



# Vhodno izhodne naprave

Laboratorijska vaja 1  
Uvod v LAB vaje VIN

# 1.1 Uvod v laboratorijske vaje VIN

## ■ Oceno iz vaj sestavljajo

### □ poročili:

- s predavanj (DN1: V/I naprave) (10%)
- z laboratorijskih vaj (DN2: simulacije, meritve) (10%)

□ VIN projekt (STM32) (70%)

□ dodatno, neobvezno delo (10%)

## ■ Pogoji za opravljene vaje so:

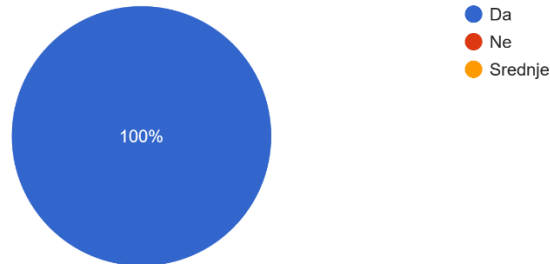
- prisotnost na vajah,
- pravočasno oddani in potrjeni poročili
- VIN projekt (uspešno oddan, objavljen in predstavljen).

**Pomembno:** večino ocene pridobite *s samostojnim delom*, pri katerem *pričakujemo izzive in vam pri tem pomagamo*.

# Laboratorijske vaje VIN – mnenja (21/22)

Delo na praktičnem projektu (VIN projekt) mi je bilo koristno in zanimivo.

14 responses



Izvedba predmeta:

Prosimo, naštejte nekaj najbolj pozitivnih opažanj, povezanih z izvedbo predmeta.

1. 21/22

- → Dober pogled nad podatkovnimi potmi. Predmet se na novo postavlja in so vidne spremembe, ki so dobre.
- → Profesor se trudi.
- → Sproščenost pri predmetu.
- → Dobra razlaga, večkratna razlaga, prijazen profesor.
- → Pri predmetu mi je seveda zelo všeč odnos profesorja, saj se mu pozna da ga učenje veseli, in da ga to kar uči zanima. Vedno pripravlja nove priložnosti za študenta, in je vedno pripravljen pomagati. Super so mi bile tudi meritve na laboratorijskih vajah, saj so mi prinesle praktično znanje uporabe osciloskopa.

Naštejte po spominu nekaj najbolj vam zanimivih vsebin laboratorijskih

vaj? 14 responses

Delo z STM32

Meritve na osciloskopu

Meritve

Presluh na liniiah

Meritve z osciloskopom

Presluhi na ploščatem kablu, Očesni vzorec, Odboji

branje ascij znakov

delo v skupini pri meritvah, pametna hiša (zadnje vaje)

meritve na osciloskopih so bile vse zelo zanimive

Merjenje z osciloskopom in uporaba tinkercada

Merjenje presluhov in odbojev

Vse meritve z osciloskopi

Merjenje z osciloskopom

Merjenje na osciloskopu

# Laboratorijske vaje VIN – mnenja (19/20)

Letos smo razširili obseg projekta z Arduinom pri LAB vajah. Se vam to zdi dobra sprememba ?

13 responses



Izbor mnenj 2019/20 :

- Izvedba prek simulatorja se mi je zdela zelo dobra in mislim da tudi če bi izvajali vaje v živo bi simulator zelo pripomogel h učenju. Osebnost mi je zelo pomagal pri razumevanju samega vezja in delovanju arduina.
- Moje izkušnje so dobre za začetek je tinkercad zelo dober da študent dobi nekaj občutka kaj pa ko se dela z arduinom.
- Kar se tiče simulatorja, se mi zdi zelo koristno, ker nam omogoča, da preizkusimo različne ideje projektov in konfiguracij samih elementov brez da bi zato rabili fizično imeti vse komponente.
- Ne, nismo meli meritev v živo glaven je prektičen del.
- Vaje se mi zdijo vredne. Dosti več stvari bi lahko izvedli sicer v živo. Zanimivo bi bilo dodati kakšen tip naloge oz. primer, kjer bi naprimer diagnosticirali realen problem pri komunikaciji na liniji (zakaj ne dela, kje je problem, pregled z osciloskopom, itd.).

# Laboratorijske vaje VIN – izhodišča, novosti

Načrt-LAB
AV11: OE, signali, linije, nap. Nivoji Preveč ponavlja, skrči in VP1!!!
VP1: Uvod, tipala, Tinkercad
VP2: TinkerCad, Arduino
VP3: STM32, CubelDE projekt, VCP, GPIO, PWM (brenčač, LED)
VP4: STM32, CubelDE projekt, breadboard vezave, pari, osciloskop
AV12: LTSpice-IV - simulacija elektronskih vezij in odbojij
LV1,2: Meritve dolžine, karakteristične impedance in odbojev na linijah
LV1,2: Meritve dolžine, karakteristične impedance in odbojev na linijah
VP5: Edge (NN) AI, STM32, SPI, I2C, Miško3 (SensorTile?)
LV3: Meritve presluhov na linijah
LV4: Očesni vzorec, RS232-SPI
LV4: Očesni vzorec, RS232-SPI
LV5: Meritev in uporaba CANBus vodila, CAN IEX modul



## Novosti 2022/23

- Več praktičnega dela:
  - STM32
  - VIN Projekt
- Osciloskop:
  - manj meritev linij, več drugih meritev
    - delovanje tipal
      - temperatura, svetlost
      - „park“ senzorji (oddaljenost)
      - digitalni/analogni

## Laboratorijske vaje :

### ■ VP: Programiranje vgrajenih sistemov in V/I naprav

- s poudarkom na razumevanju povezovanja, delovanja, in snovanj rešitev

### ■ AV,LV: Simulacije in meritve z osciloskopi

- Prenosne linije (odboji, presluhi, očesni vzorci)
- Komunikacije (RS232, CANBUS, I2C, SPI)
- Tipala

### ■ VIN projekt

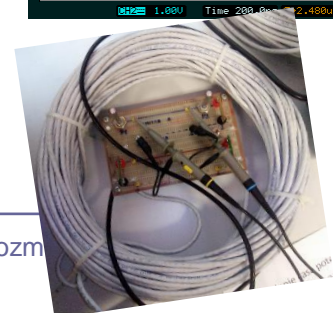
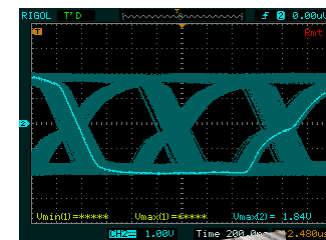
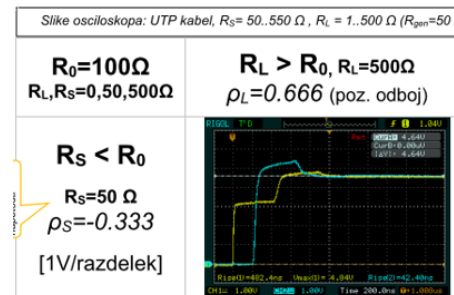
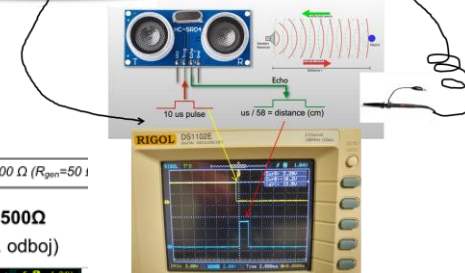
- Samostojna zasnova praktične rešitve

## Vzpodbujamo:

- sprotno delo - sodelovanje na predavanjih, vajah
- lastno kreativnost in samoiniciativnost
- radovednost in aktivnost



STM32MP1



# Laboratorijske vaje VIN

Simulacija: TinkerCad

Classes

Gallery

Blog

Learn

Teach

Q

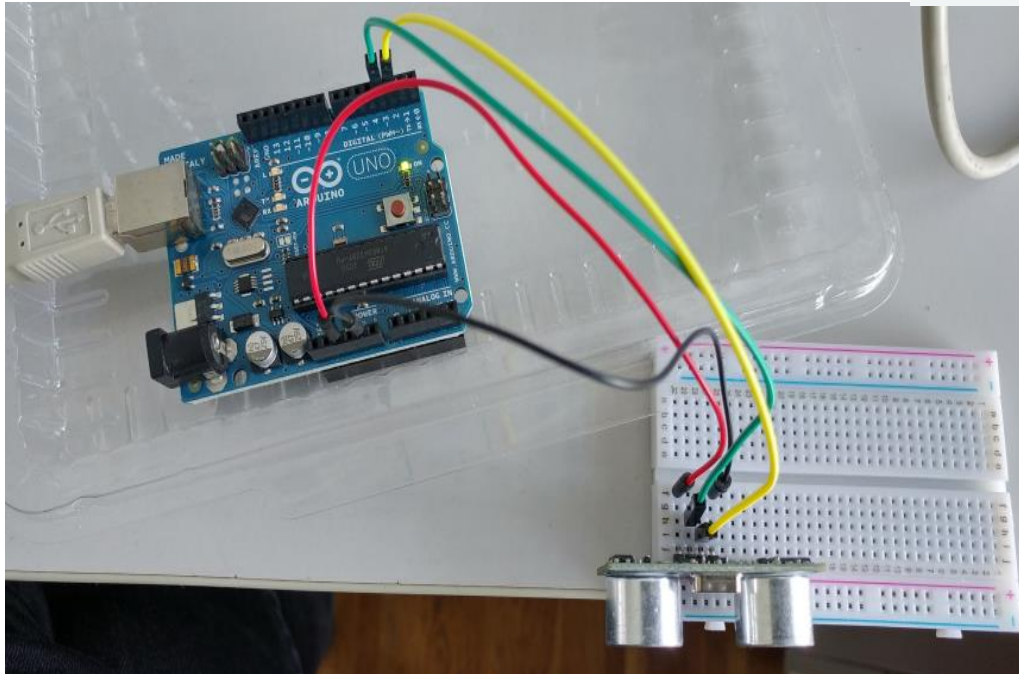
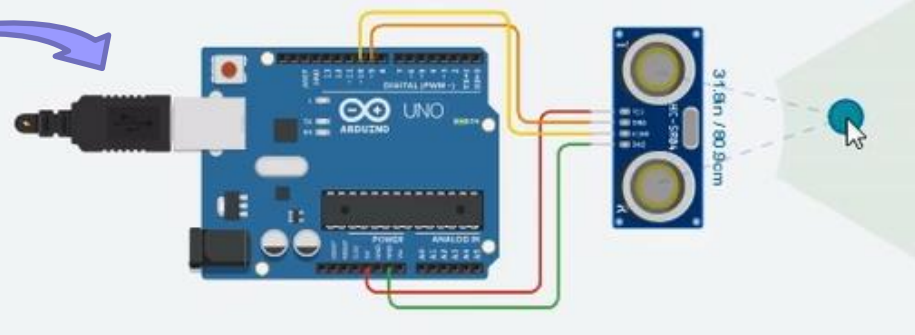


Serial Monitor

Distance (cm) : 106  
Distance (cm) : 103  
Distance (cm) : 94  
Distance (cm) : 88  
Distance (cm) : 84  
Distance (cm) : 84  
Distance (cm) : 84  
Distance (cm) :

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

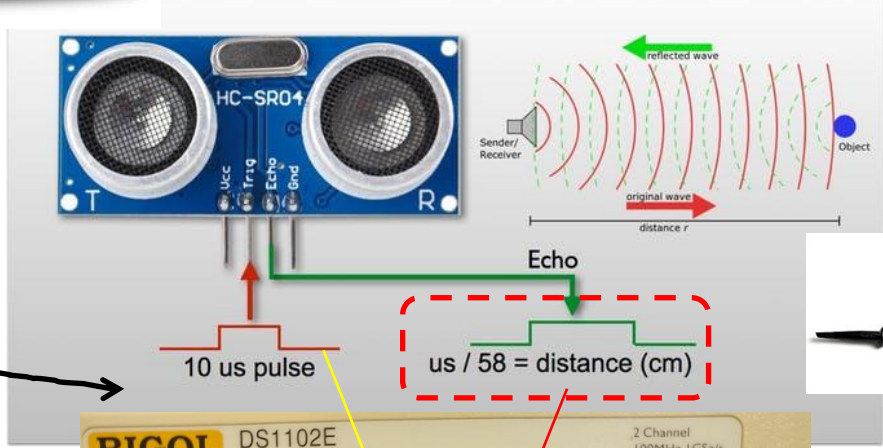
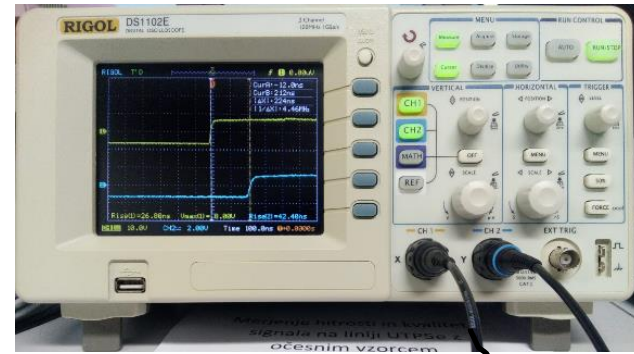
Izvedba:



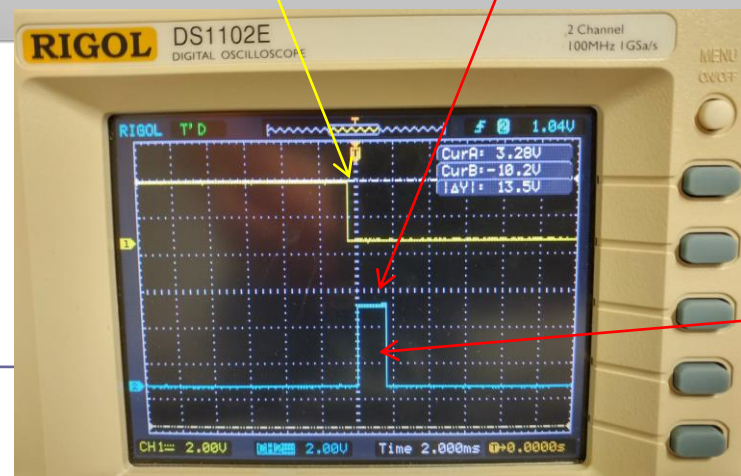
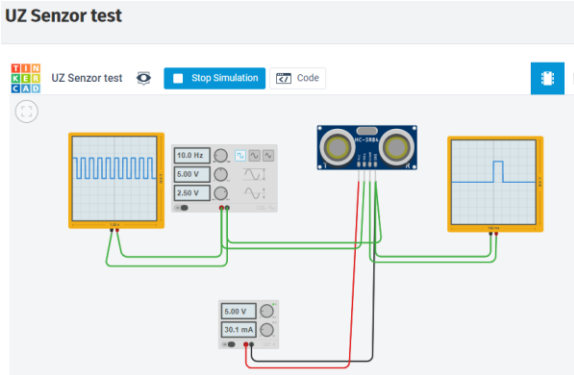
Text

```
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 }
```

# Praktična izvedba (meritev delovanja tipala)



## Simulacija:



Oscilloskop - nastavitve  
Measure -> Time-> Width



# Laboratorijske vaje VIN – platforme

## STM32F407 ST Discovery

### STM Discovery F4 (Cortex M4)

- STM32F407VGT6 microcontroller featuring 32-bit Arm® Cortex®-M4 with FPU core, 1-Mbyte Flash memory and 192-Kbyte RAM in an LQFP100 package

- USB OTG FS**

- ST MEMS 3-axis accelerometer**

- ST-MEMS audio sensor omni-directional digital microphone**

- Audio DAC** with integrated class D speaker driver

- User and reset push-buttons

- Eight LEDs:

- LD1 (red/green) for USB communication
- LD2 (red) for 3.3 V power on
- Four user LEDs, LD3 (orange), LD4 (green), LD5 (red) and LD6 (blue)

- Board connectors:

- USB with Micro-AB
- Stereo headphone output jack
- 2.54 mm pitch extension header for all LQFP100 I/Os for quick connection to prototyping board and easy probing

- External application power supply: 3 V and 5 V



STM32

USB Micro kabel

USB Mini kabel



<https://www.st.com/en/evaluation-tools/stm32f4discovery.html>

# STM32H750B-DK Discovery razvojni sistem

- Arm® Cortex® core-based microcontroller with 128 Kbytes (STM32H750XBH6) of Flash memory and 1 Mbyte of RAM, in TFBGA240+25 package
- 4.3" RGB interface LCD with touch panel connector
- Ethernet compliant with IEEE-802.3-2002, and POE
- USB OTG FS with Micro-AB connector
- SAI audio codec
- One ST-MEMS digital microphone
- 2 x 512-Mbit Quad-SPI NOR Flash memory
- 128-Mbit SDRAM
- 4-Gbyte on-board eMMC
- 1 user and reset push-button
- Fanout daughterboard
- 2 x FDCANs
- Board connectors:
  - USB FS Micro-AB connectors
  - ST-LINK Micro-B USB connector
  - USB power Micro-B connector
  - Ethernet RJ45
  - Stereo headset jack including analog microphone input
  - Audio header for external speakers
  - Arduino™ Uno V3 expansion connectors
  - STMod+



<https://www.st.com/en/evaluation-tools/stm32h750b-dk.html>

# STEVAL-MKSBOX1V1 SensorTile.box razvojni sistem

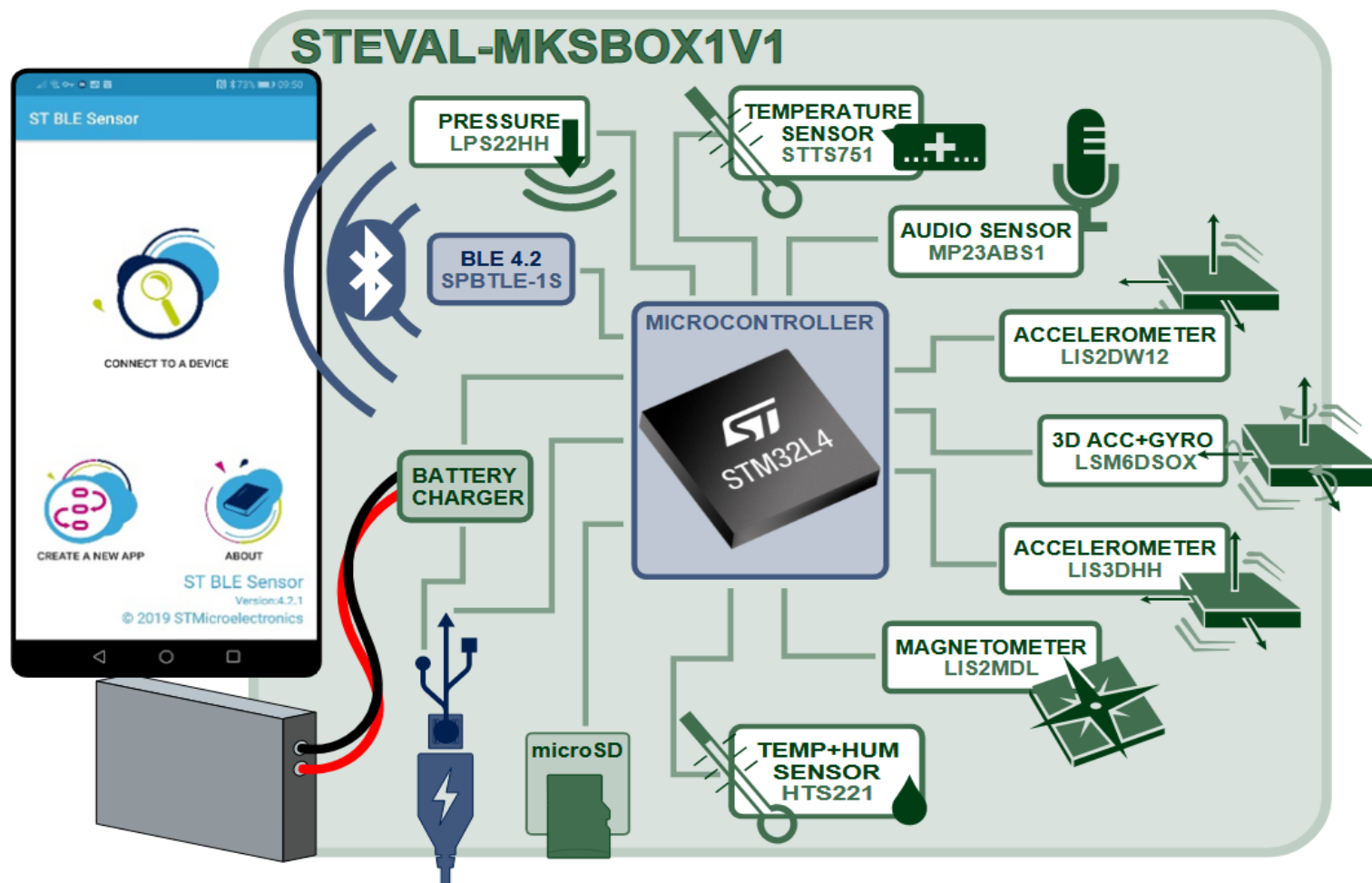
## All features

- Easy-to-use app with immediate functionality for the following motion and environmental sensor applications:
  - Pedometer optimized for belt positioning
  - Baby crying detection with Cloud AI learning
  - Barometer / environmental monitoring
  - Vehicle / goods tracking
  - Vibration monitoring
  - Compass and inclinometer
  - Sensor data logger
- Expert Mode with additional sensor app parameter settings
- Compact board with the following high precision sensors:
  - Digital temperature sensor (STTS751)
  - 6-axis inertial measurement unit (LSM6DSOX)
  - 3-axis accelerometers (LIS2DW12 and LIS3DHH)
  - 3-axis magnetometer (LIS2MDL)
  - Altimeter / pressure sensor (LPS22HH)
  - Microphone / audio sensor (MP23ABS1)
  - Humidity sensor (HTS221)
- Ultra-low-power ARM Cortex-M4 microcontroller with DSP and FPU (STM32L4R9)
- Bluetooth application processor v5.2 (BlueNRG-M2) which replaces the SPBTLE-1S Bluetooth Smart connectivity v4.2 module of the board previous batches



<https://www.st.com/en/evaluation-tools/stm32h750b-dk.html>

# STEVAL-MKSBOX1V1 SensorTile.box razvojni sistem

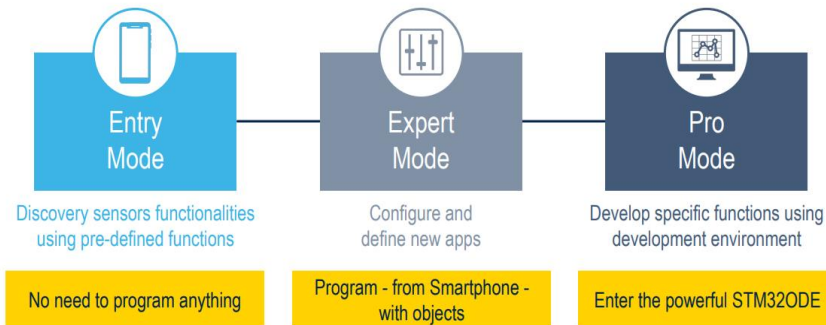


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# STEVAL-MKSBOX1V1 SensorTile.box razvojni sistem

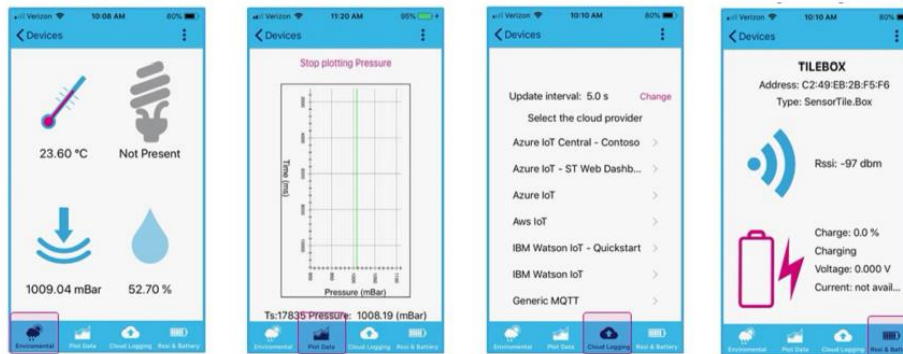
The IoT made easy

SensorTile.box has 3 operational modes



## KAJ VSE OMOGOČA APLIKACIJA?

V realnem času s pomočjo senzorjev zaznava stanje v okolju, risanje grafov na podlagi podatkov, shranjevanje podatkov v oblak - cloud logging.



## VGRAJENE APLIKACIJE

Primeri vgrajenih aplikacij, dostopnih v Entry Mode načinu aplikacije STE BLE Sensor:

- Preprosta aplikacija za štetje korakov s pomočjo merilnika pospeška
- Zaznavanje otroškega joka
  - zaznavanje otroškega joka preko mikrofona, prižig LED diode/opozorilo na aplikaciji, ko je jok zaznan
- Barometrska aplikacija
  - omogoča dodatno ponastavljanje senzorjev za temperaturo, tlak in vlago, prejete meritve prikaže grafično v obliki
- Sledenje prevažanim dobrinam, stanje v vozilu
  - s primernimi tipali (npr. merilnik vlage) merimo pogoje, katerim bi bili potencialno izpostavljeni izdelki, prevažani v nekem vozilu
- Vibration monitoring
  - določimo neko sprejemljivo meritev tresljajev, ki jih zaznamo z merilnikom pospeška - o morebitnih odstopanjih obvestimo uporabnika in zabeležimo dogodek
- Compass and inclinometer
  - beleženje sprememb v orientaciji SensorTile.box-a tekom časa, grafični prikaz meritev (npr. spremembe v smeri neba, naklon)



<https://www.st.com/en/evaluation-tools/stm32h750b-dk.html>

## STM Discovery MP1 (2xCortex A7 + 1xCortex M4)

- STM32MP157 Arm®-based **dual Cortex®-A7 32 bits + Cortex®-M4 32 bits MPU** in TFBGA361 package
- 4-Gbit DDR3L, 16 bits, 533 MHz
- 1-Gbps Ethernet** (RGMII) compliant with IEEE-802.3ab
- USB OTG HS**
- Audio codec**
- 4 user LEDs
- 2 user and reset push-buttons, 1 wake-up button
- 5 V / 3 A USB Type-CTM power supply input (not provided)
- Board connectors:Ethernet RJ454 × USB Host Type-AUSB Type-CTM DRPMIPI DSISMHDMI@Stereo headset jack including analog microphone inputmicroSDTM cardGPIO expansion connector (Raspberry Pi® shields capability)
- ARDUINO® Uno V3 expansion connectors
- STM32CubeMP1 and full mainline **open-source Linux® STM32** MPU OpenSTLinux Distribution (such as STM32MP1Starter) software and examples
- 4" TFT 480 × 800 pixels** with LED backlight, MIPI DSISM interface, and **capacitive touch panel**
- Wi-Fi® 802.11b/g/n**
- Bluetooth® Low Energy 4.1**

## STM32MP1



# STM32F769 ST Discovery

## STM Discovery F7 (Cortex M7)

- STM32F769NIH6 microcontroller featuring 2 Mbytes of Flash memory and 512+16+4 Kbytes of RAM, in BGA216 package
- On-board ST-LINK/V2-1 supporting USB reenumeration capability
- USB ST-LINK functions: virtual COM port, mass storage, debug port
- 4" capacitive touch LCD display with MIPI® DSI connector (on STM32F769I-DISCO only)
- SAI audio codec
- Two audio line jacks, one for input and one for output
- Stereo speaker outputs
- Four ST MEMS microphones on DFSDM inputs
- Two SPDIF RCA input and output connectors
- Two push-buttons (user and reset)
- 512-Mbit Quad-SPI Flash memory
- 128-Mbit SDRAM
- Connector for microSD card
- Wi-Fi or Ext-EEP daughterboard connector
- USB OTG HS with Micro-AB connector
- Ethernet connector compliant with IEEE-802.3-2002
- Arduino™ Uno V3 connectors



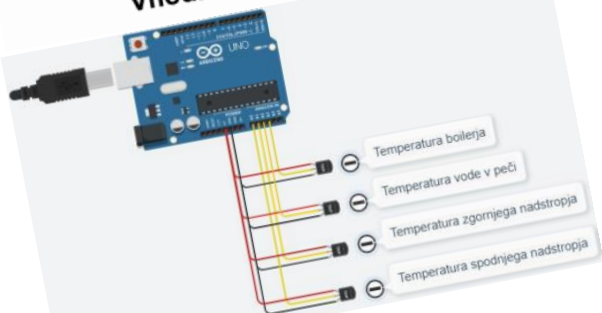
STM32



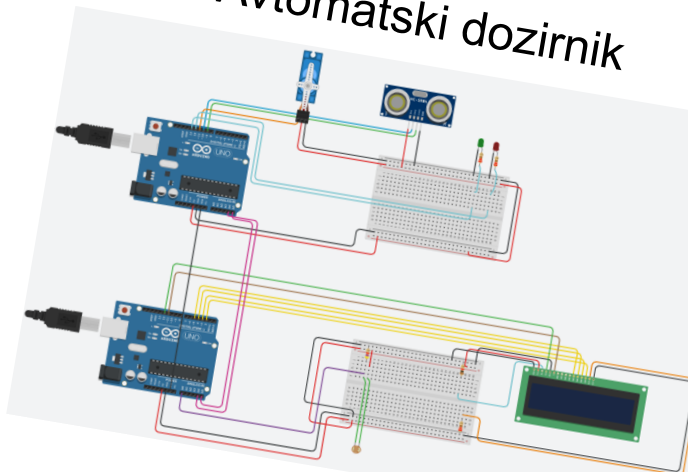
<https://www.st.com/en/evaluation-tools/32f769idiscovery.html>

# VIN Projekt – primeri simulacij (TinkerCad)

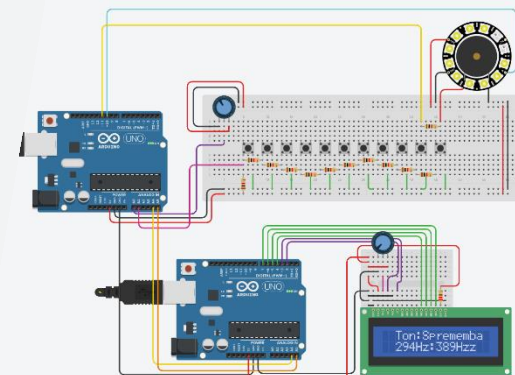
## Arduino projekt, Kontrola centralne kurjave Vhodno izhodne naprave



## Avtomatski dozirnik

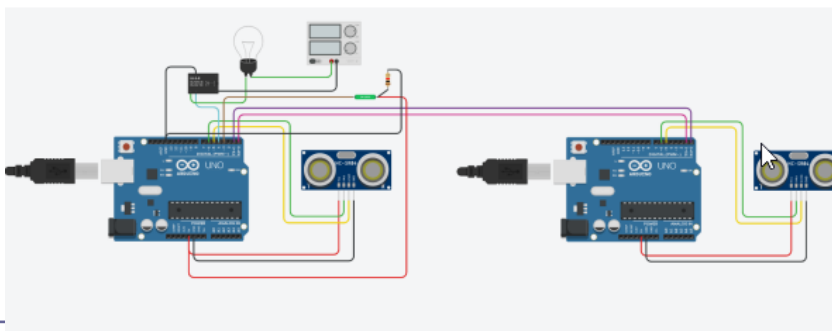


## Mini Piano



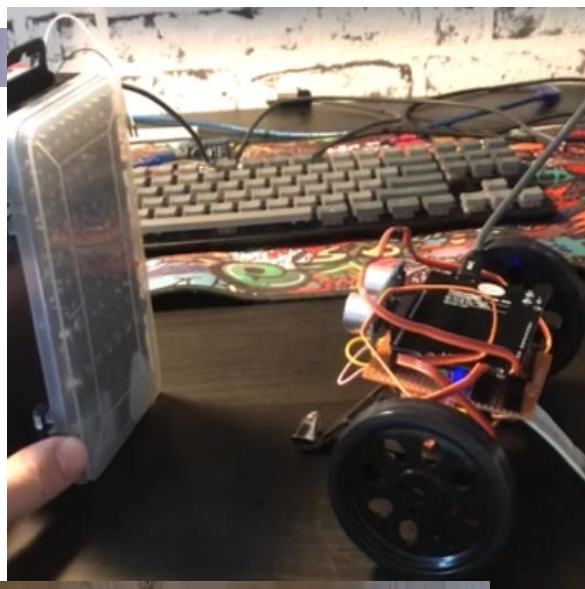
## SENZOR ZA ZAPORNICO

Varnostni sistem za preprečitev zaprtja parkirne zapornice v primeru, da je pod njo objekt.

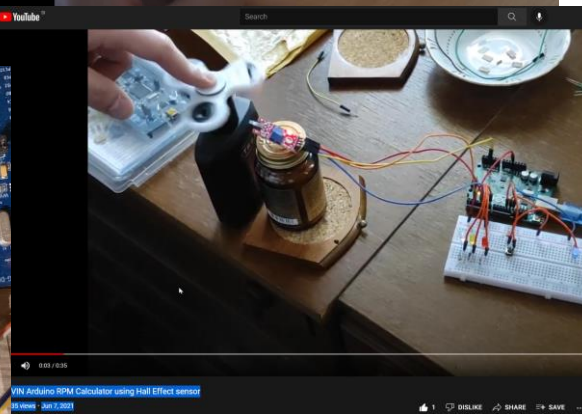
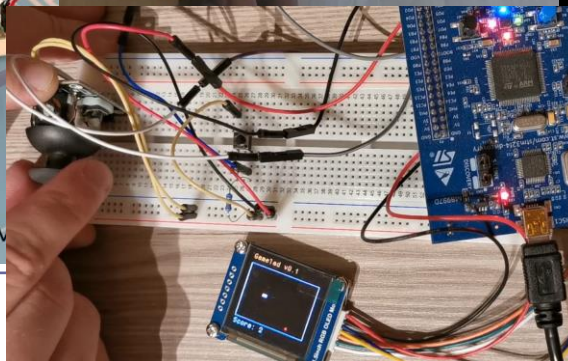
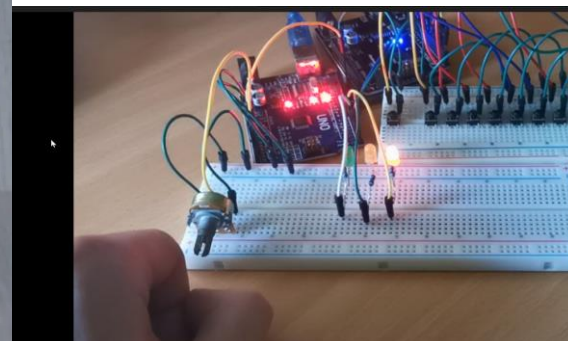
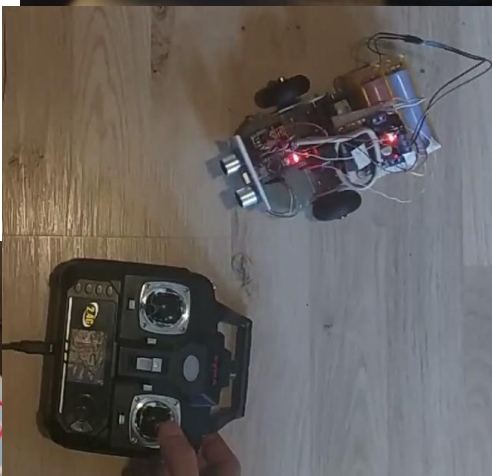




# VIN Projekt – primeri



Ob ponovnem skeniranju, se servo motor obrne v prv



# VIN Projekt - Izzivi

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



## LSM6DSOX Machine Learning Sensor

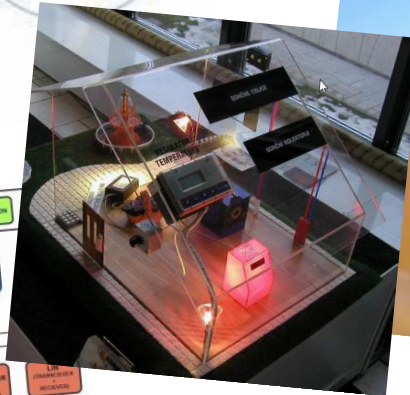
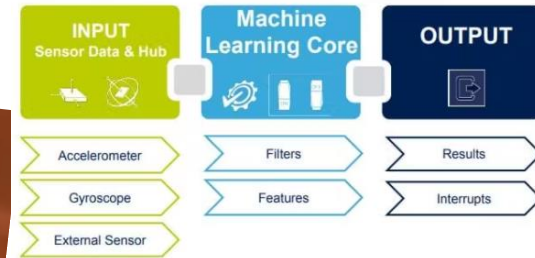
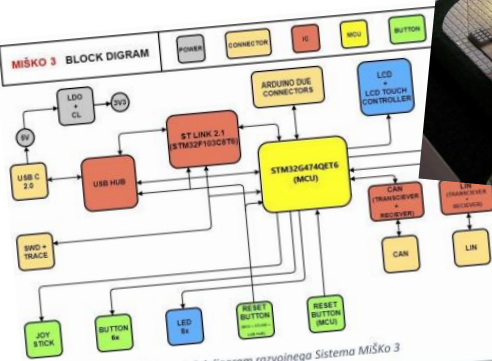
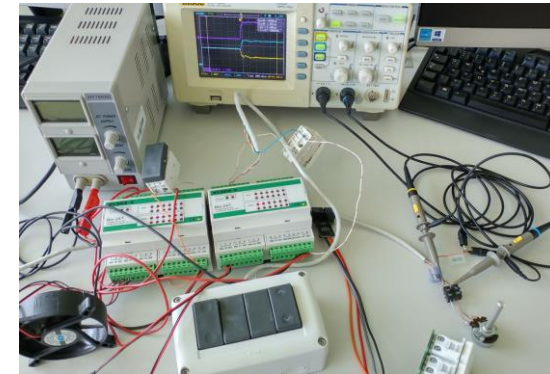


Figure 1-2:  
STM32F4 Discovery connected  
to four click™ boards through the  
STM32 Discovery Shield



Slika 1: Bločni diagram razvojnega Sistema MIŠKO 3



**STM32F4 Discovery Shield**  
is a docking station. Use it to quickly turn your Discovery board into a Rfid lock, SMS-triggered control switch, GPS tracking device, full-blown weather station, or whatever else you have in mind. Assemble your prototypes quickly using click™ additional boards. Just snap them into mikroBUS sockets, like LEGO blocks. As easy as pie!

