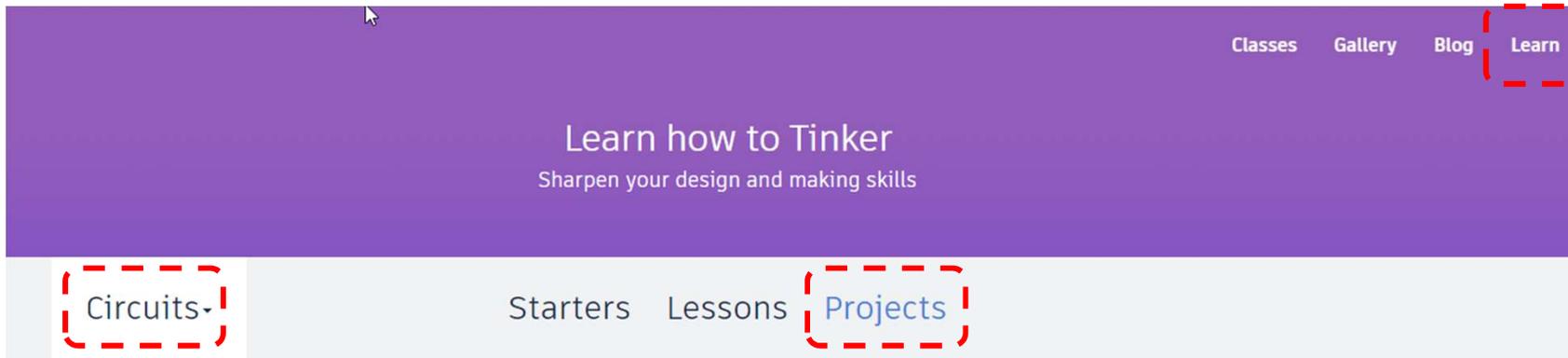
Z naslova <<https://www.youtube.com/watch?v=6uz1sCA9joc>>

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

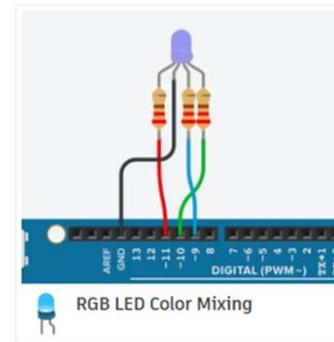
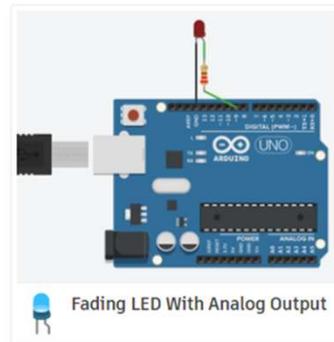
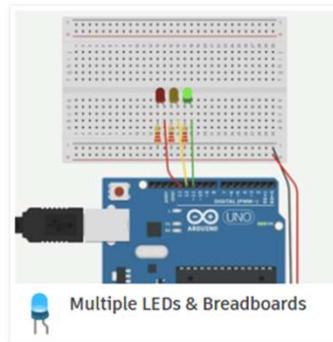
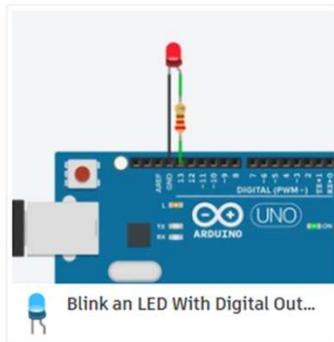


Z naslova <https://www.youtube.com/watch?v=2gHxgwoWPjw&ab_channel=ProgrammingElectronicsAcademy>

TinkerCad – učenje, primeri



Learn Arduino with our easy-to-follow lessons that set you on the fast path to coding and prototyping your own projects.

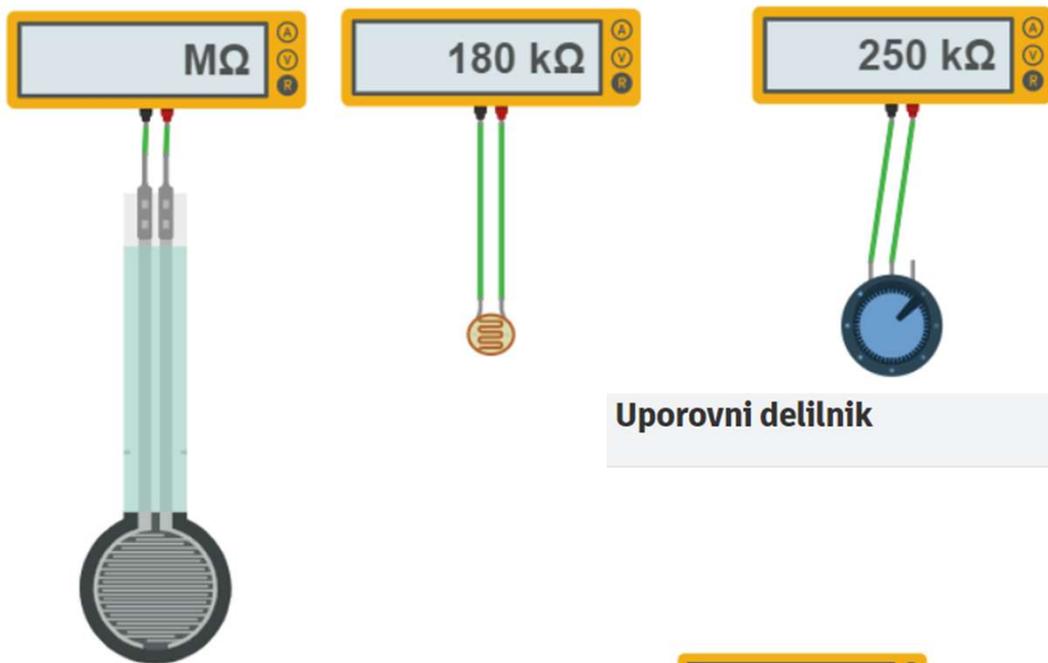


VIN projekt : TinkerCad

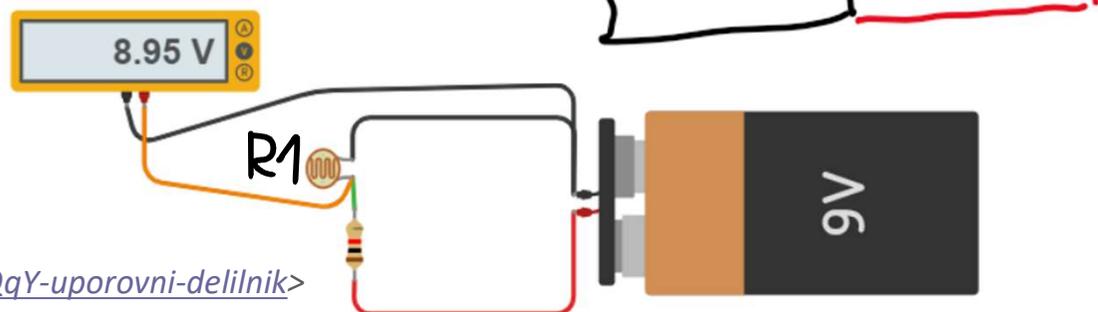
Uporovna tipala in delilnik napetosti

Uporovna tipala

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



Uporovni delilnik

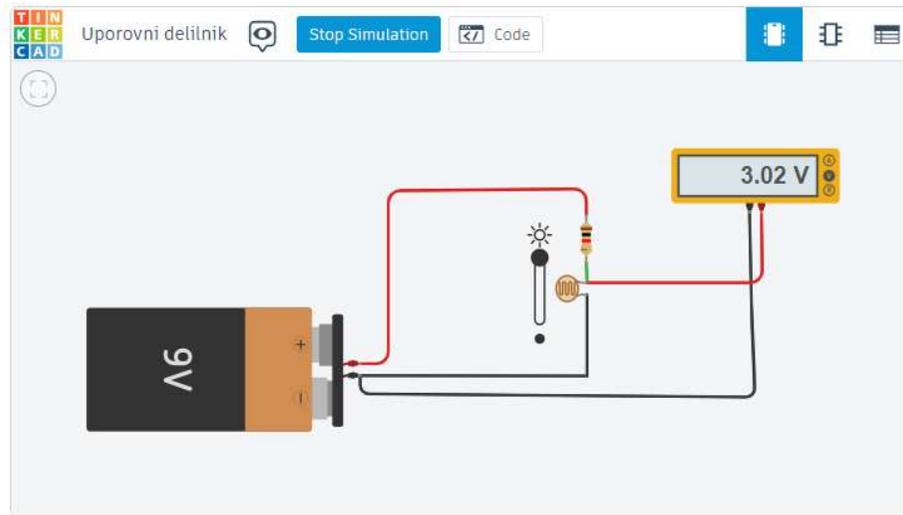


<<https://www.tinkercad.com/things/eqKLw5MkQqY-uporovni-delilnik>>

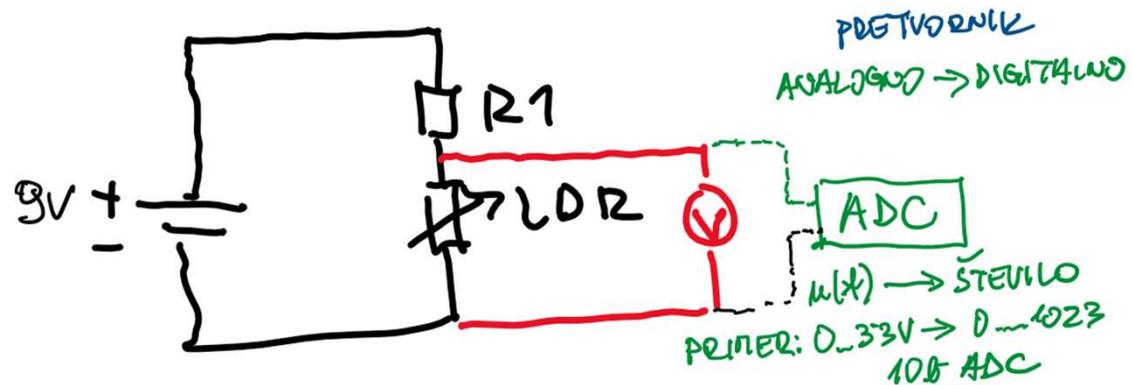
VIN projekt : TinkerCad

Uporovna tipala in delilnik napetosti - meritve

Uporovni delilnik



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

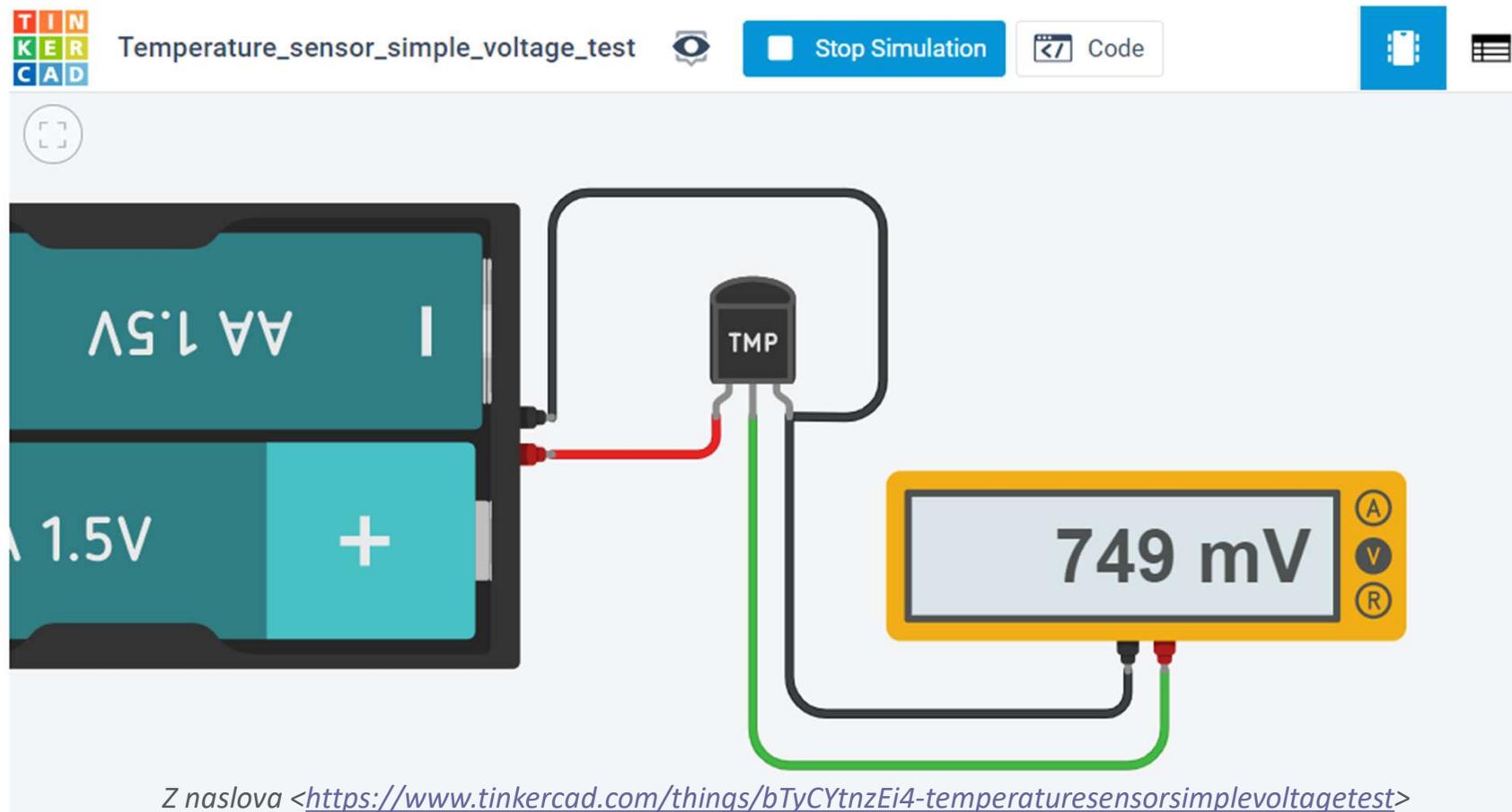


VIN projekt: TinkerCad

Ostali primeri: osnovni elementi in preproste vezave

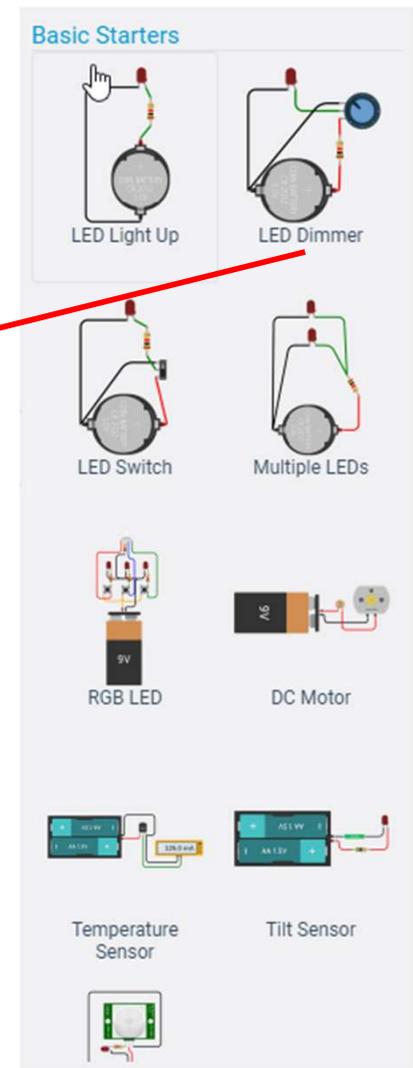
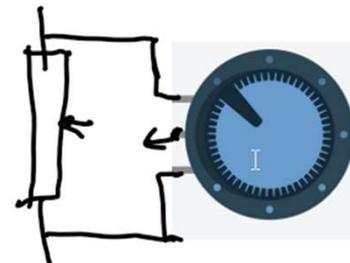
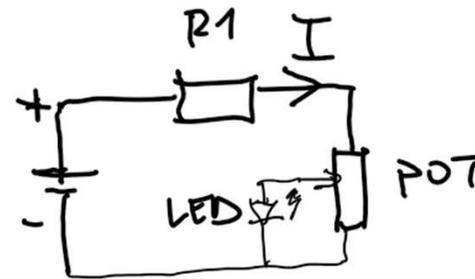
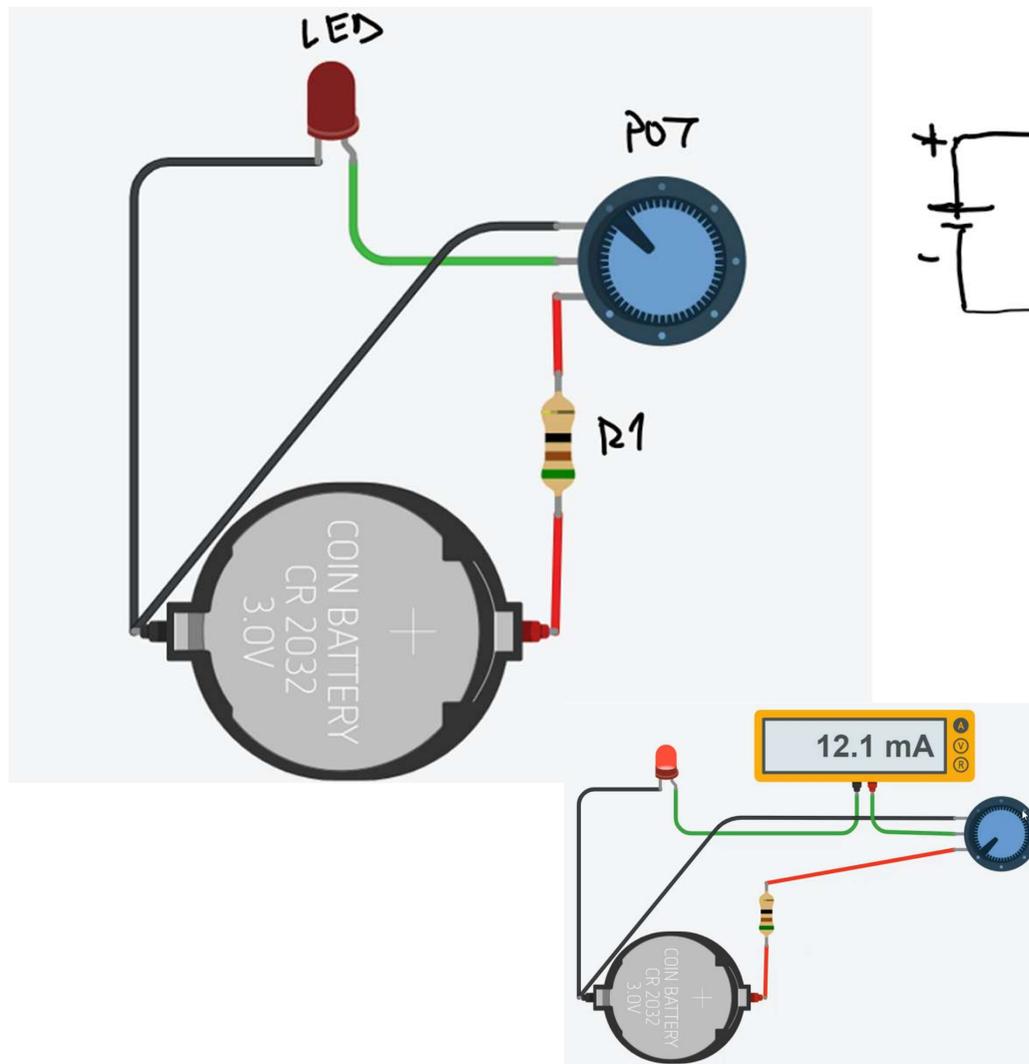
38

Temperature_sensor_simple_voltage_test



VIN projekt: TinkerCad

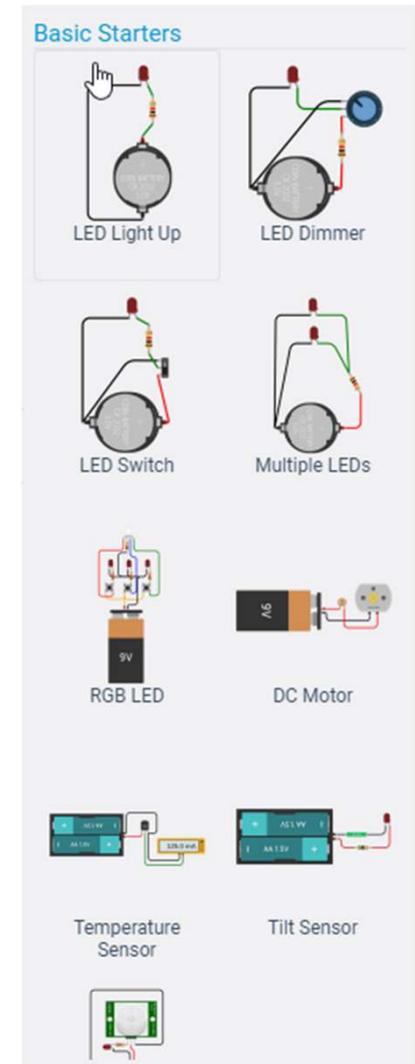
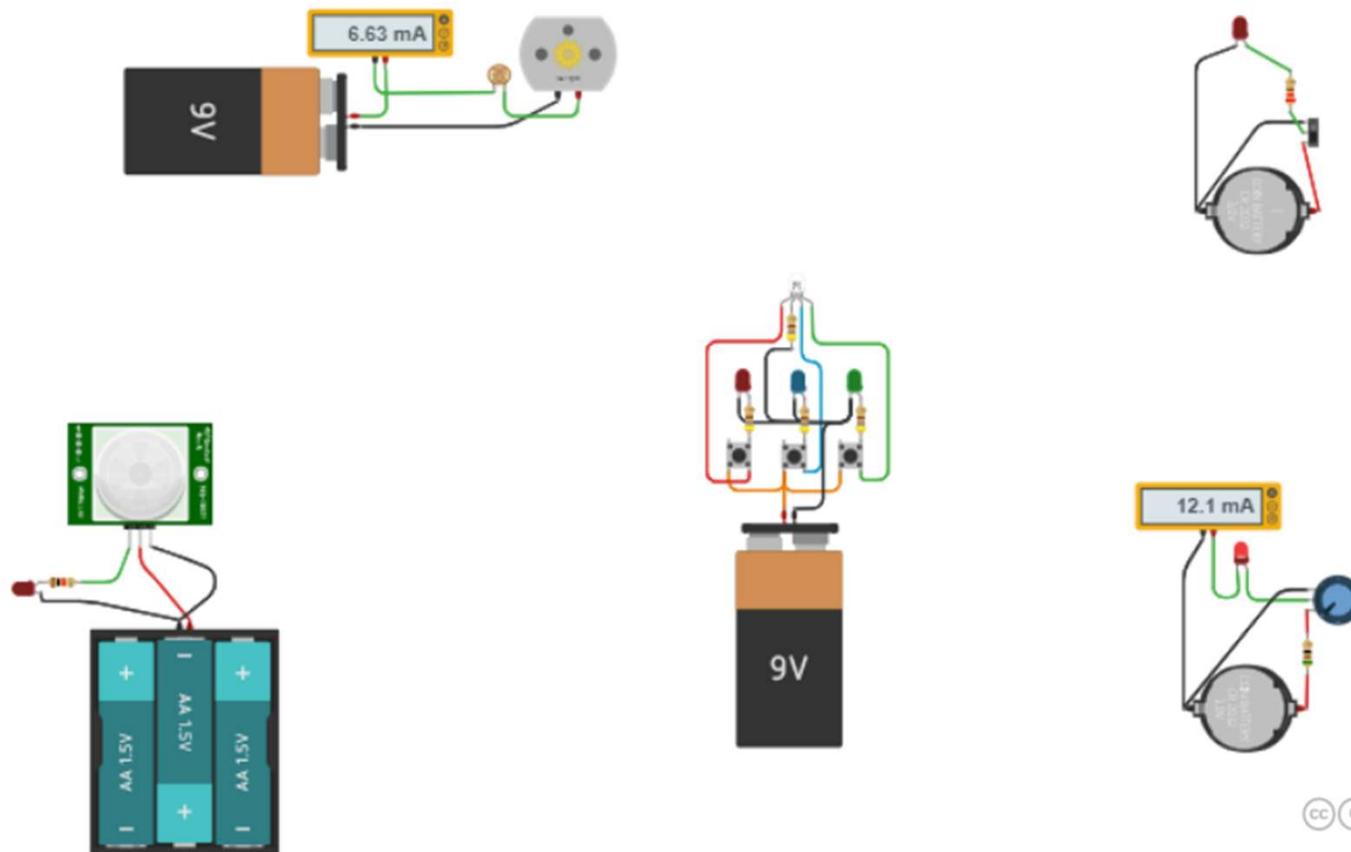
Ostali primeri: osnovni elementi in preproste vezave



VIN projekt: TinkerCad

Ostali primeri: osnovni elementi in preproste vezave

VIN Osnovni elementi in preproste povezave

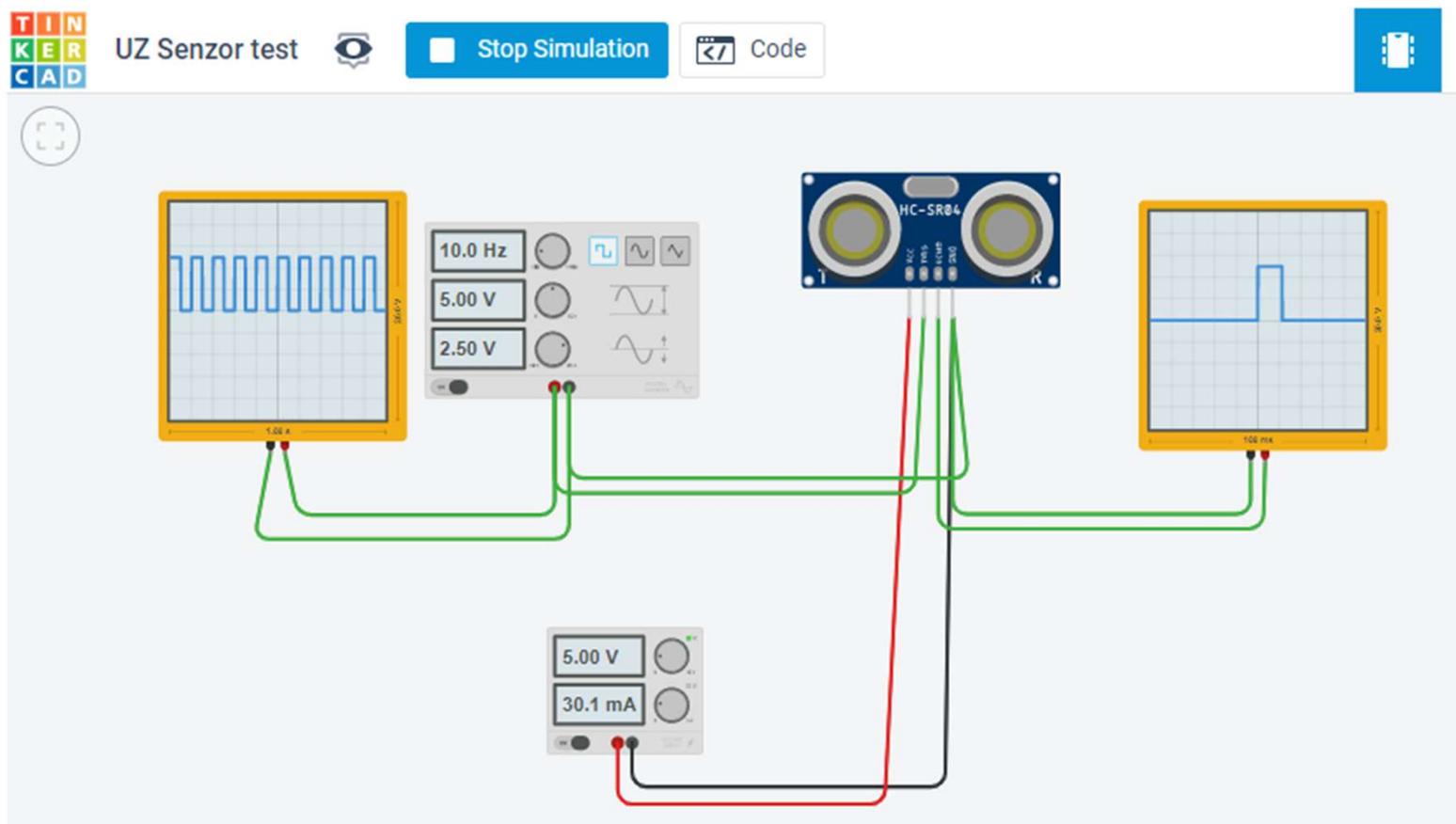


Z naslova <<https://www.tinkercad.com/things/aVrm76VMZSV-vin-osnovni-elementi-in-preproste-povezave>>

VIN projekt : TinkerCad

Primer simulacije: UZ tipalo razdalje HC-SR04

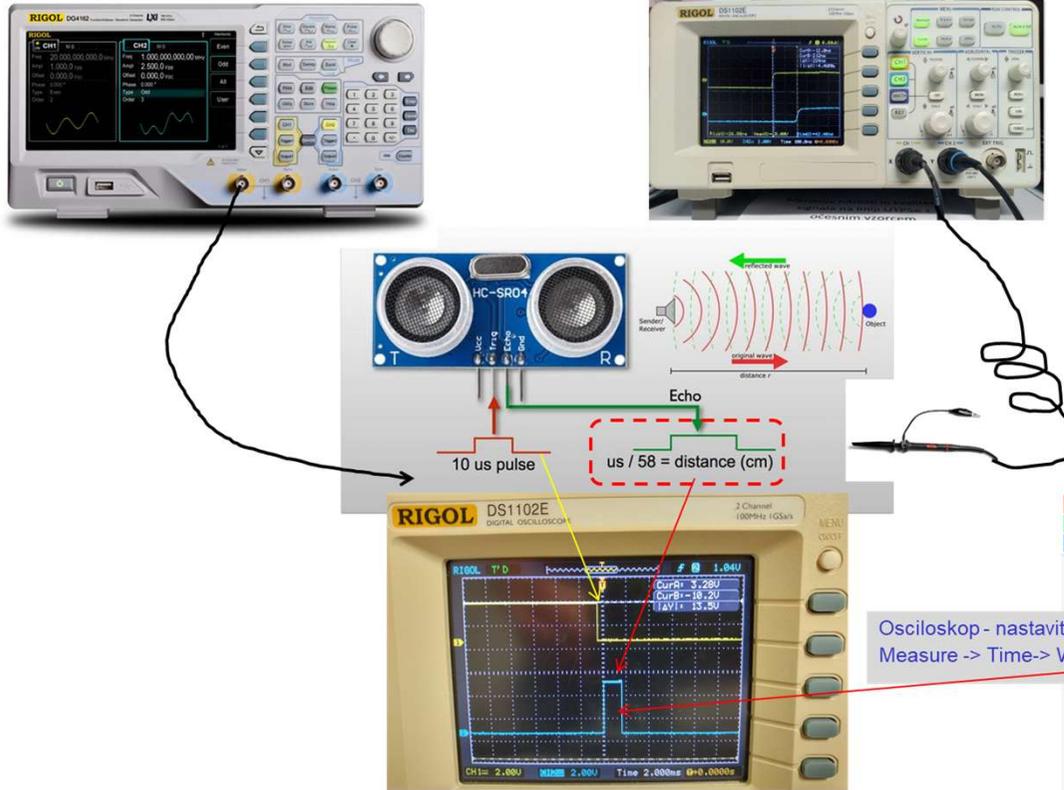
UZ Senzor test



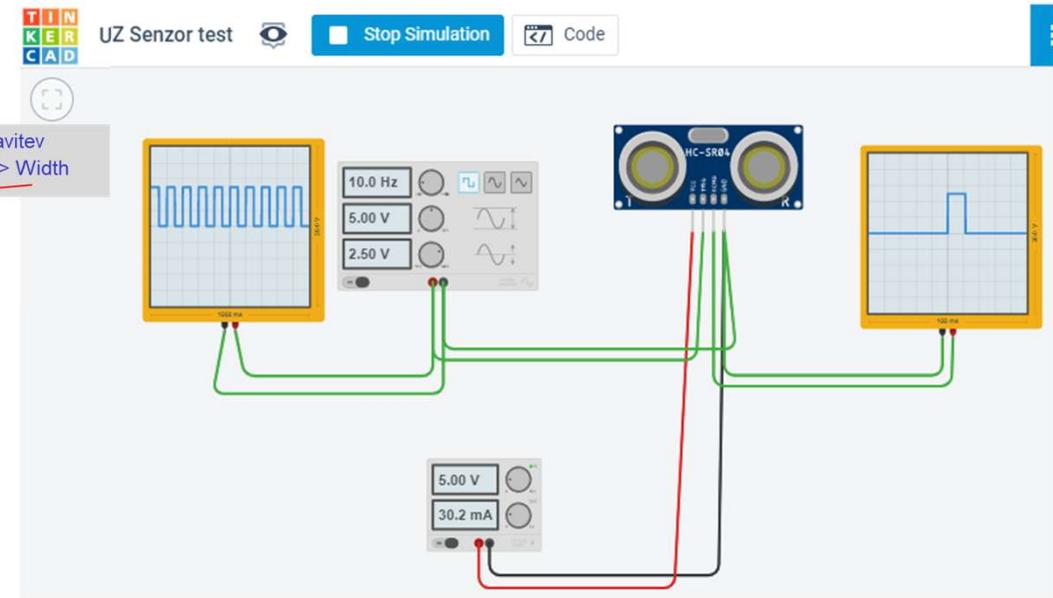
Z naslova <<https://www.tinkercad.com/things/k6it1PauvwW-uz-senzor-test>>

UZ tipalo razdalje 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>

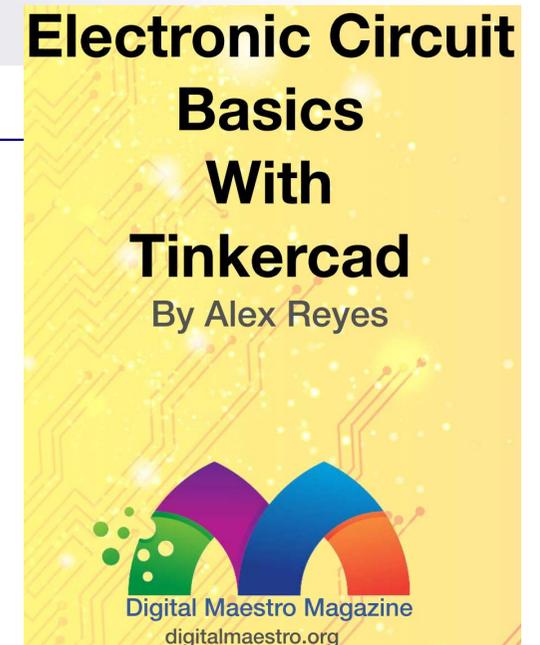
■ Learn how to use Tinkercad to design, build, and test simple circuits.

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/>

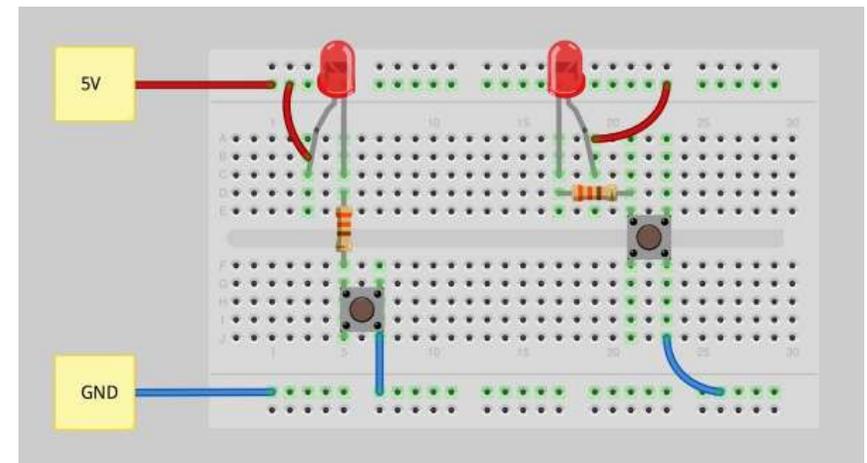
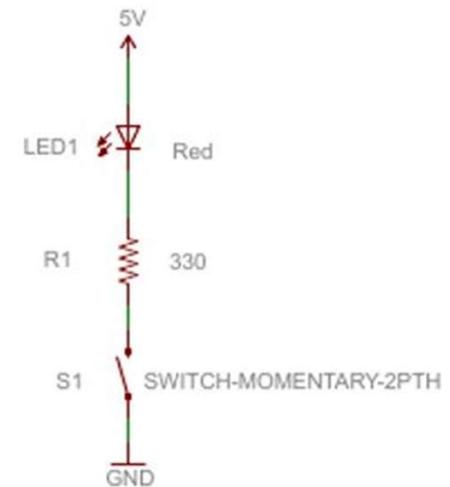
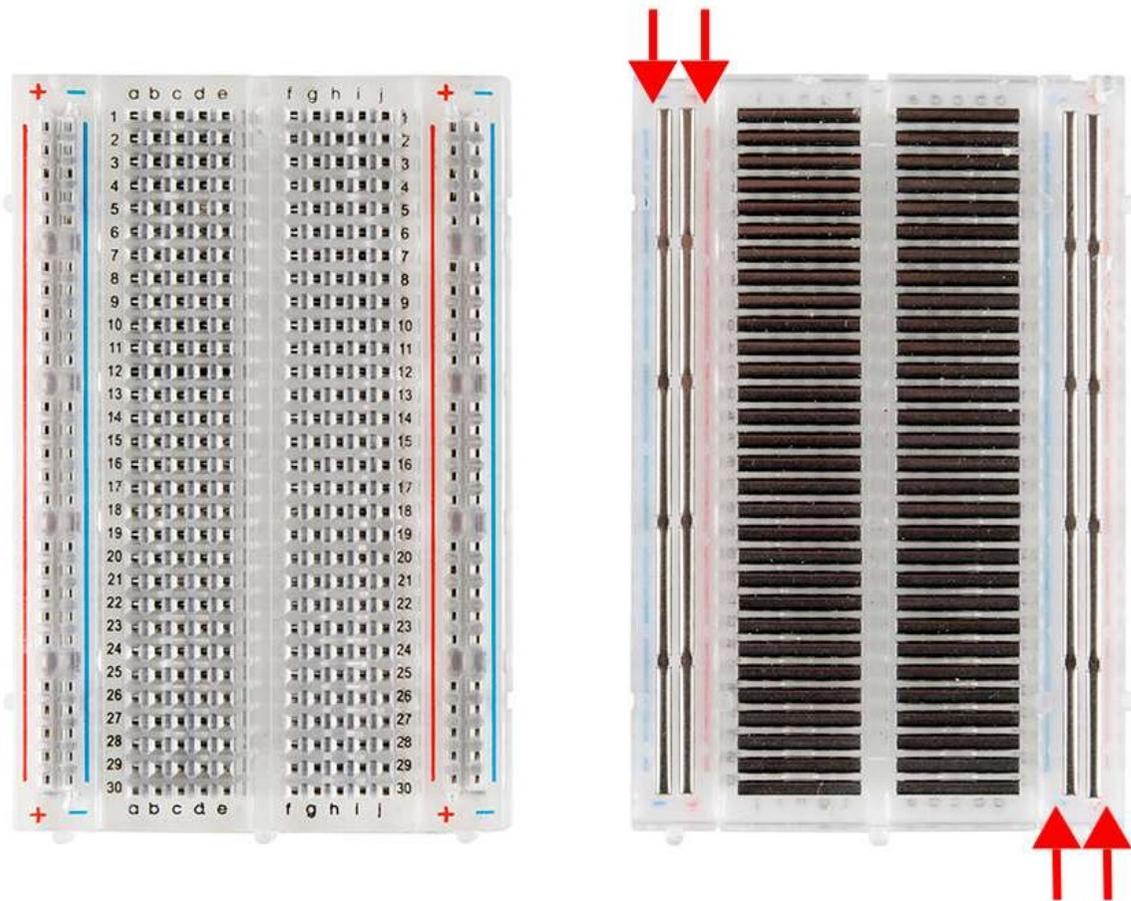
■ [Electronic Circuit Basics with TinkerCAD 2 \(energiazero.org\)](https://energiazero.org)



VIN projekt - VP3: Uvod, tipala, TinkerCad, Breadboard, vezave

- Uvod v VIN projekt
- Tipala
- Spoznavanje TinkerCad-a
- Breadboard – osnovne vezave
- DN2.1 – VP3
- Dodatek: Vezja v TinkerCad z Arduinom

VIN projekt : TinkerCad Breadboard vezave

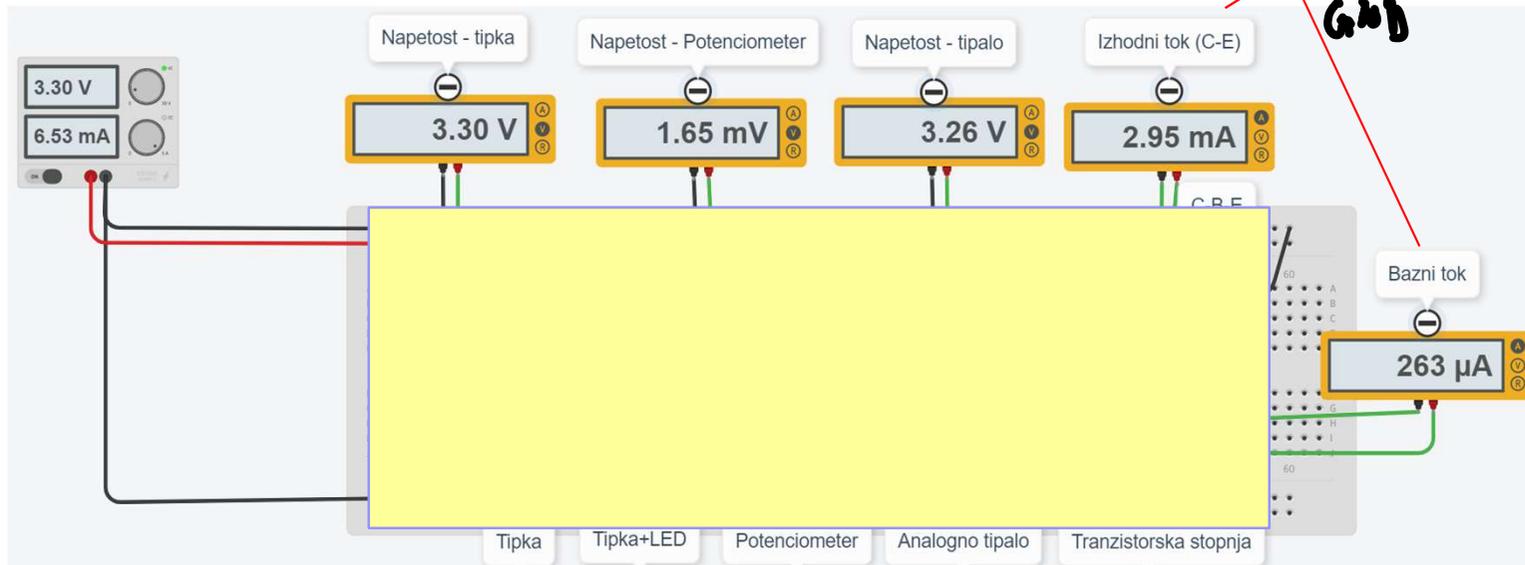
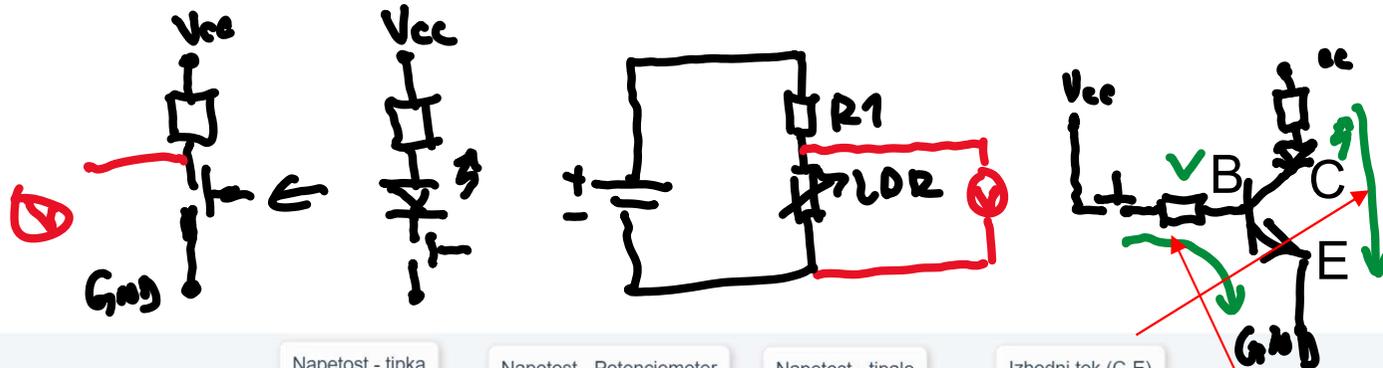


Viri

- <https://learn.sparkfun.com/tutorials/how-to-use-a-breadboard/>
- <https://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-breadboard>

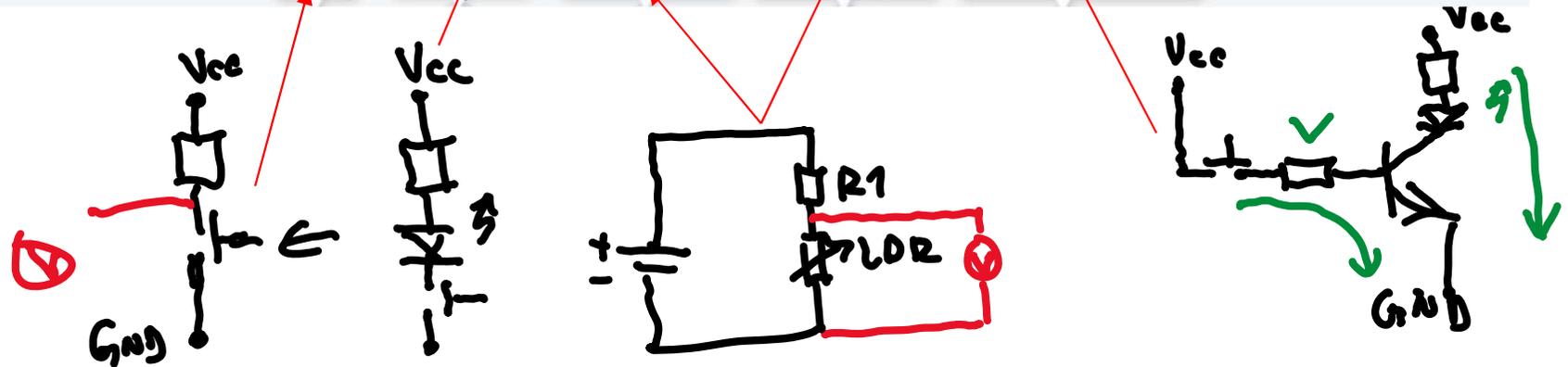
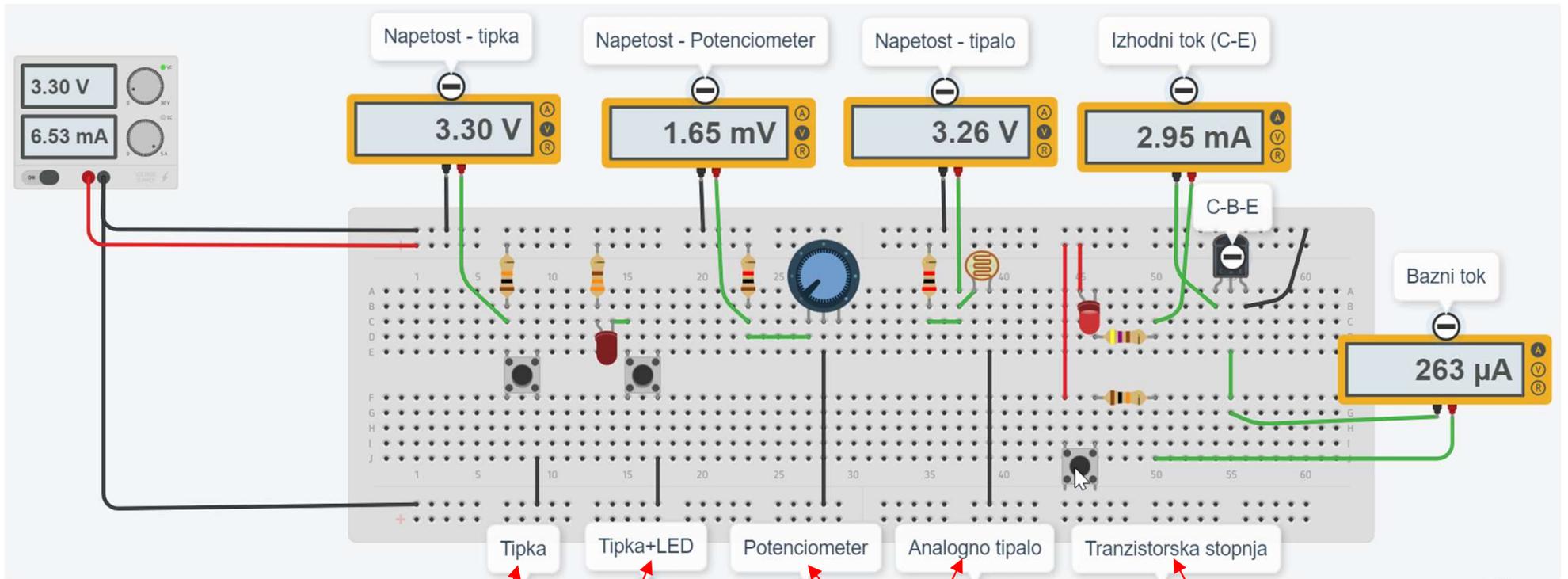
VIN projekt : TinkerCad

Breadboard – osnovne vezave



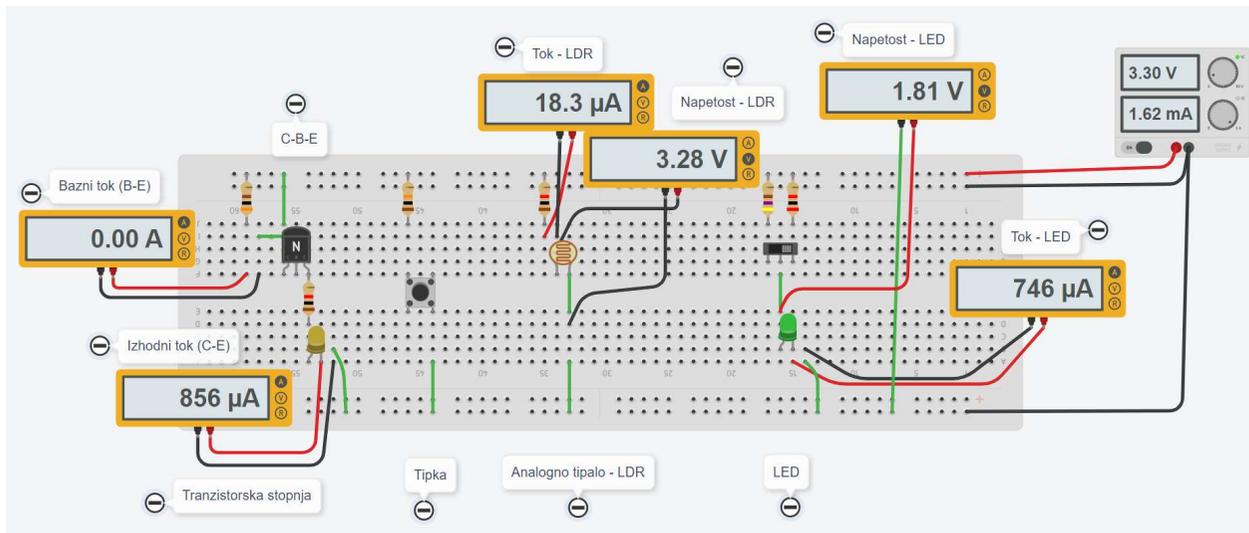
VIN projekt : TinkerCad

Breadboard vezave – Primer rešitve

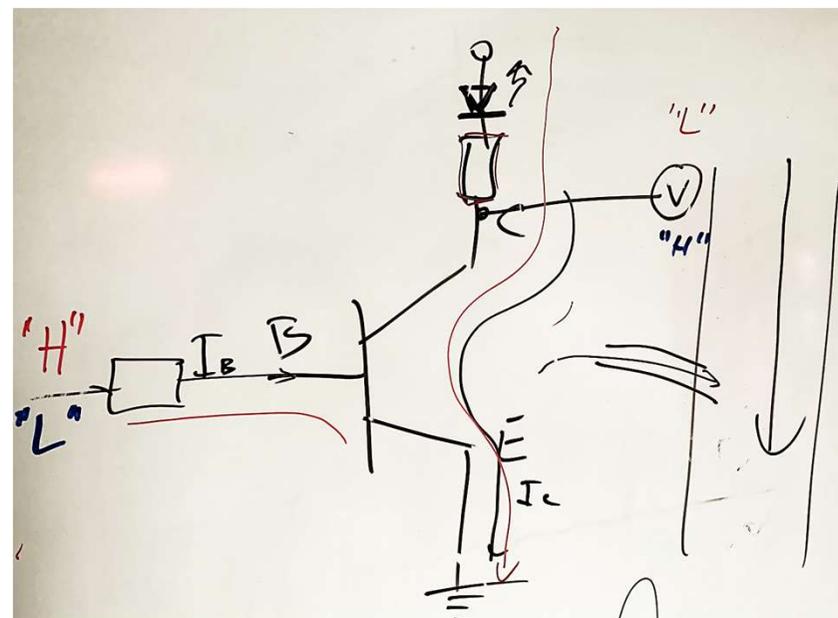
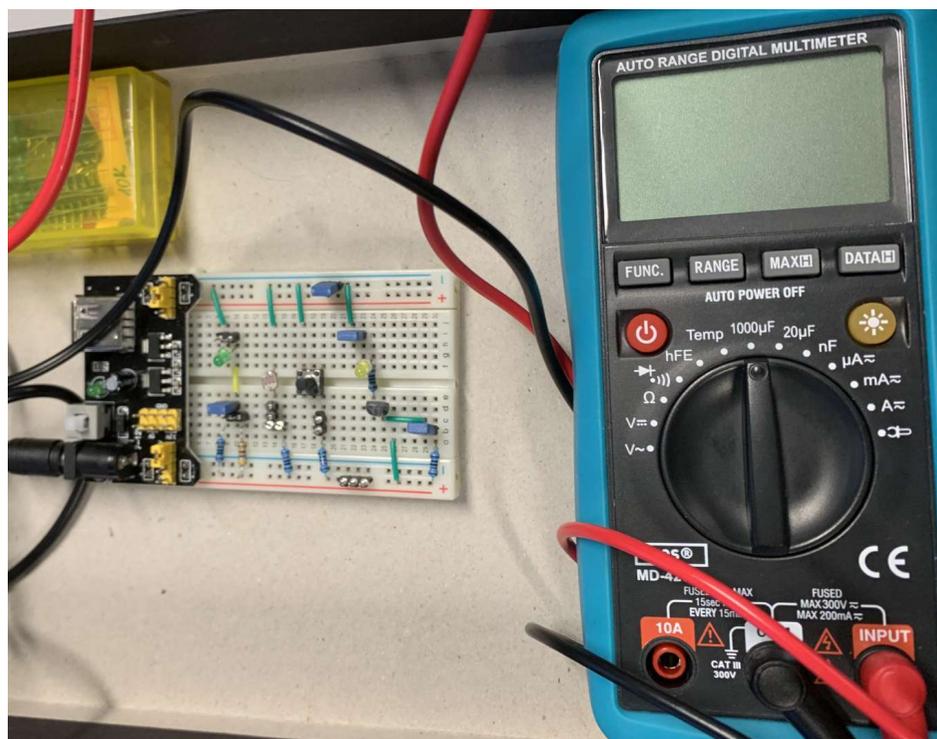


VIN projekt : Breadboard vezave + Unimer

V različnih točkah vezja lahko merimo el. napetost, tok.



<https://www.tinkercad.com/things/1UQpxVO5DSY-vin-lab-breadboard-demo>

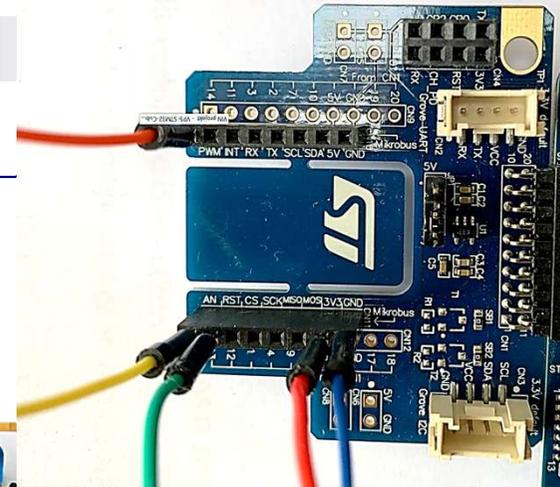
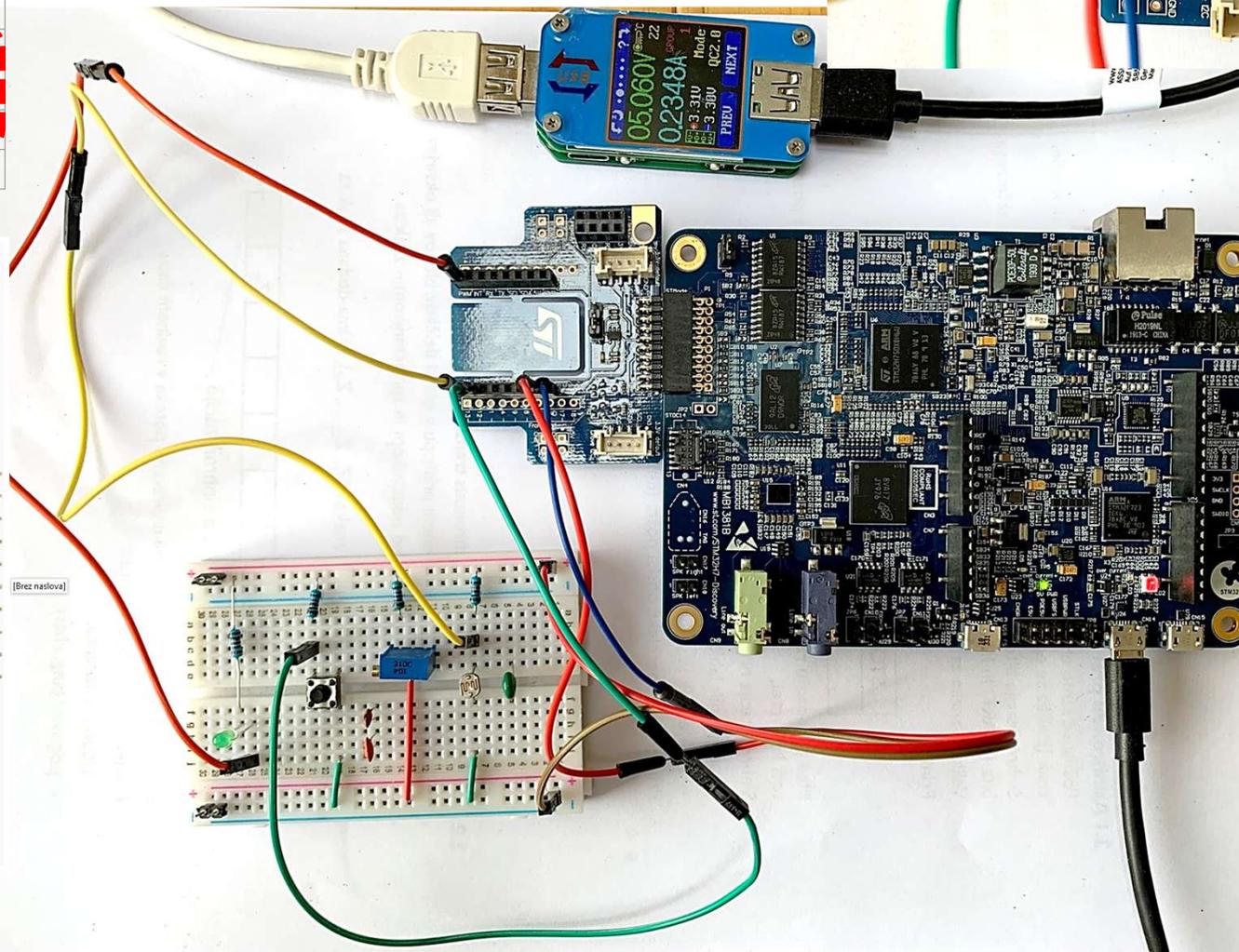
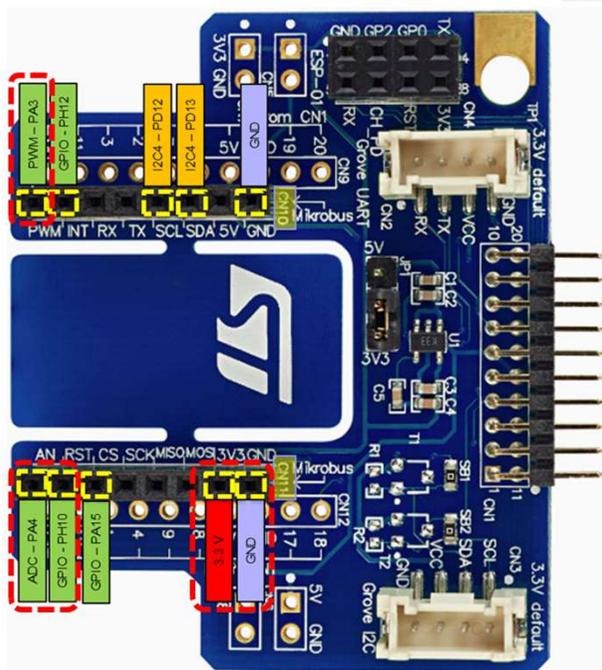


STM32H7

Priključitev na STM32 : 1x analogni, 1x digitalni vhod, 1x digitalni izhod

Testno vezje (primer) - STM32H7 :

GPIO	Vrsta	Povezava
PC13	User tipka	Modra tipka
PA4	Analogni vhod	Rumena žička
PH10	Dig. Vhod	Zelena žička
PA3	Dig. Izhod - LED	Oranžna žička
PJ2, Pi13	Dig. Izhodi	vgr. LED diode

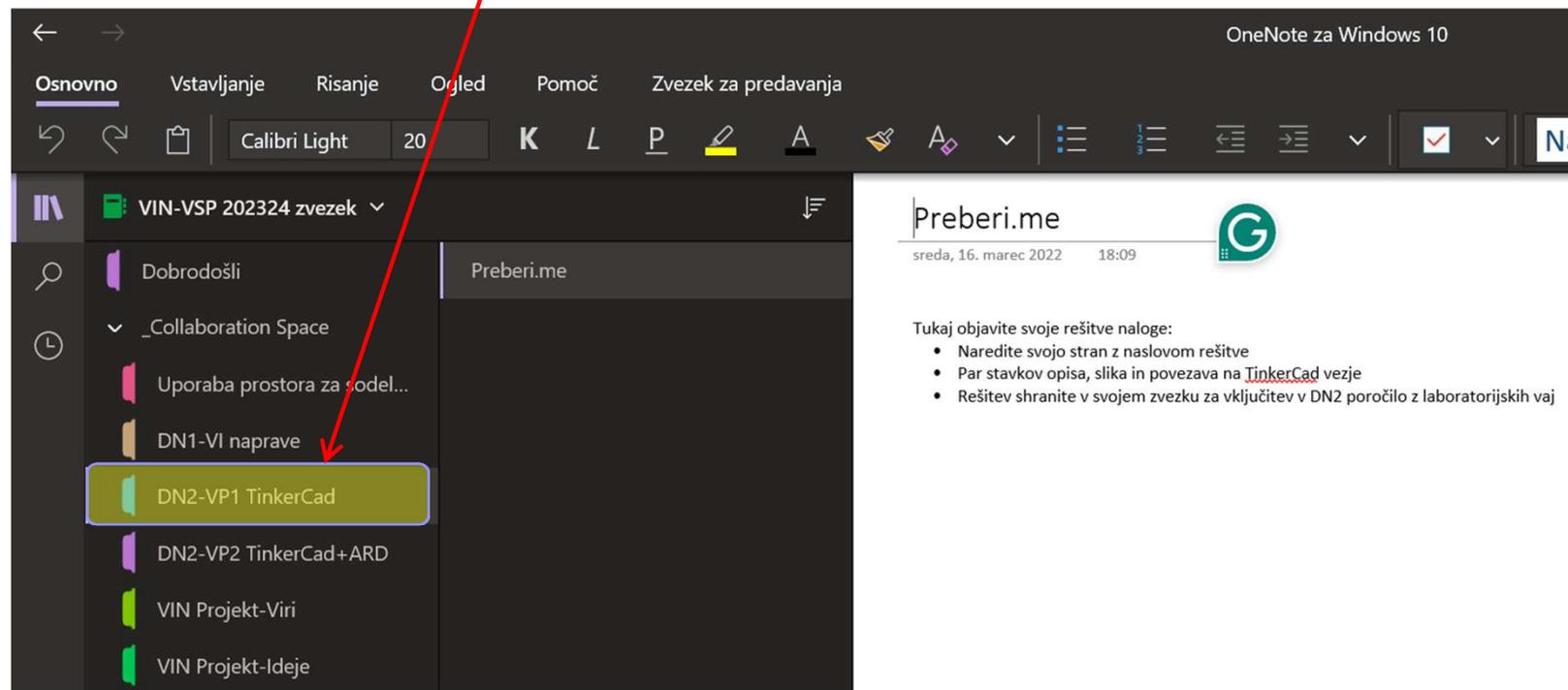
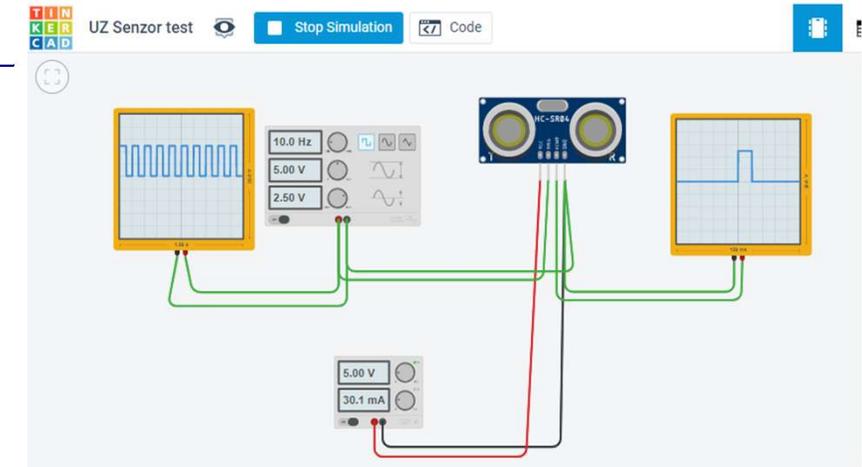


VIN projekt - VP3: Uvod, tipala, TinkerCad, Breadboard, vezave

- Uvod v VIN projekt
- Tipala
- Spoznavanje TinkerCad-a
- Breadboard – osnovne vezave
- DN2.1 – VP3
- Dodatek: Vezja v TinkerCad z Arduinom

TinkerCad – DN2.1-VP3 :

- Spada v sklop poročila z LAB vaj (DN2)
- Naredite sebi zanimivo osnovno vezje(a),
 - lahko tudi z uporabo mikrokrmilnika (Arduino)
- Objavite v OneNote delovnem zvezku
 - Prostor za sodelovanje, razdelek DN2.1-VP3 TinkerCad



TinkerCad – DN2.1-VP3: Primer zapisa (objave)

Preprosto vezje za preizkus delovanja UZ tipala razdalje

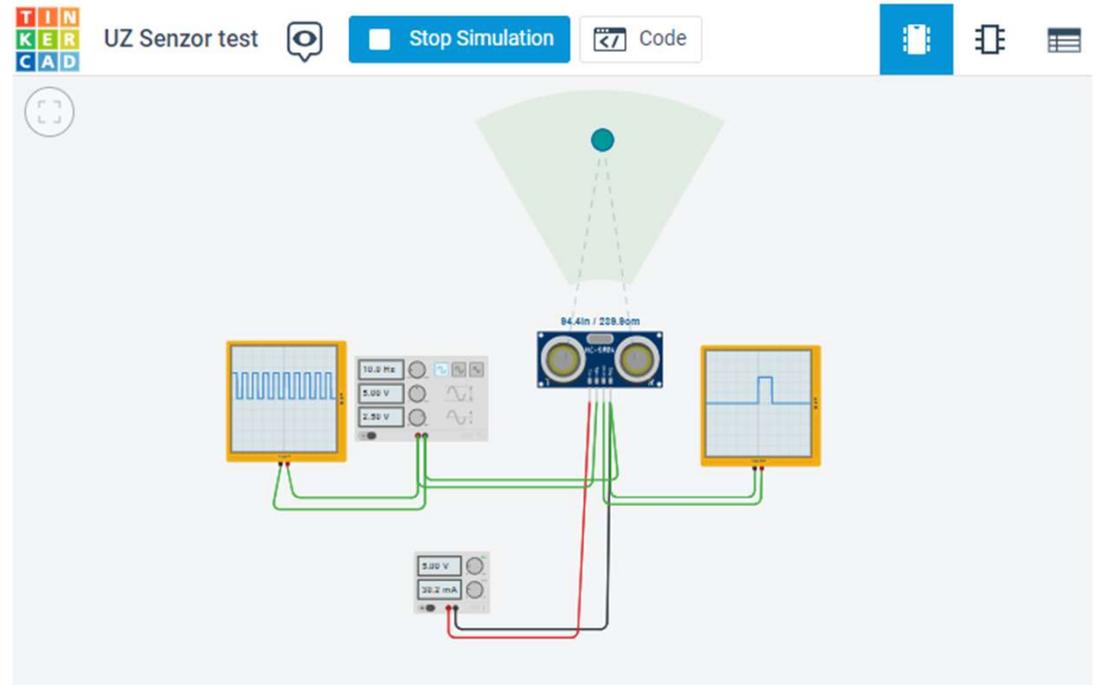
Sestavni deli:

- 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).

UZ Senzor test



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