

Vhodno-izhodne naprave (VIN)

Predavanja

12. VIN projekt in SensorTile.box

Robert Rozman

rozman@fri.uni-lj.si

12. VIN projekt in SensorTile.box

■ Praktična naloga - VIN Projekt

- Razvojne plošče
- Viri (gradiva, posnetki, primeri, ...)
- Osnovna projekta v CubeIDE:
 - CubeMX (HAL knjižnica, BSP) – STM32H7, STM32F4
 - CubeMX – osnovni projekt (GPIO – tipka, LED diode, USART)
 - BSP – osnovni projekt (Touch, LCD)

■ SensorTile.box (kompaktna razvojna platforma)

VIN Projekt – Navodila

Preberite podana navodila (OneNote zvezek, LAB vaje s temo VIN projekta) in vsebino oblikujte v skladu s priporočili.

Poročilo oblikujte v PDF obliki. Dodajte tudi **infografiko** (grafični povzetek vašega projekta) in **video posnetek**. Vse datoteke (skupaj s poročilom) dajte v zip arhiv in oddajte (video lahko tudi kje objavite ali kako drugače delite z nami, da ga objavimo). Projekt vsaj v obliki tekstovnega povzetka in **infografike objavite tudi v OneNote zvezku VIN - sekcija VIN projekti Teme.**

Projekt **priporočamo, da objavite tudi javno (GitHub, <https://video.arnes.si/>, Youtube, ...)**, skupaj z multimedijskimi datotekami (video posnetek delovanja, poročilo, razlage, skice)...

Primer zelo dobro narejenega opisa izvedbe projekta, kjer so podane vse potrebne informacije za razumevanje in samostojno izvedbo projekta: [Snake game on 8x8 LED matrix using the STM32F4 discovery board.](#) | [zrezke's blog](#)

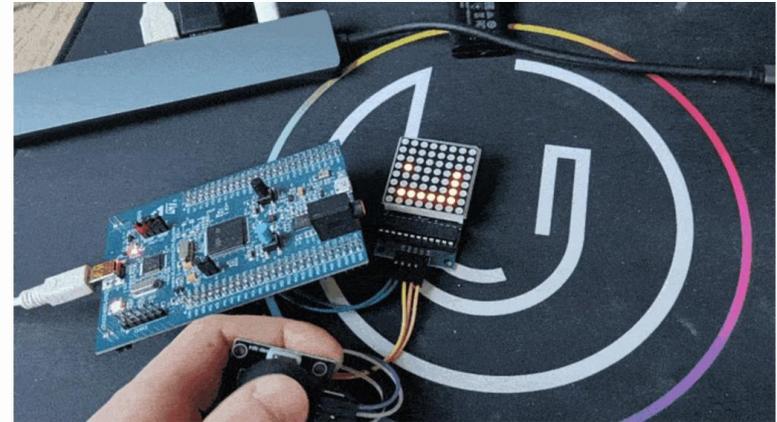
<https://zrezke.github.io/jekyll/update/2022/02/23/8by8-snake.html>

Velikost zip datoteke, ki jo oddate, je omejena na 50MB.

Snake game on 8x8 LED matrix using the STM32F4 discovery board.

Feb 23, 2022 • Filip Jeretina

In this post we will be implementing a [snake game on bare metal](#). This means we will only use assembly and registers, without any fancy tools such as the CUBEMX :)



Parts list

- [STM32F407G-DISC1](#) board
- 8x8 LED MATRIX with [MAX7219](#) display driver.
- [Joystick module](#)
- [Wires with female to female dupont connectors](#)

[Snake game on 8x8 LED matrix using the STM32F4 discovery board.](#) | [zrezke's blog](#)

<https://zrezke.github.io/jekyll/update/2022/02/23/8by8-snake.html>

VIN Projekti – Pregled (OneNote objave tem)

Preberi.me

sreda, 16. marec 2022 18:09

Tukaj lahko objavljate svoje vsebine, vaš VIN projekt:

- Naredite svojo stran z naslovom VIN projekta
- Naredite lahko podstrani z različnimi vsebinami (viri, gradiva, sheme, ...)
- Imejte kopijo v svojem osebni zvezku - tukaj lahko spreminjamo vsi vsebino.

Predstavitev projekta :

- **Poročilo v PDF obliki** (s tekstovnim povzetkom in infografiko na prvi strani)
 - Objavite tudi na svoji strani v tem zvezku ali spletnem blogu
- **Infografika** - grafični povzetek projekta
- Kratek **video posnetek** - pošljete nam ali objavite sami (link)
- **Priporočilo: GitHub**: opis projekta (**Readme.md**) in koda

Vse datoteke oddajte v .zip na e-učilnico (če prevelika, izpustite video).
Vsaj del vsebine objavite tudi v OneNote zvezku VIN.

Primer odličnega opisa projekta (informativen, izobraževalen, ponovljiv):

[Snake game on 8x8 LED matrix using the STM32F4 discovery board. | zrezke's blog](#)

- 4-wire bipolar stepper motor
- Plant Watering Alert
- Neimenovana stran
- Pametna ura na H7
- Hribovski spremljevalec

Komentarji, ideje

- Mešalec pijač
- Mešalnik glasnosti
- Sistem DRO za merilne letve
- Parking senzor
- Detekcija predmetov v gibanju in...
- Laser tag
- Infrardeča kamera
- NFC reader na H7
- Povezovanje MicroE Lightange...
- PlantHealth - Nega rastlin
- Rulet na H7
- Space Invaders

Vizualizacija zvoka

- FireAlarm
- PooF – pametni lonček
- Sistem za spremljanje nivoja v...
- Kalkulator z mehničnimi stikali
- Guess the Colored Cup's Positi...
- Merilec temperature
- GrowBox
- Pametni pastir za govedo
- Neimenovana stran
- Križci in krožci
- Potapljanje ladjic
- T-rex runner

12. VIN projekt in SensorTile.box

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- BSP – osnovni projekt (Touch, LCD)

■ SensorTile.box (kompaktna razvojna platforma)

VIN Projekt – Osnovna platforma

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



ST Discovery STM32MP157C

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 cardGPIC 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

STM32



VIN Projekt – Osnovna platforma

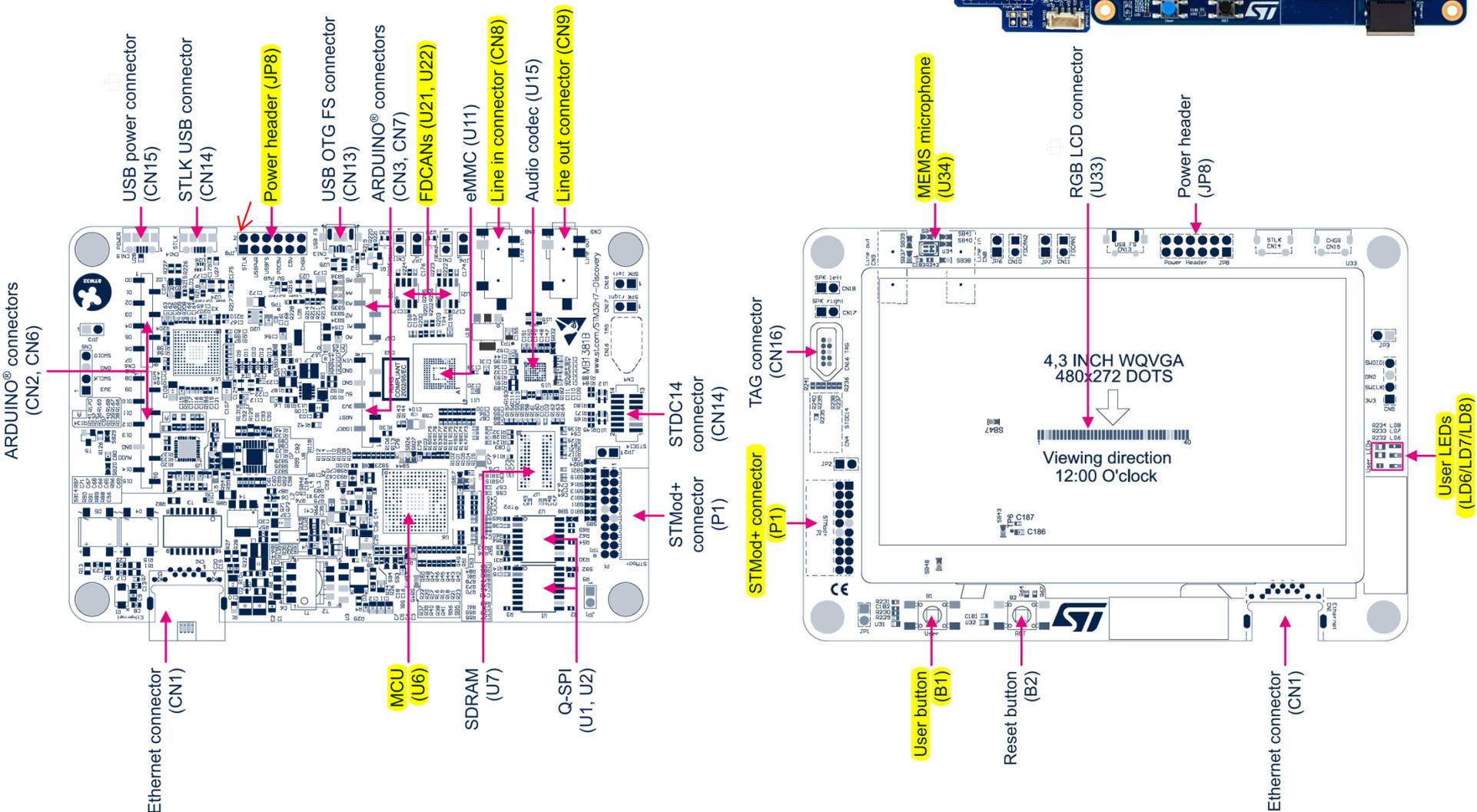
STM32H750B-DK Discovery razvojni sistem

- 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>

STM32H750B-DK Discovery razvojni sistem



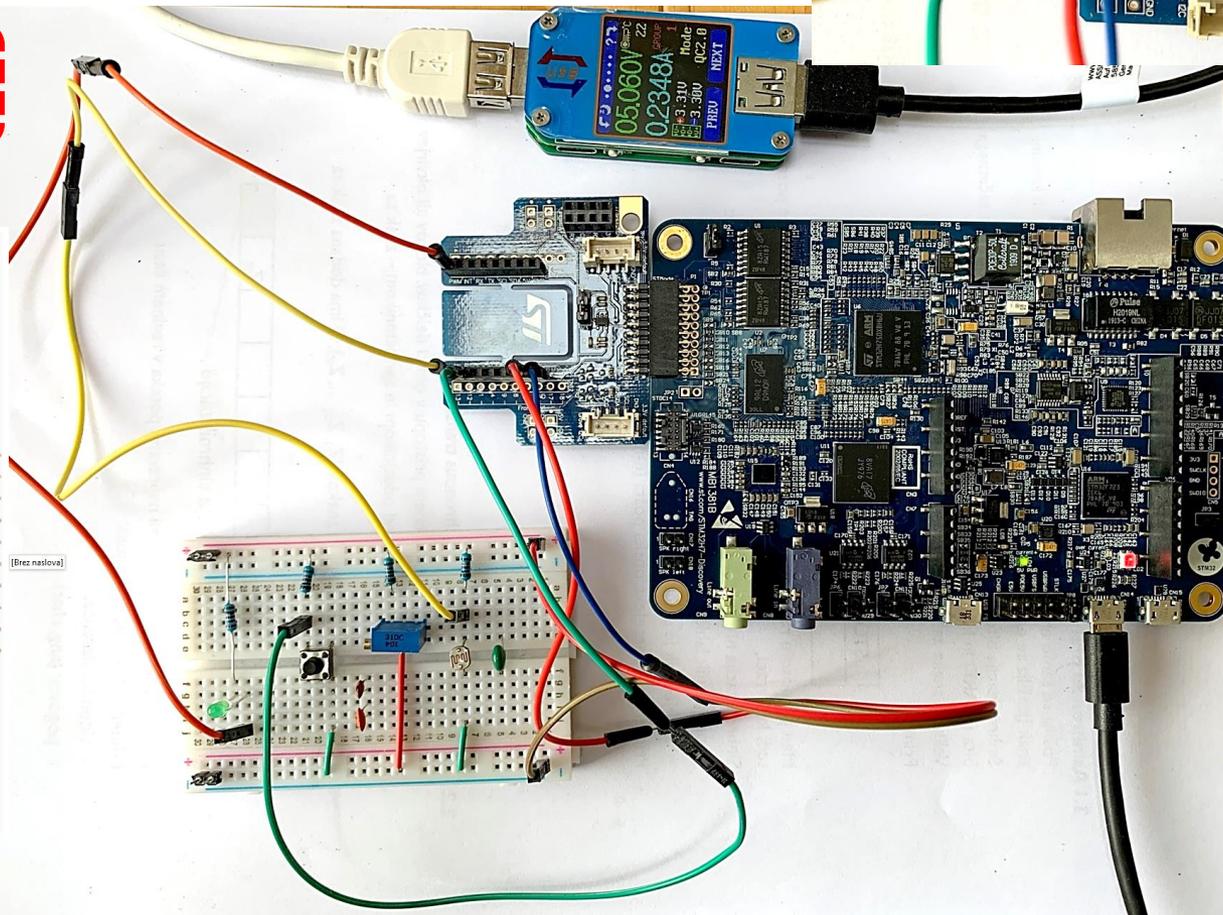
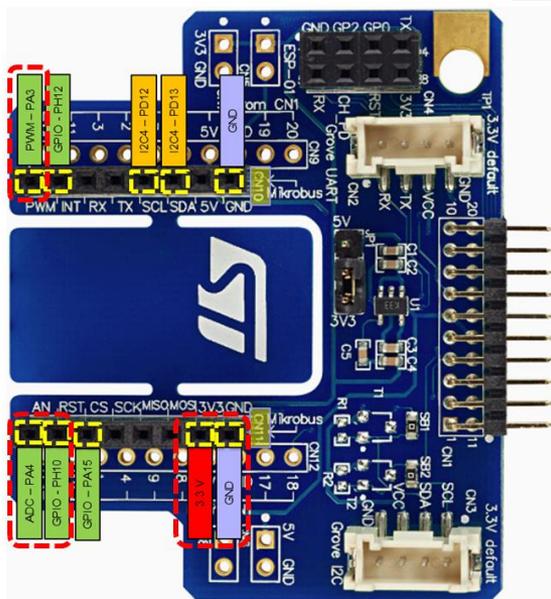
STM32H7

Breadboard vezava – STM32H7

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

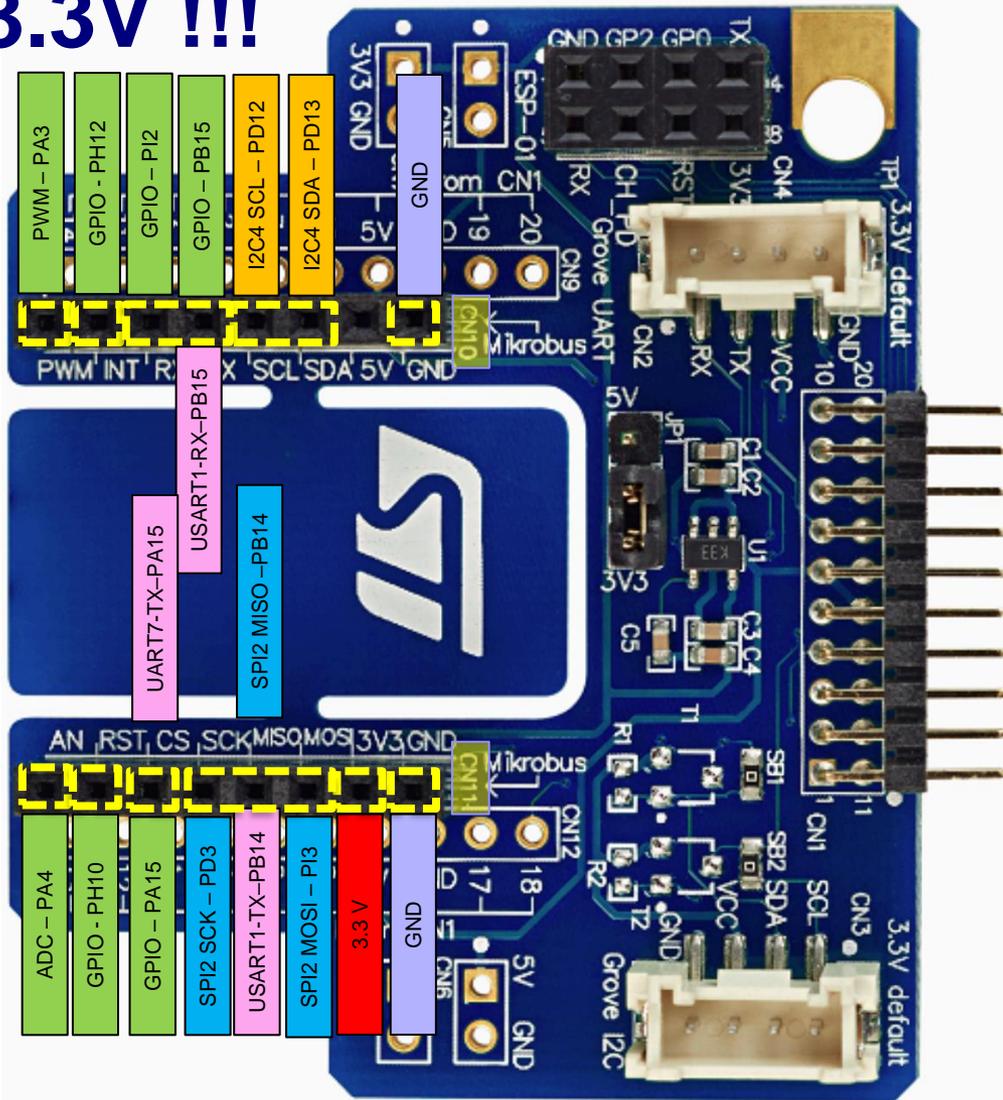
Testno vezje (primer) - STM32H7 :

| 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 |

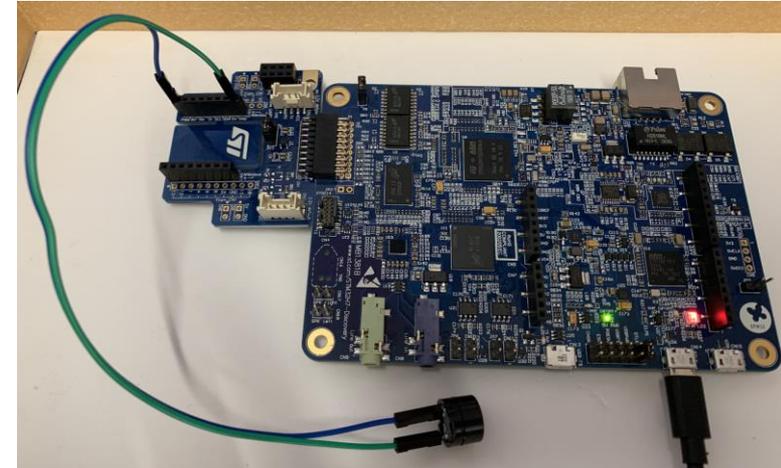


STM32H750B – DISCOVERY StMod+ konektor

3.3V !!!



Pravilna priključitev



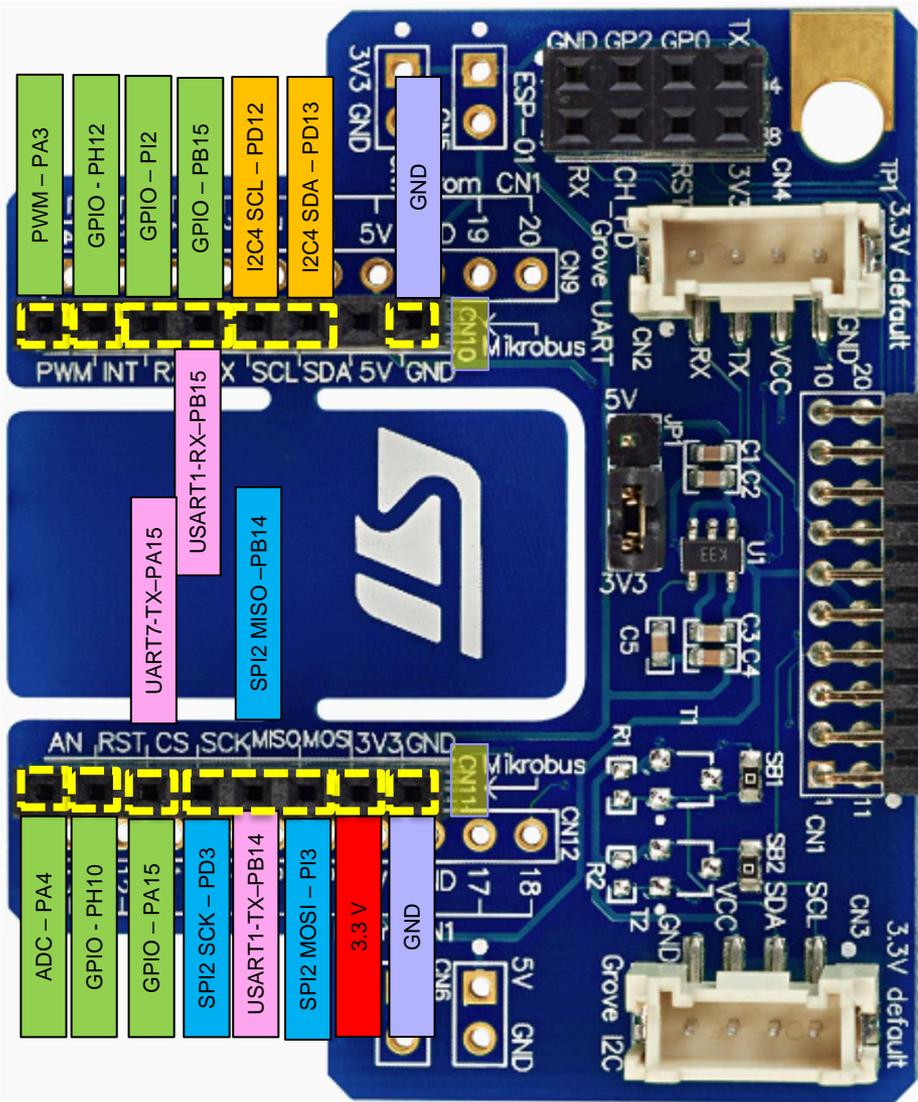
Nepravilna priključitev



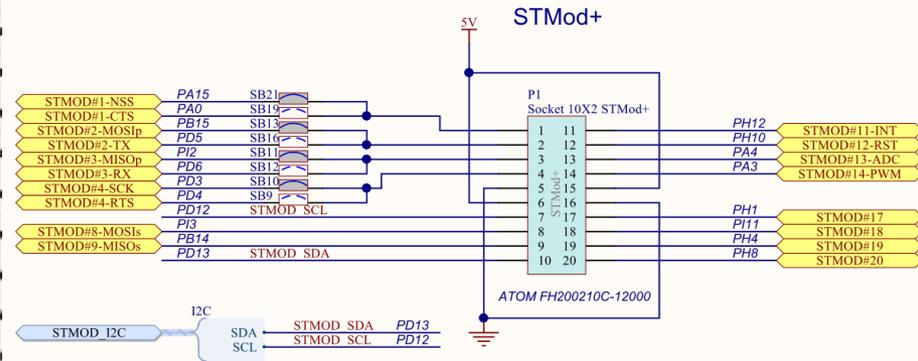
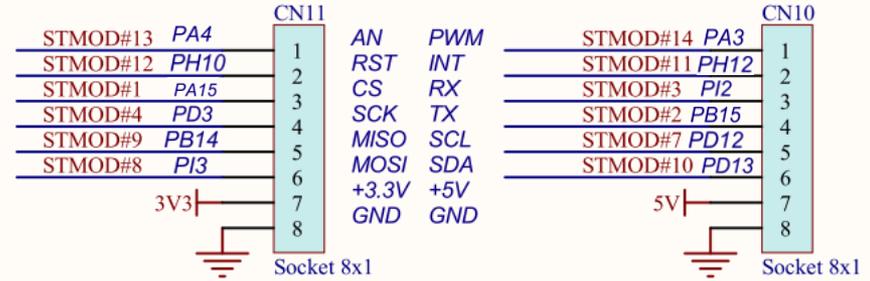
<https://www.st.com/en/evaluation-tools/stm32h750b-dk.html>

3.3V !!!

STM32H750B – DISCOVERY StMod+ konektor



Mikrobus connectors



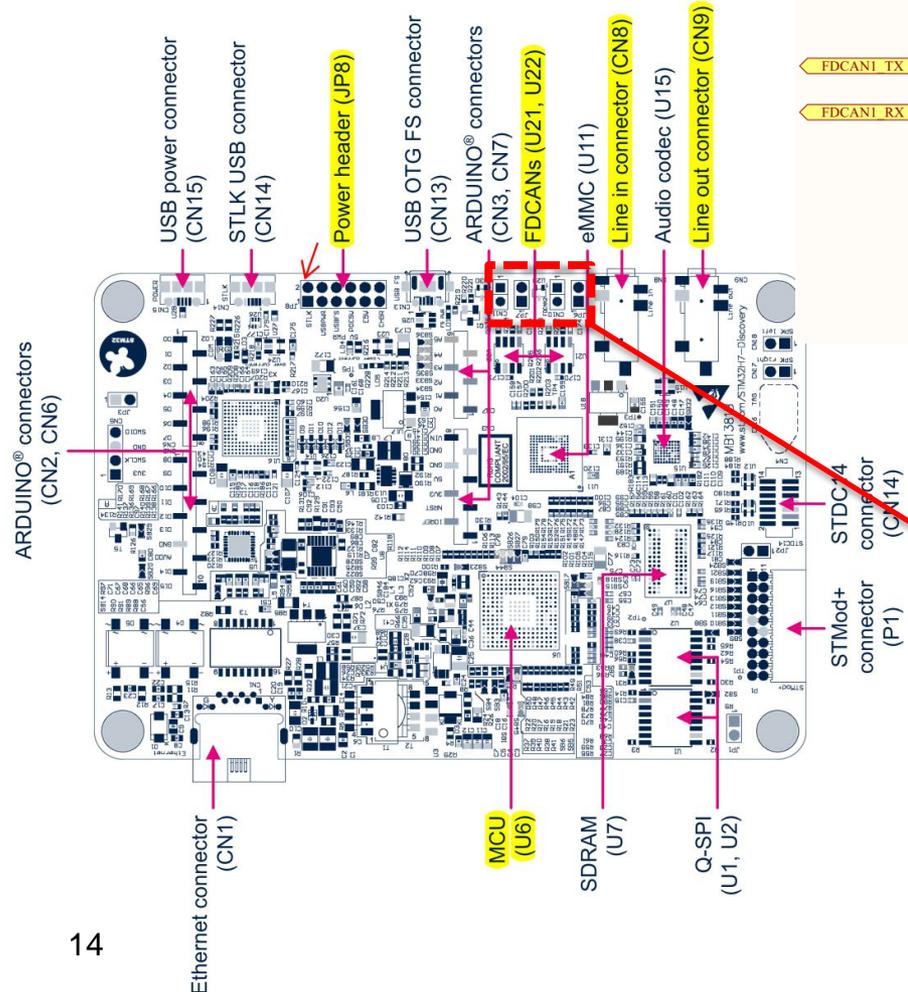
STM32H7

3.3V !!!

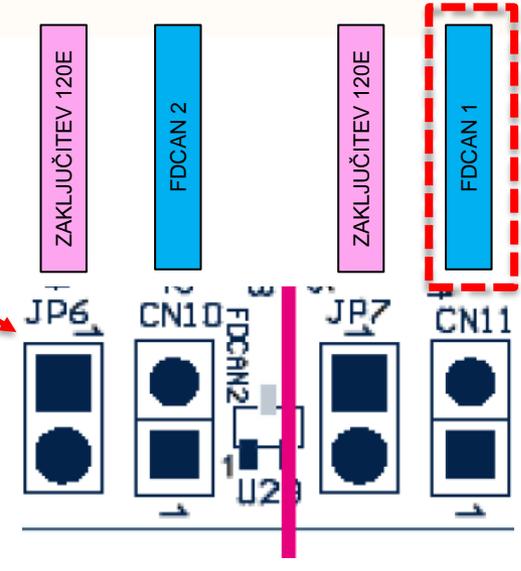
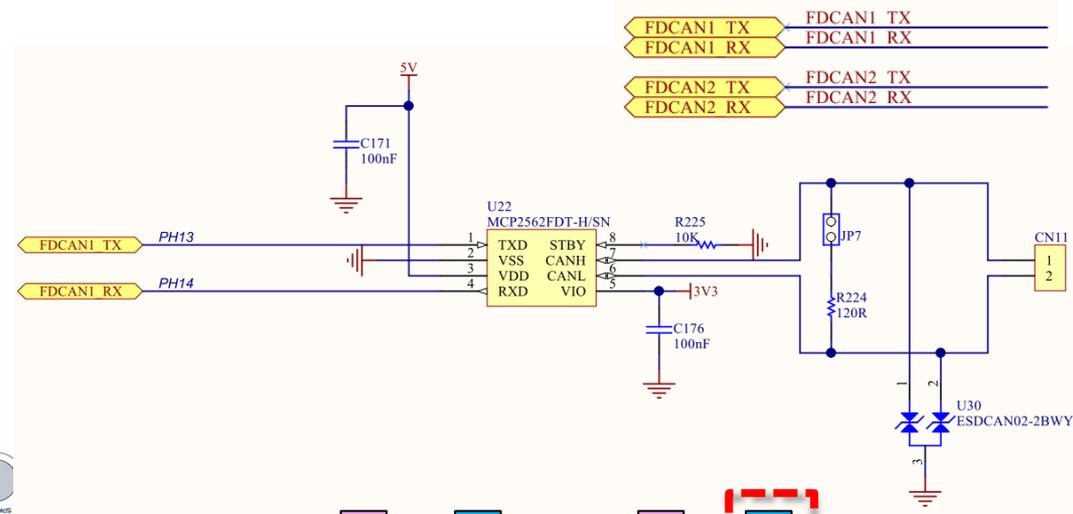
STM32H750B – DISCOVERY CANBUS konektorja

STM32H7

Figure 5. STM32H745I-DISCO and STM32H750B-DK Discovery board bottom layout



FDCAN



12. VIN projekt in SensorTile.box

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LAPSy Embedded Academy

LAPSy Embedded Academy - Home (sharepoint.com)



Študentski projekti pri predmetih RA, OR in VIN
unij.sharepoint.com

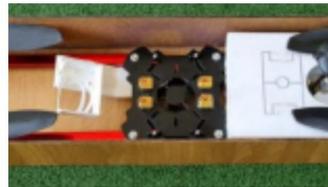
Različni študentski projekti iz prejšnjih šolskih let.



Tečaji, tutoriali ...

unij.sharepoint.com

Različni krajši tečaji z izbranimi tematikami



Diplomska dela

unij.sharepoint.com

Izbrana diplomska dela in ideje za teme

Izbrani projekti (RA, OR, VIN)

[See all](#)



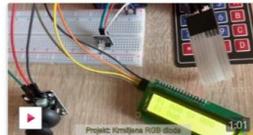
Forms
Študentski projekti pri predmetih RA, OR in VIN (RAVINOR Projekti)_Krajši...
Rozman, Robert
Edited Apr 13, 2024



Forms
VIN PROJ 2023 Zaznavanje človeka z matrično termo kamero_Jakob Jelovčan
Rozman, Robert
Edited Apr 8, 2024



Forms
VIN PROJ 2023 STM32H7 in LCD-1602A_Nejc Vene
Rozman, Robert
Edited Apr 8, 2024

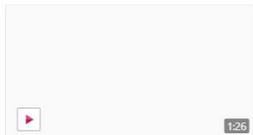


Forms
VIN PROJ 2023 Krmiljena RGB dioda_Gregor Volčanjk
Rozman, Robert
Edited Apr 8, 2024

1 of 12

Ostale izbrane vsebine (diplome, tečaji, ...)

[See all](#)



Forms
VSP DIPL 2023 Preizkušanje seizmografa s spustom uteži_Luka Maček
Rozman, Robert
Edited Apr 26, 2024



Forms
VSP DIPL 2024 Samodejni točilni sistem_Bine Lipuš
Rozman, Robert
Edited Apr 26, 2024



Forms
VSP DIPL 2023 Biomimetična antropomorfná robotska roka_Nejc...
Rozman, Robert
Edited Apr 26, 2024



Forms
Izbrane diplomske naloge (Diplome)
Rozman, Robert
Edited Apr 26, 2024

LAPSy Embedded Academy – VIN LAB

Vhodno izhodne naprave (VIN) (sharepoint.com)



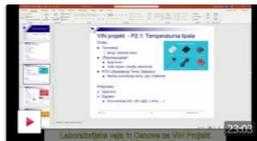
Laboratorijske vaje

Priprava na izvedbo VIN projekta - STM32H7 (VIN LAB I)

See all



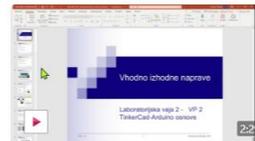
LAPSy Embedded Academy
_VIN LAB 01-06 Priprava na izdelavo VIN projekta (VIN-LAB Projekt)_Krajši...



LAPSy Embedded Academy
VIN LAB 01.01 Osnove za VIN Projekt_Spolšno o tipalih.mp4



LAPSy Embedded Academy
VIN LAB 01.02 Osnove za VIN Projekt_Uvod in osnovne vezave v...



LAPSy Embedded Academy
VIN LAB 02.01 TinkerCad in Arduino_Uvod v potek LAB vaj.mp4



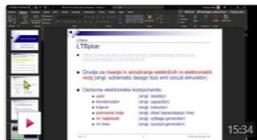
1 of 12

Praktične laboratorijske meritve z osciloskopi, generatorji (VIN LAB II)

See all



LAPSy Embedded Academy
_VIN LAB 07-12 Meritve odbojev, presluhov, očesnih vzorcev in tipal (VI...



LAPSy Embedded Academy
VIN LAB 07.01 AV1 - Simulacija vezij v orodju LTSpice_Uvod v LTSpice.mp4



LAPSy Embedded Academy
VIN LAB 07.01 AV1 - Simulator vezij LTSpice_Uvod v LTSpice.mp4



LAPSy Embedded Academy
VIN LAB 07.02 AV1 - Simulacija vezij v orodju LTSpice_Osnovno vezje s...



LAPSy Embedded Academy – OneNote zvezek

[LAPSy Embedded Academy - Home \(sharepoint.com\)](#)

The screenshot shows a OneNote page with a dark-themed navigation bar at the top. The page title is "Preberi me" and it was last updated on Tuesday, April 19, 2022, at 14:32. The main content area contains the text "Tukaj zbiramo ideje za teme VIN projektov" followed by a vertical bar and the letter "R". On the right side, there is a table of contents pane with the following items:

- Preberi me
- Spletni viri
- Teme, področja
- Praktični izzivi v LAPSYLAB
 - STM32F4 Shield + Click boards
 - Clickboards
 - Model Hiške
 - Arduino Smart Home Kit
 - CANBUS - IEX modul
 - LSM6DSOX (30 kosov na voljo)
 - Breadboard samogradnja
 - Gibanje
 - Joystick
 - DIY osciloskop STM32
 - Arduino
 - Upornost/prevodnost kože
 - WS2812 Neopixel
 - How To Measure Water Tank Dept...
- Praktični izzivi
 - Clickboards (STM32H7,F4,Rp)
 - LTE IOT 2 CLICK (BG96)
 - STM32H750B DK + clickboards
 - STMod+ konektor
 - STM32F4 Shield + Click boards

LAPSy Embedded Academy – MS Teams

< Vse skupine



LAPSy Embedded Academy ...

- Domača stran
- Class Notebook
- Classwork
- Dodeljene naloge
- Ocene
- Reflect
- Insights

▼ Glavni kanali

- Splošno
- 1. Assembly programming ARM I (RA-LAB-E...)
- 1. Programiranje v zbirniku ARM I (RA-LAB)
- 2. Programiranje v zbirniku ARM II (OR-LAB I)
- 3. Programiranje v zbirniku ARM III (Razv. plo...)
- 4. Programiranje v C (OR,VIN-LAB-STM32H7)
- 5. Računalniška arhitektura (RA)
- 6. Organizacija računalnikov (OR)
- 7. Vhodno izhodne naprave (VIN)
- 8. Projekti
- 9. Tečaji, diplome in ostale vsebine
- Datotečna shramba
- Discussion
- Dokumentacije, gradiva

 **8. Projekti** Objave Datoteke Notes

+ Novo Naloži Uredi v mrežnem pogledu Daj v skupno rabo Kopiraj povezavo Sinhronizacija

8. Projekti > Vsebine projektov

| Name | Modified | Modified By | Video_channel | Item Child Count |
|--|----------|----------------|---------------|------------------|
| STM32F4 | April 24 | Rozman, Robert | | 0 |
| STM32H7 | April 24 | Rozman, Robert | | 0 |
| VIN PROJ 2023 Analiza senzorjev CO2, tem... | April 24 | Rozman, Robert | | 1 |
| VIN PROJ 2023 APC1 in Arduino - Merjenje ... | April 24 | Rozman, Robert | | 2 |
| VIN PROJ 2023 Pametna IR kamera 8x8_Jak... | April 24 | Rozman, Robert | | 4 |



Spletni viri

Full range of STM32H7 training courses available online



Full range of STM32H7 training courses available online

ST offers a full range of training courses in both **ePresentation** and **PDF** format for the STM32H7 series of High Performance MCUs. These courses provide helpful instructions and specific information on how to design applications that take advantage of the STM32H7's performance capabilities. More than 60 specific training modules focus on teaching the skills and knowledge for getting the most performance from STM32H7 MCUs for your applications.

Z naslova <https://www.st.com/content/st_com/en/support/learning/stm32-education/stm32-online-training/stm32h7-online-training.html>

BSP STM32H750B-DK Component

Z naslova <<https://github.com/STMicroelectronics/stm32h750b-dk-bsp>>

MOOC - STM32CubeIDE basics

STM32CubeIDE basics
01 - Introduction

STM32CubeIDE basics

STM32CubeIDE basics

13 videos 192,894 views Last updated on Jan 3, 2020

Play all Shuffle

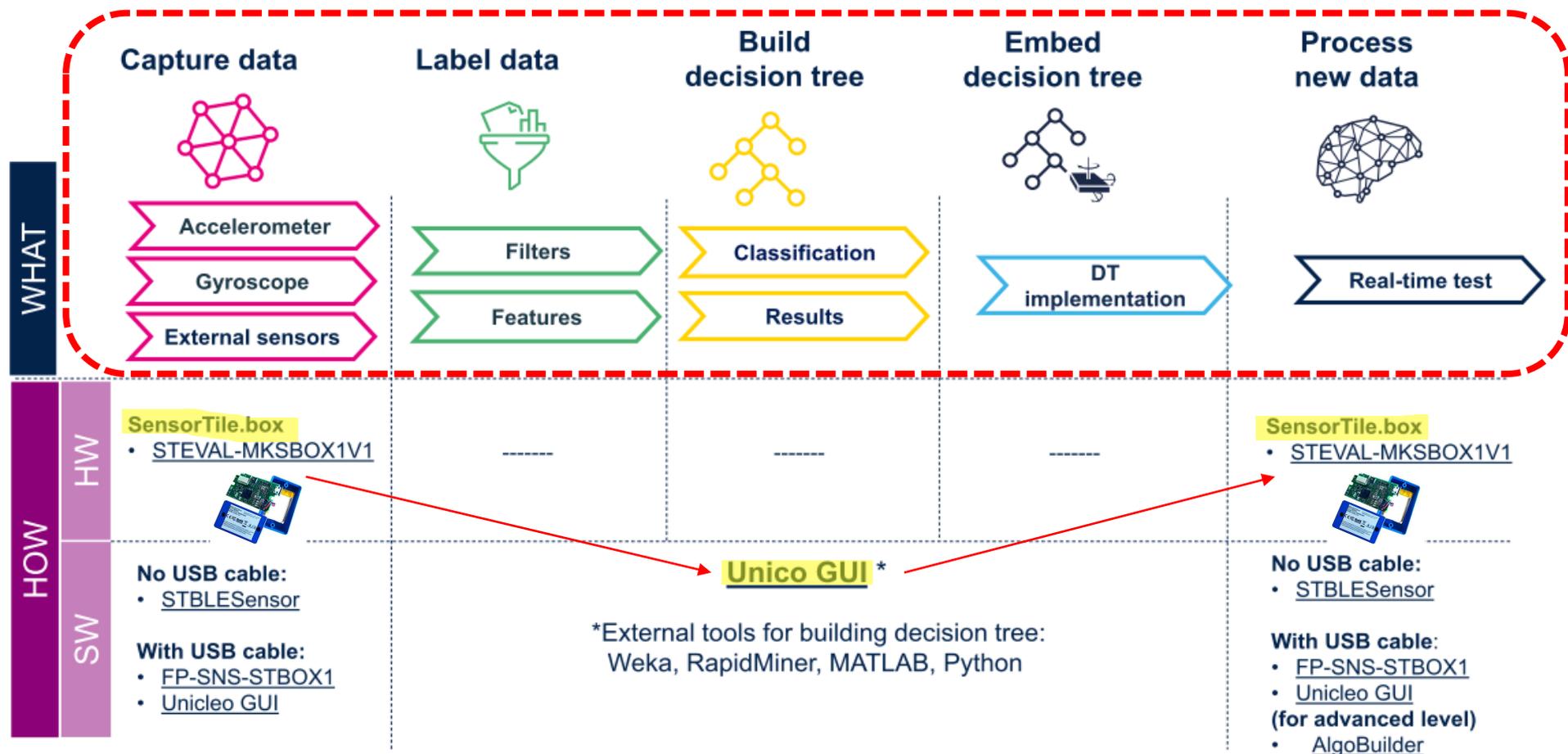
Learn how to create your STM32 based application using STM32CubeIDE
STM32CubeIDE can be used to create applications for STM32 devices using STM32Cube libraries (HAL and Low Layer versions).

STM32CubeIDE basics - 03 GPIO HAL lab

STM32CubeIDE basics - 11 USART HAL lab

Edge computing – moduli, tipala

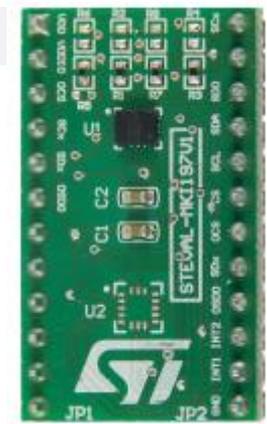
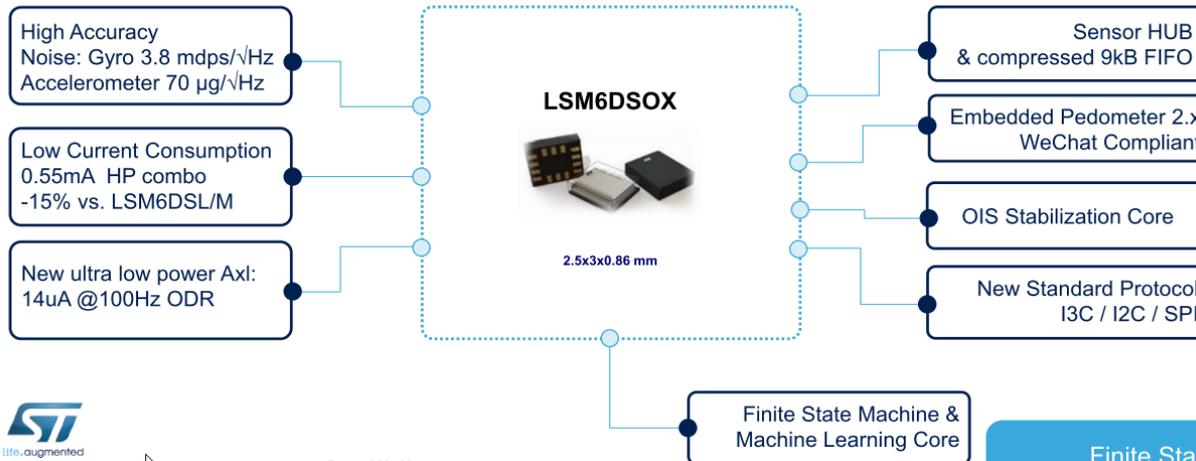
LSM6DSOX – SensorTile.box



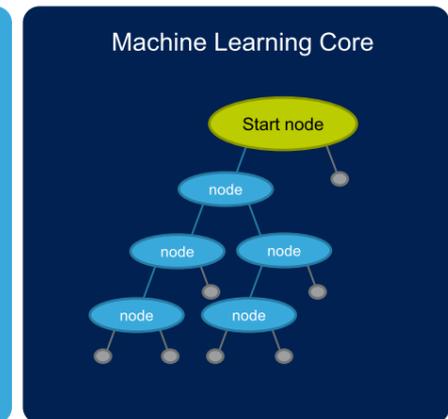
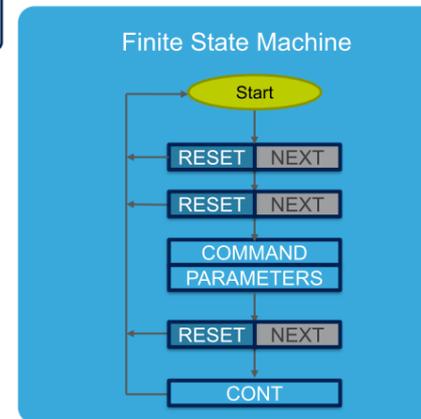
Edge computing – moduli, tipala

LSM6DSOX Unique Performance

Improved Accuracy, Optimized System Power

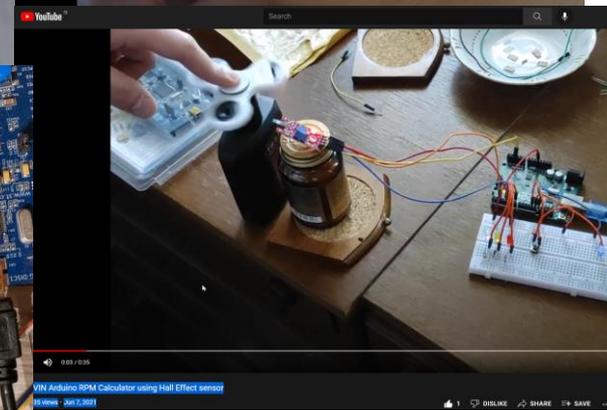
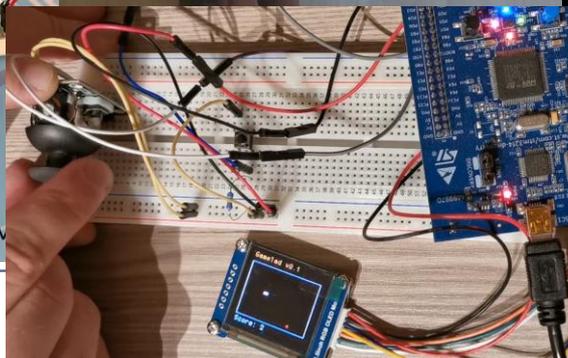
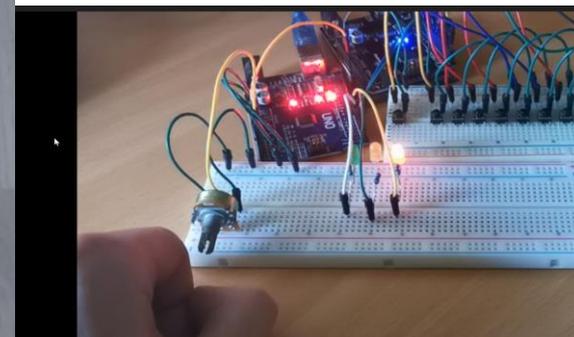
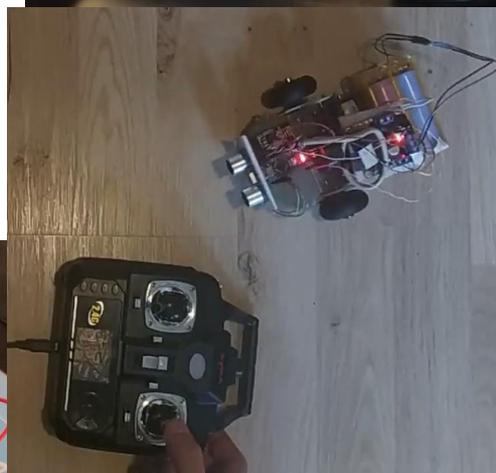
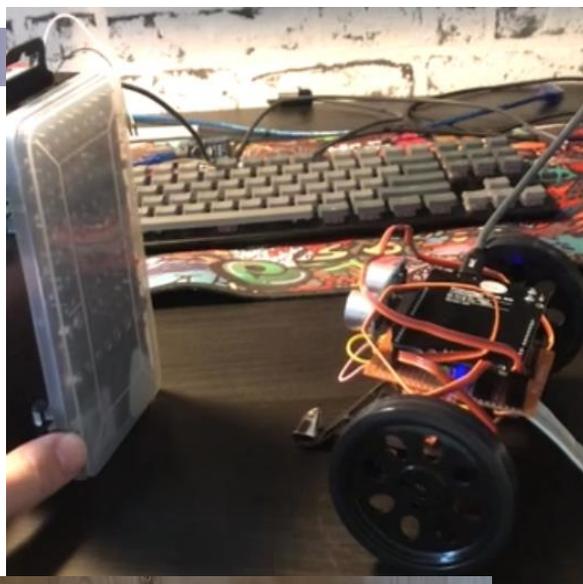


Jan Renar
Zaznavanje človeških aktivnosti s
tipali na razvojni plošči **Sensortile.box**
DIPLOMSKO DELO

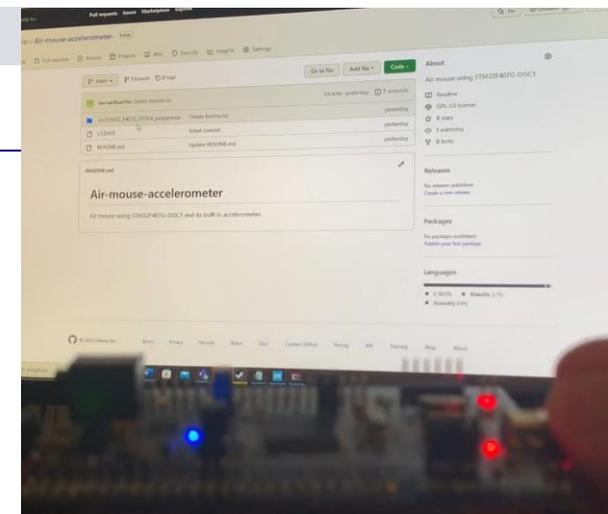


FSM & MLC allows sensors to process data with reduced help of a host MCU

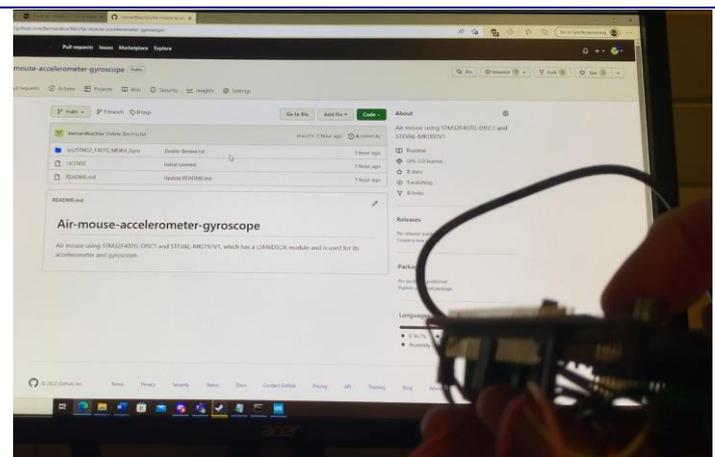
VIN Projekti



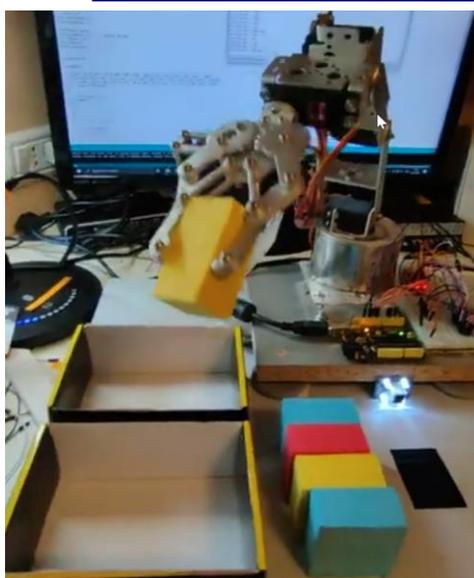
VP – Primeri projektov STM32F4, H7 – 21/22



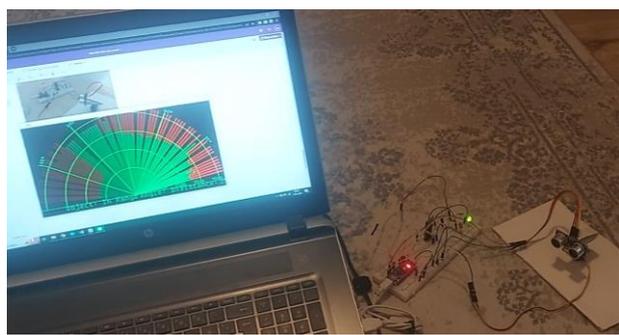
F4: Air Mouse



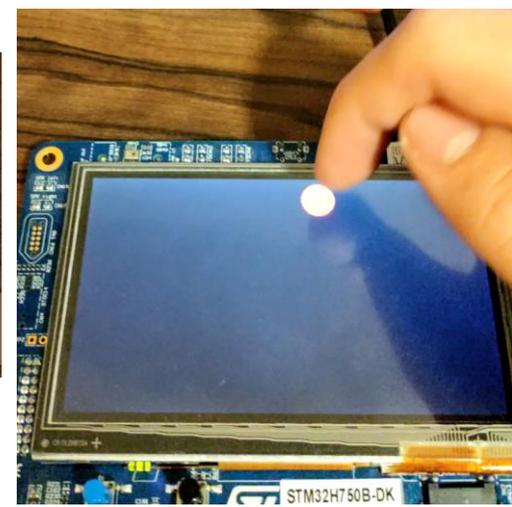
F4: LSM6DSOX – Air Mouse



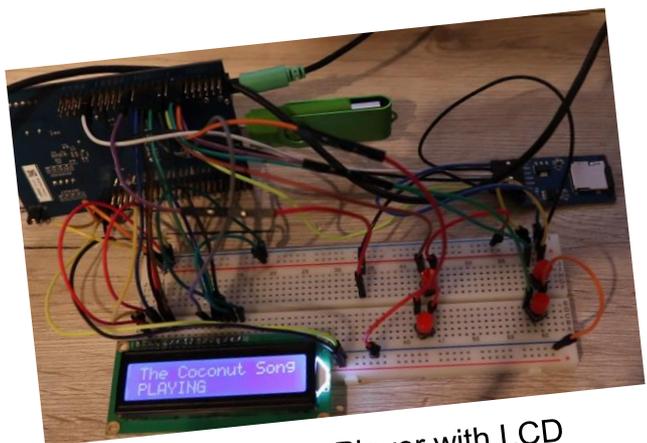
Robot: Colour Box sorter



3D Sonar



H7: Circle Popper



F4: Wave Player with LCD

https://github.com/LAPSyLAB/STM32F4_Docs_and_Examples/

Termo kamera - LIR tipalo Smarteh

Izzivi

Prilagam kratek dokument z navodili za priklop in zagotovitev pravilnega delovanja komunikacije med LIR-2 senzorjem ter osebnim računalnikom.

Poleg tega prilagam še link: <https://github.com/kolan51/ModbusLIR2example>, do GitHub repozitorija, kjer se nahaja osnovna python skripta, ki jo lahko uporabite, kot osnovo za izdelavo vaših lastnih projektov.

V navodilih je na koncu tudi kratek opis uporabe dodatnega projekta za barvni oziroma toplotni izris zajetih meritev, ki pa rabi še en minimalen popravek in ga bom poslal naknadno. Poleg naštetega prilagam še user manual za LIR-2, kjer je podrobnejši opis vseh registrov in samega delovanja.

Pošiljam še dodatni projekt kolega Domna, kot sem obljubil včeraj: https://github.com/kolan51/LIR2_ColorTemp. Lahko ga poganjate, kar preko .exe datoteke, navodila za uporabo projekta pa so ravno tako opisana v dokumentu, ki sem ga poslal včeraj. Tudi ta projekt lahko uporabite kot osnovo za nadaljnje delo.

[VIN PROJ 2023 Pametna IR kamera 8x8 Jakob Jelovčan](#)

[Smarteh LIR2 Tipalo](#)

[VIN PROJ 2023 Pametna IR kamera 8x8 Jakob Jelovčan](#)

[VIN PROJ 2023 Zaznavanje človeka z matrično termo kamero Jakob_jelovčan.mp4](#)

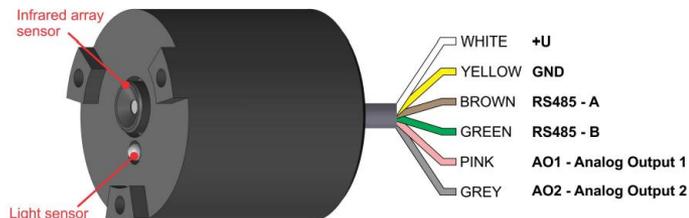
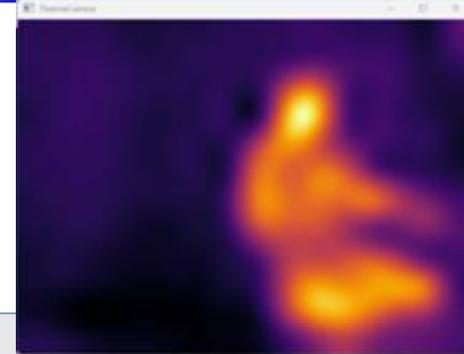
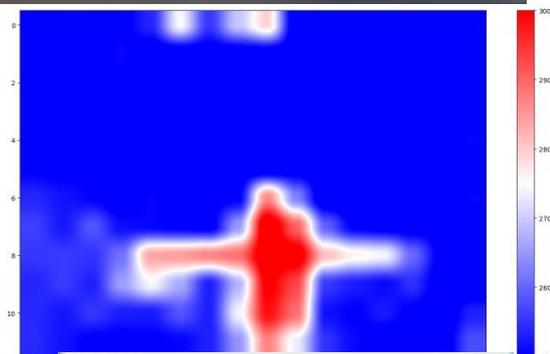
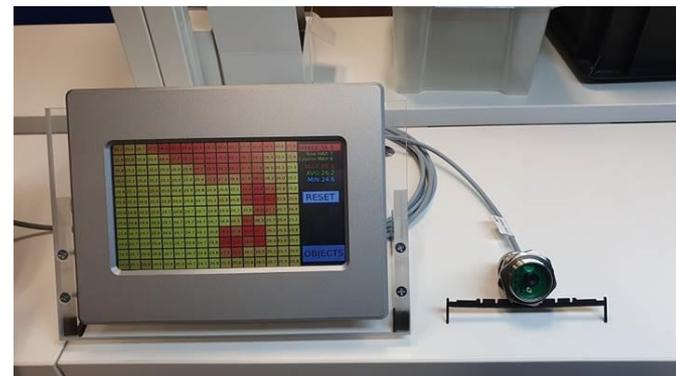


Table 1: Features

| |
|-------------------------------------|
| Infrared array sensor 12 x 16 Pixel |
| Light indication |
| Modbus RTU communication protocol |
| 2 analog outputs 0 .. 10 V |
| IP65 |



```
Windows PowerShell
PS C:\Users\Jakob\git\LIR2> python3 .\classifier.py models/convolutional_model.pt -s COM4 -d
Person present: True
```

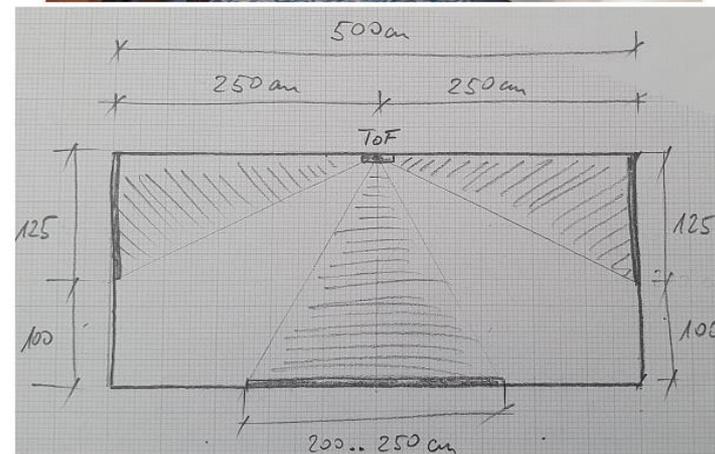
Izzivi

Zaznavanje potnikov v ladijski kabini - Smarteh

a.) kot prvi, in upam da ne prezahteven cilj, bi želeli razviti **algoritem za detekcijo ljudi v prostoru**. Tukaj nas še ne bi zanimalo število ljudi, pač pa samo njihova prisotnost, tudi če so v "mirovanju->spanje". Klasični PIR senzor tukaj odpove, in to bi radi nadgradili za potniške kabine na ladji (sliki v priponki, številke v kvadratih so razdalje v mm).

b.) kot drugi korak pa bi poiskovali **detektirati število ljudi v prostoru**. Ja, ta del bo zahtevnejši, mogoče za začetek, če uspemo prepoznati enega, dva in več kot dve osebi.

Oboje bi morali znati implementirati na napravi sami (matrični termo senzor obdelujemo na enem od ST ukontroler-jev), kar pomeni delo z omejenimi resurci -> implementacija preprostejših algoritmov. Obdelava pa PC-ju tukaj odpade, razen v začetni fazi -> fazi učenja pred fazo optimizacije.



Recommended products:
VL53L7CX and VL53L8CX selection guide

| | VL53L7CX | VL53L8CX |
|---------------------|------------------------------|--|
| Field of view | 60° x 60° (90° diagonal) | 45° x 45° (65° diagonal) |
| Resolution | Up to 8x8 (64 zones) | |
| Common features | Autonomous low power mode | |
| Additional features | External synchronization pin | |
| Driver | 100% compatible | |
| Interfaces | I ² C (1 MHz) | I ² C (1 MHz) and SPI (3 MHz) |
| Distance ranging | Dark condition | 350 cm |
| | Under ambient light* | 65 cm |
| Power consumption** | 4.5mW | 1.6mW |
| Module size | 6.4 x 3.0 x 1.6 mm | 6.4 x 3.0 x 1.75 mm |

* Best conditions using white target (88% reflectance)
** Power consumption measured at 1Hz frequency and with 3.3 V analog and VCSEL supply

ST
www.st.com

12. VIN projekt in SensorTile.box

- Praktična naloga - VIN Projekt
 - Razvojne plošče
 - Viri (gradiva, posnetki, primeri, ...)
 - Osnovna projekta v CubeIDE:
 - CubeMX (HAL knjižnica, BSP) – STM32H7, STM32F4
 - CubeMX – osnovni projekt (GPIO – tipka, LED diode, USART)
 - BSP – osnovni projekt (Touch, LCD)

- SensorTile.box (kompaktna razvojna platforma)

Baremetal - zbirnik

```
INIT_IO:
push {r5, r6, lr}
// Enable GPIO Peripheral Clock (bit 3 in AHB1ENR register)
ldr r6, =RCC_AHB1ENR // Load peripheral clock reg address to r6
ldr r5, [r6] // Read its content to r5
orr r5, 0x00000008 // Set bit 3 to enable GPIO clock
str r5, [r6] // Store result in peripheral clock register

// Make GPIO Pin12 as output pin (bits 25:24 in MODER register)
ldr r6, =GPIO_BASE // Load GPIO BASE address to r6
ldr r5, [r6,#GPIO_MODER] // Read GPIO_MODER content to r5
and r5, 0x00FFFFFF // Clear bits 31-24 for P12-15
orr r5, 0x55000000 // Write 01 to bits 31-24 for P12-15
str r5, [r6] // Store result in GPIO MODER register
pop {r5, r6, pc}
```

```
LED_ON:
push {r5, r6, lr}
// Set GPIO Pins to 1 (through BSSR register)
ldr r6, =GPIO_BASE // Load GPIO BASE address to r6
mov r5, #LEDs_ON
str r5, [r6,#GPIO_BSSR] // Write to BSSR register
pop {r5, r6, pc}
```

```
LED_OFF:
push {r5, r6, lr}
// Set GPIO Pins to 0 (through BSSR register)
ldr r6, =GPIO_BASE // Load GPIO BASE address to r6
mov r5, #LEDs_OFF
str r5, [r6,#GPIO_BSSR] // Write to BSSR register
pop {r5, r6, pc}
```

https://github.com/LAPSYLAB/ORLab-STM32/tree/main/GPIO_LEDs

RA, OR

Baremetal - C

```
/* USER CODE BEGIN 2 */

RCC->AHB1ENR |= 0x08;
// Enable clock for GPIO
GPIO->MODER |= 0x01000000; //
MODE Register: bit 12 == out

/* USER CODE END 2 */

/* Infinite loop */
/* USER CODE BEGIN WHILE */
while (1)
{
GPIO->ODR ^= 0x1000; //
Toggle PD12

/* USER CODE END WHILE */

/* USER CODE BEGIN 3 */
for (int i=0; i<0x1000000; i++) {};
// waste some time
}
/* USER CODE END 3 */
```

https://github.com/LAPSYLAB/STM32F4_Discovery_VIN_Projects/tree/main/LED_GPIO_C_Baremetal_C

VIN

HAL - C

```
/* Infinite loop */
/* USER CODE BEGIN WHILE */
while (1)
{
HAL_GPIO_TogglePin(GPIO, GPIO_PIN_12);

/* USER CODE END WHILE */

/* USER CODE BEGIN 3 */
HAL_Delay(1000);
}
/* USER CODE END 3 */

void HAL_GPIO_TogglePin(GPIO_TypeDef* GPIOx,
uint16_t GPIO_Pin)
{
uint32_t odr;

/* Check the parameters */
assert_param(IS_GPIO_PIN(GPIO_Pin));

/* get current Output Data Register value
*/
odr = GPIOx->ODR;

/* Set selected pins that were at low
level, and reset ones that were high */
GPIOx->BSRR = ((odr & GPIO_Pin) <<
GPIO_NUMBER) | (~odr & GPIO_Pin);
}
```

https://github.com/LAPSYLAB/STM32F4_Discovery_VIN_Projects/tree/main/LED_Blink_Demo

Vir: UM2217 - HAL and Low-layer drivers

UM2217

User manual

Programska knjižnica

Vsebuje predpripravljene funkcije za delo s sistemskimi in V/I napravami.



This section contains the following APIs:

- `HAL_Init()`
- `HAL_DeInit()`
- `HAL_MspInit()`
- `HAL_MspDeInit()`
- `HAL_InitTick()`



Description of STM32H7 HAL and low-layer drivers

This section contains the following APIs:

- `HAL_IncTick()`
- `HAL_GetTick()`
- `HAL_GetTickPrio()`
- `HAL_SetTickFreq()`
- `HAL_GetTickFreq()`
- `HAL_Delay()`
- `HAL_SuspendTick()`
- `HAL_ResumeTick()`
- `HAL_GetHalVersion()`

This section contains the following APIs:

- `HAL_USART_Transmit()`
- `HAL_USART_Receive()`
- `HAL_USART_TransmitReceive()`
- `HAL_USART_Transmit_IT()`
- `HAL_USART_Receive_IT()`
- `HAL_USART_TransmitReceive_IT()`
- `HAL_USART_Transmit_DMA()`
- `HAL_USART_Receive_DMA()`
- `HAL_USART_TransmitReceive_DMA()`

35.2.4

IO operation functions

This section contains the following APIs:

- `HAL_GPIO_ReadPin()`
- `HAL_GPIO_WritePin()`
- `HAL_GPIO_TogglePin()`
- `HAL_GPIO_LockPin()`
- `HAL_GPIO_EXTI_IRQHandler()`
- `HAL_GPIO_EXTI_Callback()`

This section contains the following APIs:

- `HAL_I2C_Init()`
- `HAL_I2C_DeInit()`
- `HAL_I2C_MspInit()`
- `HAL_I2C_MspDeInit()`
- `HAL_I2C_RegisterCallback()`
- `HAL_I2C_UnRegisterCallback()`
- `HAL_I2C_RegisterAddrCallback()`
- `HAL_I2C_UnRegisterAddrCallback()`

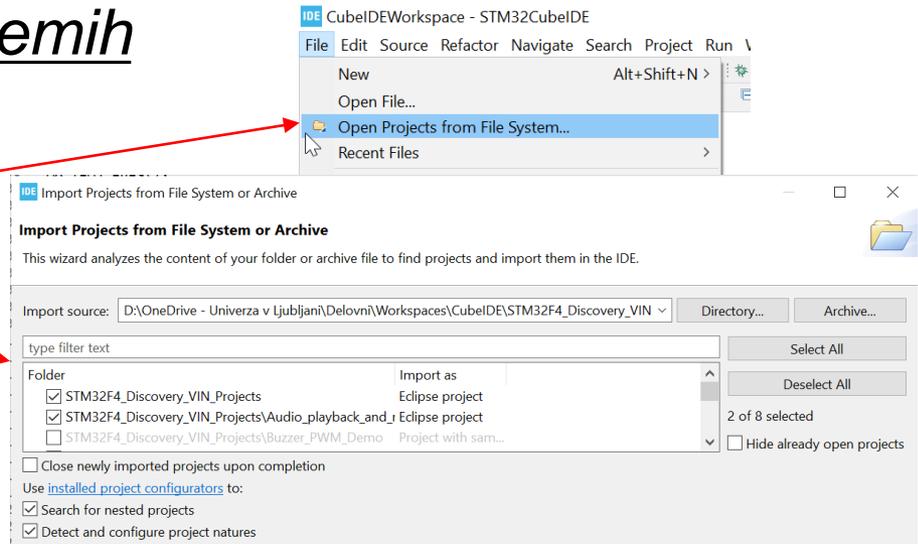
UM2217 - Rev 6

page 2/4020

CubeIDE: delo na STM32 sistemih

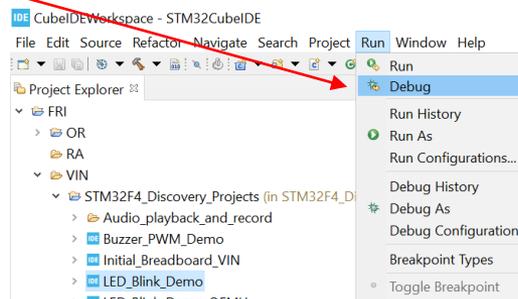
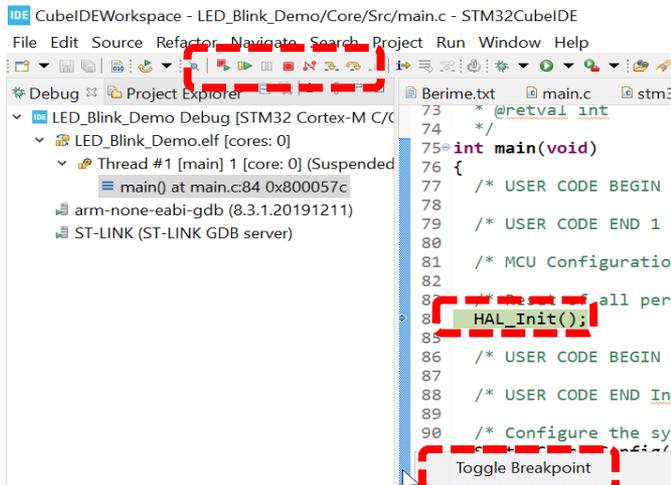
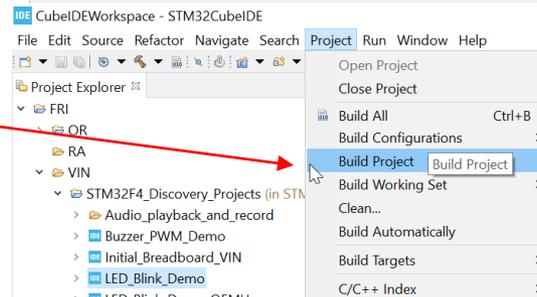
Vzpostavitev začetnega projekta :

- **Uvoz obstoječega (npr. BSP)**
 - Open projects from File System
 - Select project(s)
- **Nov projekt CubeMX ->**
(v nadaljevanju)



Prevajanje, zagon :

- Project -> Build Project
- Run -> Debug
- Step (Into,Over), Breakpoints



CubeIDE: delo na STM32 sistemih

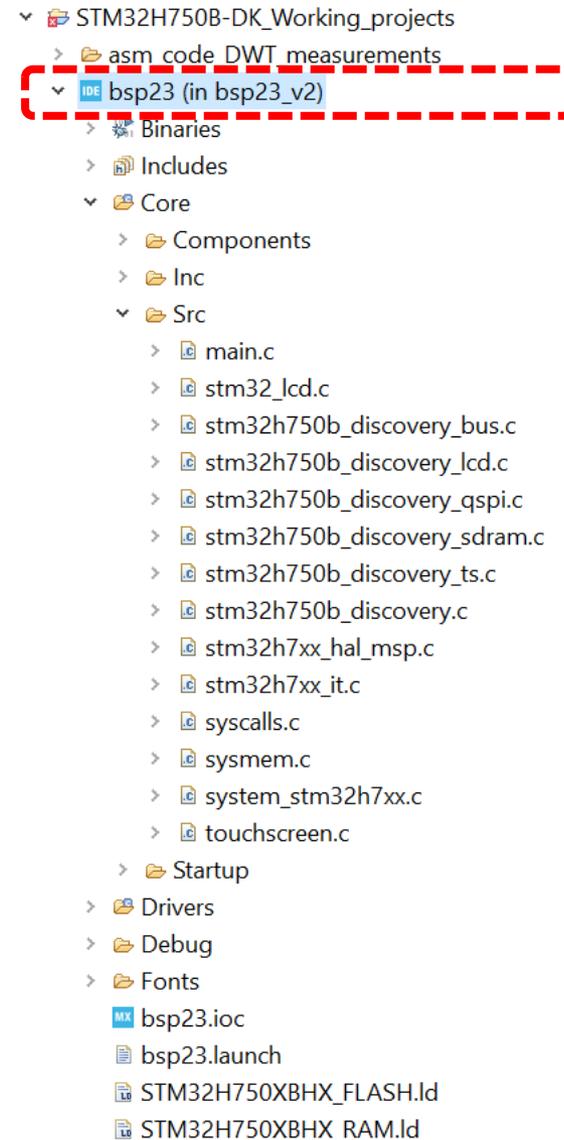
Kopiranje projekta :

•Kopiranje CubeIDE projekta z CubeMX .ioc datoteko

- 1) Edit > **Copy (obstoječi projekt).**
- 2) Edit > **Paste (nova lokacija).**
- 3) Preimenuj .ioc datoteko.
- 4) Zbriši **Debug.launch** datoteko.
- 5) Project > **Clean.**
- 6) Generiraj kodo s **CubeMX.**
- 7) Project > **Build** Project.
- 8) Debug As Stm32 Application.
- 9) **Debug** aplikacije.
-

•Kopiranje osnovnih CubeIDE asm,BSP C projekta

- 1) Edit > **Copy (obstoječi projekt).**
- 2) Edit > Paste **(nova lokacija).**
- 3) Delete the Debug.launch file.
- 4) Project > Clean.
- 5) Project > Build Project.
- 6) Debug As Stm32 Application.
- 7) And debug the application
- 8) Add breakpoint on first instruction if necessary



12. VIN projekt in SensorTile.box

■ Praktična naloga - VIN Projekt

- Razvojne plošče
- Viri (gradiva, posnetki, primeri, ...)
- Osnovna projekta v CubeIDE:

- CubeMX (HAL knjižnica, BSP) – STM32H7, STM32F4

- CubeMX – osnovni projekt (GPIO – tipka, LED diode, USART)
- BSP – osnovni projekt (Touch, LCD)

■ SensorTile.box (kompaktna razvojna platforma)

Delo na STM32H7 razvojnem sistemu

Mikro USB priključek na daljši stranici (srednji !!!) ↓

Priključitev :

- Mikro USB priključek na daljši stranici (srednji !!!)

Poseben začetni projekt in info za STM32H7 (e-učilnica,github):

- dodajanje vsebine (main.c):



```
CubelDEWorkspace - Sluzba/ORLab-STM32H7/STM32H750B-DK_C_Basic/Core/Src/main.c - STM32CubelDE
File Edit Source Refactor Navigate Search Project Run Window Help
Project Explorer
CubelDE_Workspace
Delo
Node_V4 (in node_v4)
Sluzba
  CAN_IEX_Module
  CAN_IEX_Module_bak
  H7-BSP-LCD-OS
  ORLab-STM32
  ORLab-STM32H7
    Docs
    DWT_Cycles_Measurements
    GPIO_LEDs
    STM32H750B-DK_C_Basic
      Core
        Inc
        Src
main.c
131
132  /* Infinite loop */
133  /* USER CODE BEGIN WHILE */
134  while (1)
135  {
136      HAL_GPIO_TogglePin(GPIOI, GPIO_PIN_13);
137      HAL_GPIO_TogglePin(GPIOJ, GPIO_PIN_2);
138
139      /* USER CODE END WHILE */
140
141      /* USER CODE BEGIN 3 */
142      sprintf (SendBuffer,BUFSIZE,"USART3:%d secs\r\n",Cnt);
143      HAL_UART_Transmit(&huart3,SendBuffer,strlen(SendBuffer),1);
144
145      HAL_Delay(1000);
146      Cnt++;
147  }
148  /* USER CODE END 3 */
149 }
150
```



Lastni viri :

[https://github.com/LAPSyLAB/STM32H7 Discovery VIN Projects](https://github.com/LAPSyLAB/STM32H7_Discovery_VIN_Projects)

<https://github.com/LAPSyLAB/ORLab-STM32H7>



CubeIDE – Vzpostavitev novega projekta s CubeMX

Nov projekt :

IDE CubeIDEWorkspace - STM32_USB_Key_LED/Berime.txt - STM32CubeIDE

File Edit Source Refactor Navigate Search Project Run Window Help

1 - New

STM32 Project

IDE STM32 Project

Target Selection

STM32 target or STM32Cube example selection is required

2 - Poišči ploščo

Board Selector

Commercial Part Number: STM32F407, STM32F407G-DISC1

Commercial Part Number: STM32H750B-DK, STM32H750B-DK

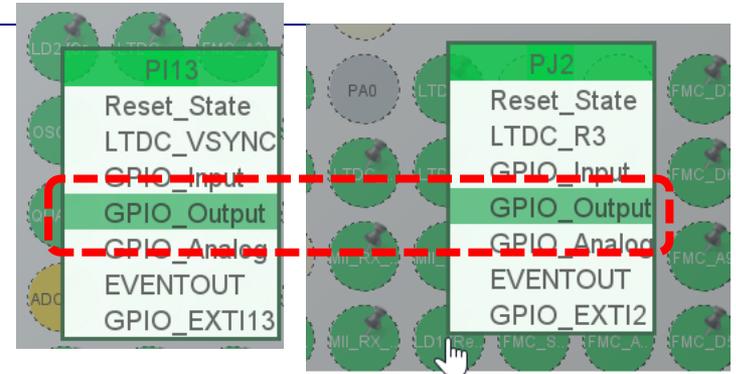
3 - Izberi ploščo - Next

| Board | Type | Market... | Unit Pri... | Mounted |
|------------------|--------------|-----------|-------------|--------------|
| STM32F407G-DISC1 | Discovery... | Active | 19.89 | STM32H750... |
| STM32H750B-DK | Discovery... | Active | 87.0 | STM32H750... |

STM32H7

Osnovni projekt CubeIDE – CubeMX

Konfiguracija : priključki, knjižnice STM32H7



STM32Cube MCU packages and embedded software packs

- Copy all used libraries into the project folder
- Copy only the necessary library files
- Add necessary library files as reference in the toolchain project configuration file

Generated files

- Generate peripheral initialization as a pair of '.c'/'h' files per peripheral
- Backup previously generated files when re-generating
- Keep User Code when re-generating
- Delete previously generated files when not re-generated

HAL Settings

- Set all free pins as analog (to optimize the power consumption)
- Enable Full Assert

Template Settings

Select a template to generate customized code Settings...

Project Settings

Project Name: LED_GPIO_C_Baremetal_C

Project Location: D:\Delovni\CubeIDE\CubeIDEWorkspace

Application Structure: Advanced Do not generate the main()

Toolchain Folder Location: D:\Delovni\CubeIDE\CubeIDEWorkspace\LED_GPIO_C_Baremetal_C

Toolchain / IDE: STM32CubeIDE Generate Under Root

Linker Settings

Minimum Heap Size: 0x200

Minimum Stack Size: 0x400

Thread-safe Settings

Cortex-MANS

Enable multi-threaded support

Thread-safe Locking Strategy: Default - Mapping suitable strategy de

McU and Firmware Package

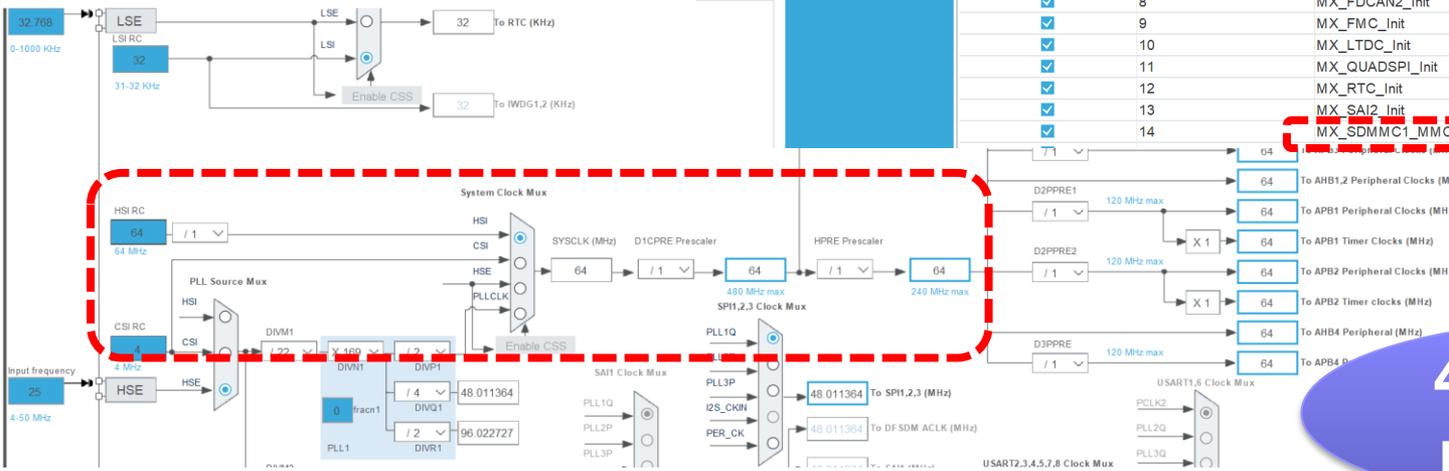
McU Reference: STM32F407VGTx

Firmware Package Name and Version: STM32Cube FW_F4 V1.26.2

Advanced Settings

Generated Function Calls

| Generate Code | Rank | Function Name | Peripheral Instance Name | Do Not Generate Function Call |
|-------------------------------------|------|--------------------|--------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | 1 | SystemClock_Config | RCC | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 2 | MX_GPIO_Init | GPIO | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 3 | MX_ADC1_Init | ADC1 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 4 | MX_ADC2_Init | ADC2 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 5 | MX_ADC3_Init | ADC3 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 6 | MX_ETH_Init | ETH | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 7 | MX_FDCAN1_Init | FDCAN1 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 8 | MX_FDCAN2_Init | FDCAN2 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 9 | MX_FMC_Init | FMC | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 10 | MX_LTDC_Init | LTDC | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 11 | MX_QUADSPI_Init | QUADSPI | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 12 | MX_RTC_Init | RTC | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 13 | MX_SAI2_Init | SAI2 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 14 | MX_SDMMC1_MMC_Init | SDMMC1 | <input checked="" type="checkbox"/> |



4 – Preveri nastavitve

STM32H7

Osnovni projekt CubeMX – USB Virtual COM

Program : za pošiljanje po USB Virtual COM Port (USART3)

```
/* Private variables ----- */

/* USER CODE BEGIN PV */
#define    BUFSIZE 256
char      SendBuffer[BUFSIZE];
int       Counter;
/* USER CODE END PV */

/* Infinite loop */
/* USER CODE BEGIN WHILE */
while (1)
{
    /* USER CODE END WHILE */

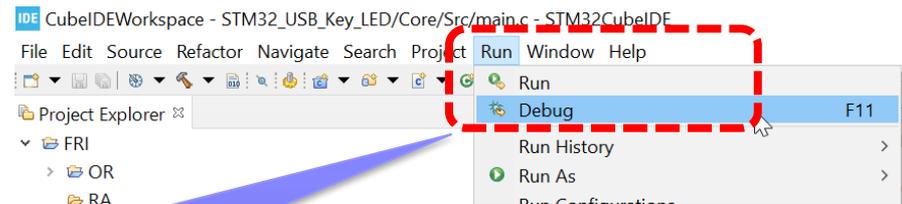
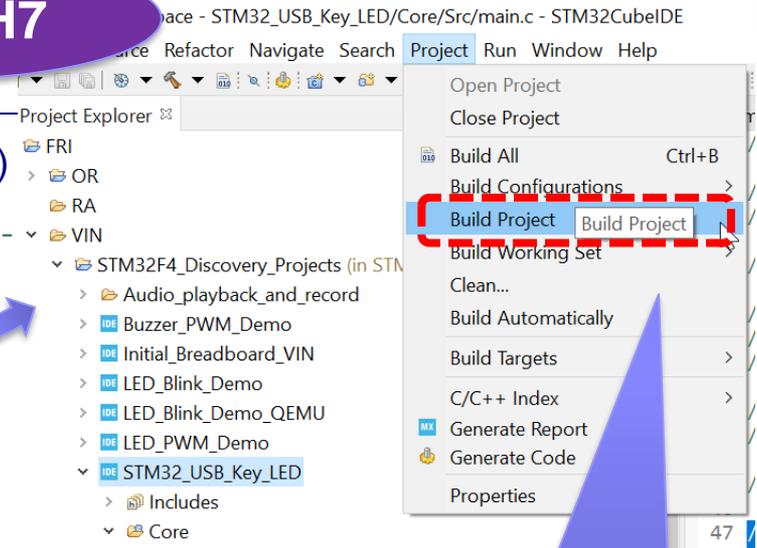
    /* USER CODE BEGIN 3 */
    snprintf (SendBuffer, BUFSIZE, "USART3:%d secs\r\n", Counter);
    HAL_UART_Transmit(&huart3, SendBuffer, strlen(SendBuffer), 100);

    HAL_Delay(1000);
    Counter++;
}
/* USER CODE END 3 */
```

5 – UART
koda

6 – Build
project

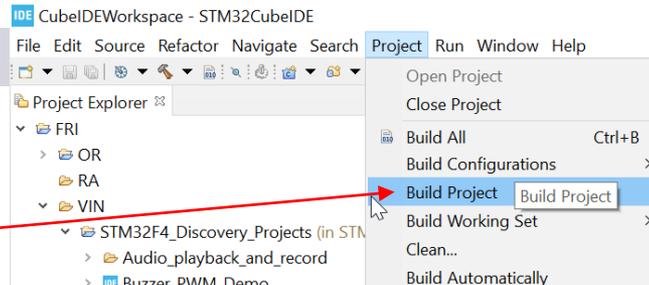
7 – Debug
project



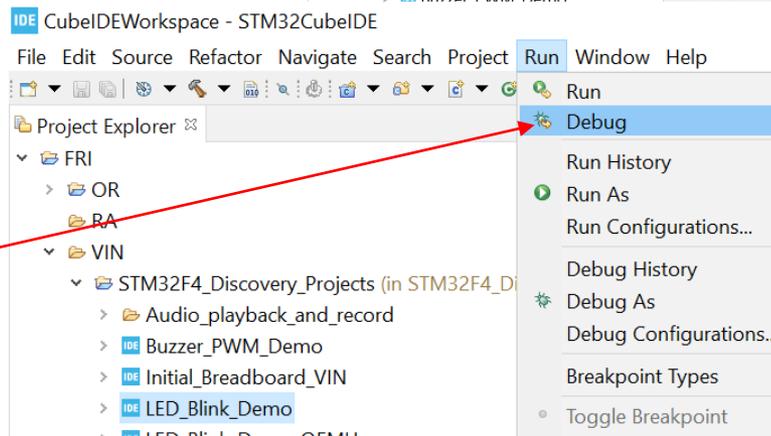
CubelIDE – Zagon, debug

Prevajanje, zagon :

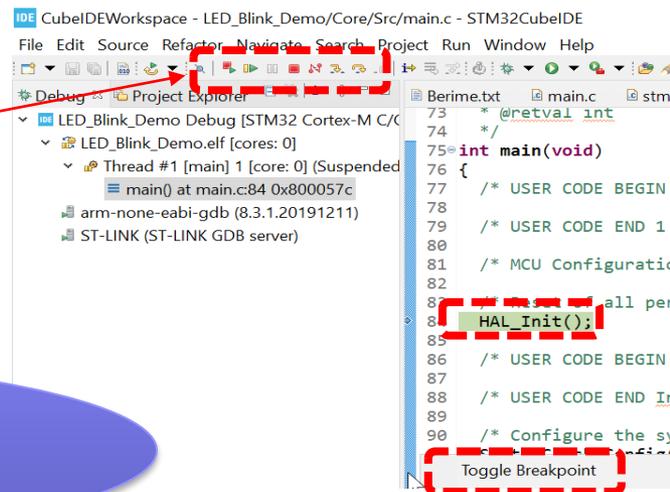
- Project -> Build Project



- Run -> Debug



- Step (Into,Over), Breakpoints



Build <-> Debug
project, ...

HAL - C

```

/* USER CODE BEGIN PV */
#define BUFSIZE 256
char SendBuffer[BUFSIZE];
int Counter;
int KeyState=0;

/* USER CODE END PV */

/* Infinite loop */
/* USER CODE BEGIN WHILE */
while (1)
{
    HAL_GPIO_TogglePin(GPIOI, GPIO_PIN_13);

    KeyState = HAL_GPIO_ReadPin(GPIOC, GPIO_PIN_13);
    HAL_GPIO_WritePin(GPIOJ, GPIO_PIN_2, KeyState);

    sprintf(SendBuffer, BUFSIZE, "Hello World [%d]: Key:%d\r\n", Counter++, KeyState);
    HAL_UART_Transmit(&huart3, SendBuffer, strlen(SendBuffer), 100);

    HAL_Delay(1000);
    /* USER CODE END WHILE */

    /* USER CODE BEGIN 3 */
}
/* USER CODE END 3 */

```

UM2217

User manual

Description of STM32H7 HAL and low-layer drivers

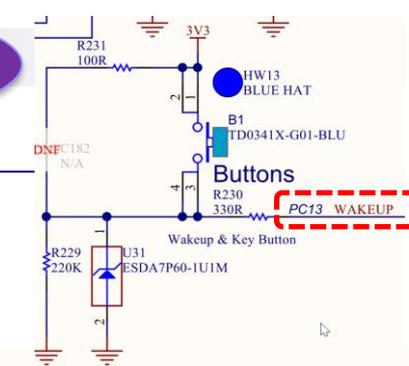
35.2.4 IO operation functions

This section contains the following APIs:

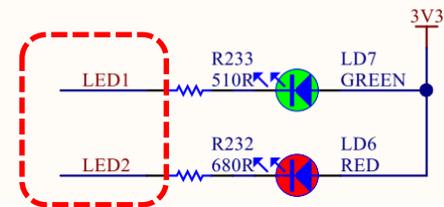
- HAL_GPIO_ReadPin()
- HAL_GPIO_WritePin()
- HAL_GPIO_TogglePin()
- HAL_GPIO_LockPin()
- HAL_GPIO_EXTI_IRQHandler()
- HAL_GPIO_EXTI_Callback()

5 – GPIO

6 – USART COM Port



LEDs



| | | |
|------|----|-----------|
| P111 | H1 | LCD HSYNC |
| P112 | H2 | LED2 |
| P113 | H3 | LCD CLK |
| P114 | P5 | LCD R0 |
| P115 | | |

| | | |
|-----|-----|--------|
| P30 | P6 | LCD R2 |
| PJ1 | T6 | LED1 |
| PJ2 | T16 | LCD R4 |

Osnovni projekt CubeIDE – USB Virtual COM Port

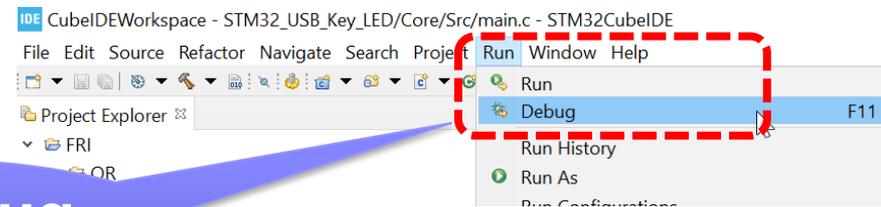
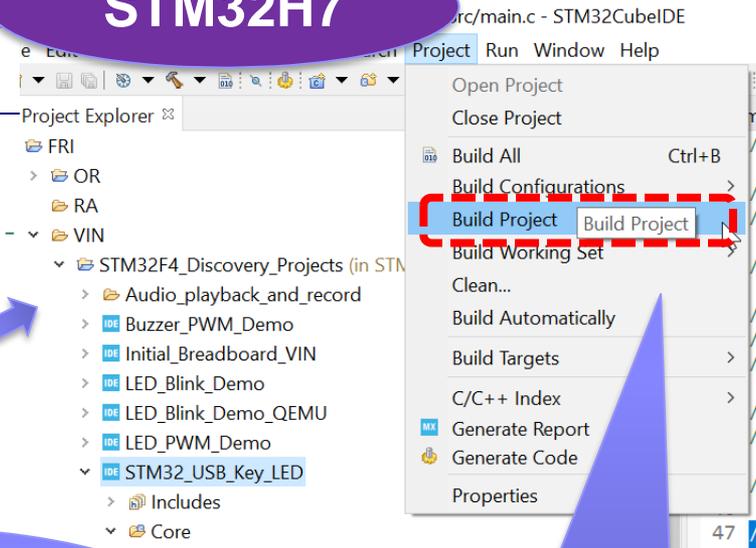
Program : za pošiljanje po USB Virtual COM Port

```
/* Private variables -----  
  
/* USER CODE BEGIN PV */  
#define BUFSIZE 256  
char SendBuffer[BUFSIZE];  
int Counter;  
int KeyState=0;  
  
/* USER CODE END PV */  
  
/* Infinite loop */  
/* USER CODE BEGIN WHILE */  
while (1)  
{  
  
    HAL_GPIO_TogglePin(GPIOI, GPIO_PIN_13);  
  
    KeyState = HAL_GPIO_ReadPin(GPIOI, GPIO_PIN_13);  
    HAL_GPIO_WritePin(GPIOJ, GPIO_PIN_2, KeyState);  
  
    snprintf(SendBuffer, BUFSIZE, "Hello World [%d]: Key:%d\r\n", Counter++, KeyState);  
    HAL_UART_Transmit(&huart3, SendBuffer, strlen(SendBuffer), 100);  
  
    HAL_Delay(1000);  
/* USER CODE END WHILE */  
  
/* USER CODE BEGIN 3 */  
}  
/* USER CODE END 3 */
```

7 – Delay

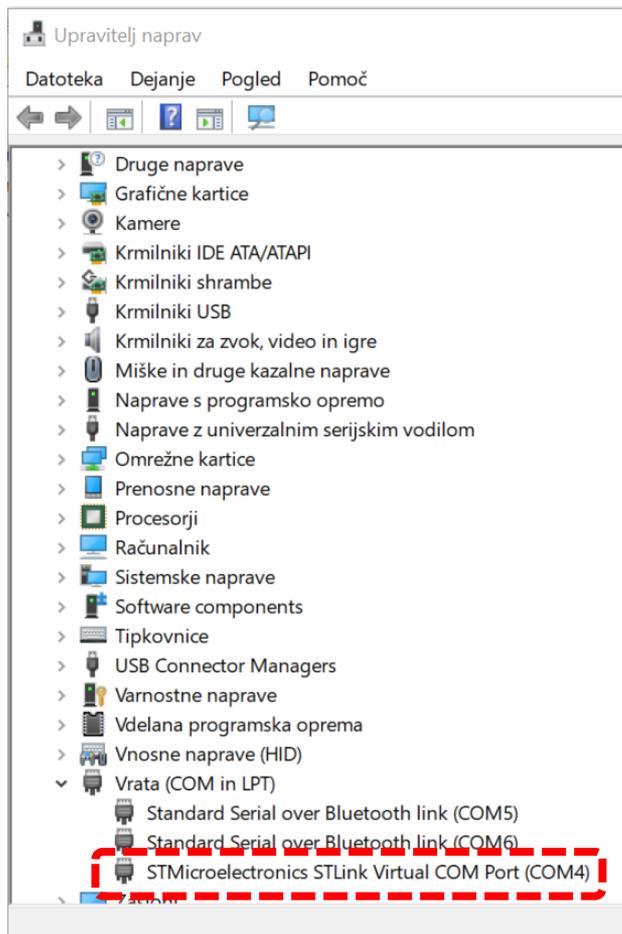
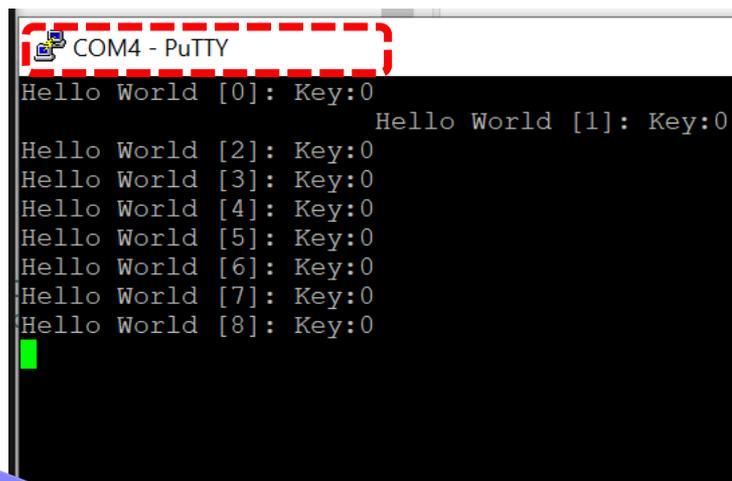
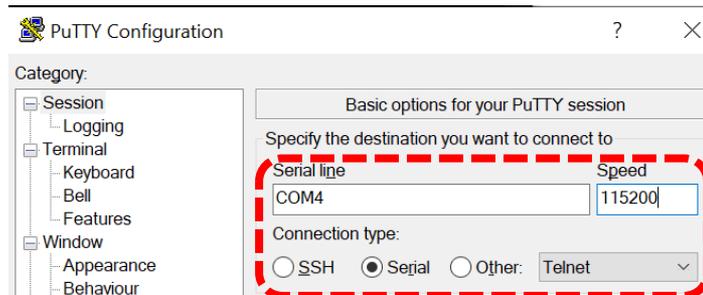
8 – Build project

9 – Debug project



Osnovni projekt CubeIDE – USB Virtual COM Port (USART3 na STM strani)

Program : sprejem na PC strani (povezava z Micro-USB kablom)

<https://the.earth.li/~sgtatham/putty/latest/w64/putty.exe>

10 – Test project

12. VIN projekt in SensorTile.box

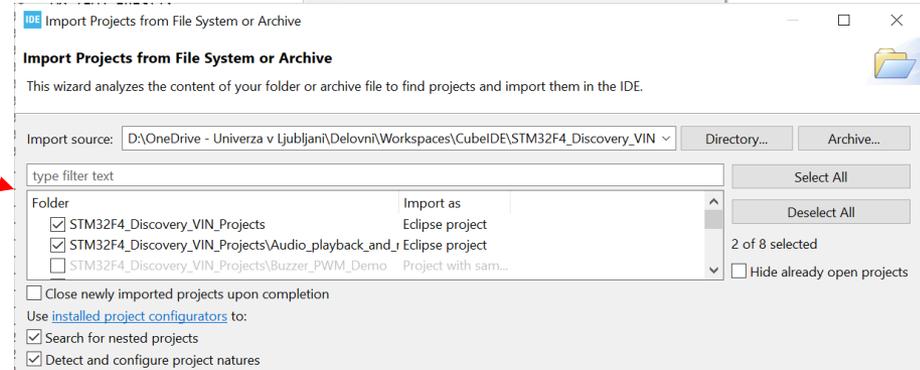
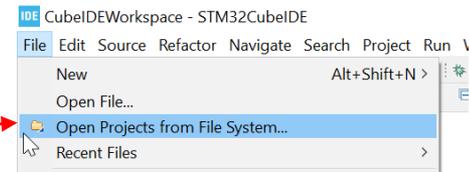
- Praktična naloga - VIN Projekt
 - Razvojne plošče
 - Viri (gradiva, posnetki, primeri, ...)
 - Osnovna projekta v CubeIDE:
 - CubeMX (HAL knjižnica, BSP) – STM32H7, STM32F4
 - CubeMX – osnovni projekt (GPIO – tipka, LED diode, USART)
 - BSP – osnovni projekt (Touch, LCD)

- SensorTile.box (kompaktna razvojna platforma)

CubeIDE: delo na STM32 sistemih

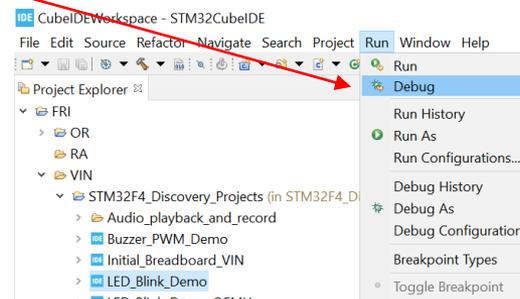
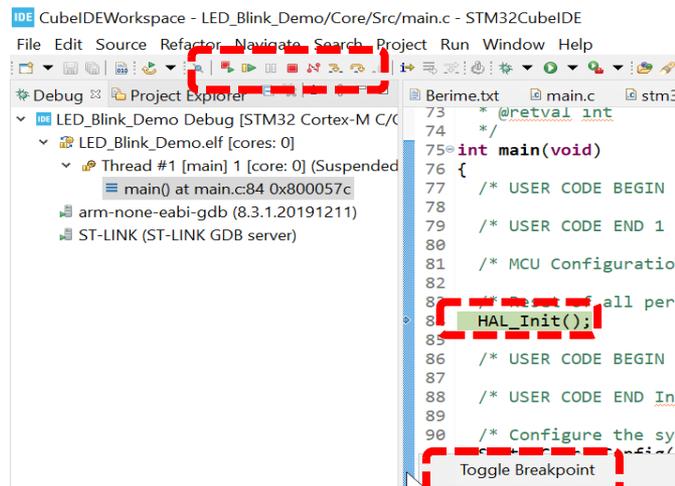
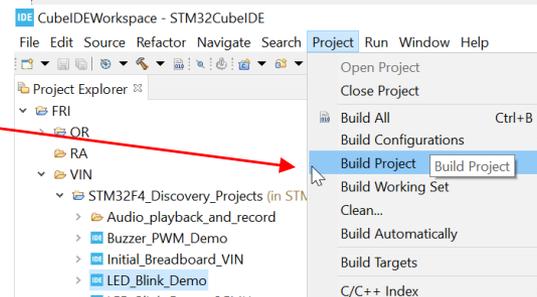
Uvoz obstoječega projekta (npr. BSP... iz Github)

- Open projects from File System
- Select project(s)



Prevajanje, zagon :

- Project -> Build Project
- Run -> Debug
- Step (Into,Over), Breakpoints



LAPSyLAB/STM32H7_Discovery_VIN_Projects

Z naslova <https://github.com/LAPSyLAB/STM32H7_Discovery_VIN_Projects>

| | | |
|---|---|--------------|
| .settings | Breadboard project added (initial preparation) | last year |
| STM32H750-DK BSP Touch Demo | BSP Touch Demo project added (Basic starting BSP project) | 2 weeks ago |
| STM32H750B-DK Breadboard VIN | Update 2024 1.st | 2 months ago |
| STM32H750B-DK Buzzer PWM Demo | Update 2024 1.st | 2 months ago |
| STM32H750B-DK C CAN IEX Module Base | Minor update | 4 days ago |
| STM32H750B-DK I2C Basic Demo | Update 2024 1.st | 2 months ago |
| STM32H750B-DK I2C Touch Demo | Update 2024 1.st | 2 months ago |
| STM32H750B-DK VIN Basic | Update 2024 1.st | 2 months ago |
| .gitignore | Initial commit | last year |
| .project | Breadboard project added (initial preparation) | last year |
| README.md | Initial commit | last year |

LAPSyLAB/STM32H7_Discovery_VIN_Projects

Z naslova [<https://github.com/LAPSyLAB/STM32H7_Discovery_VIN_Projects>](https://github.com/LAPSyLAB/STM32H7_Discovery_VIN_Projects)

STM32H750-DK BSP Touch Demo

Vključuje HAL knjižnico in podporno kodo (BSP) za STM32H7

- BSP ... Board Support Package
- - Ni generiran s CubeMX, vse spreminjamo ročno v kodi
- + delujejo zaslون, dotiki, ostale naprave

STM32H750B-DK VIN Basic

Vključuje HAL knjižnico in je generiran s CubeMX

- + generiran s CubeMX, lahko spreminjamo konfiguracije
- - ne delujejo zaslون, dotiki, ostale naprave
 - Lahko pa se minimalna koda doda (nastavitve so večinoma že prisotni)

IDE STM32H750-DK_BSP_Touch_Demo

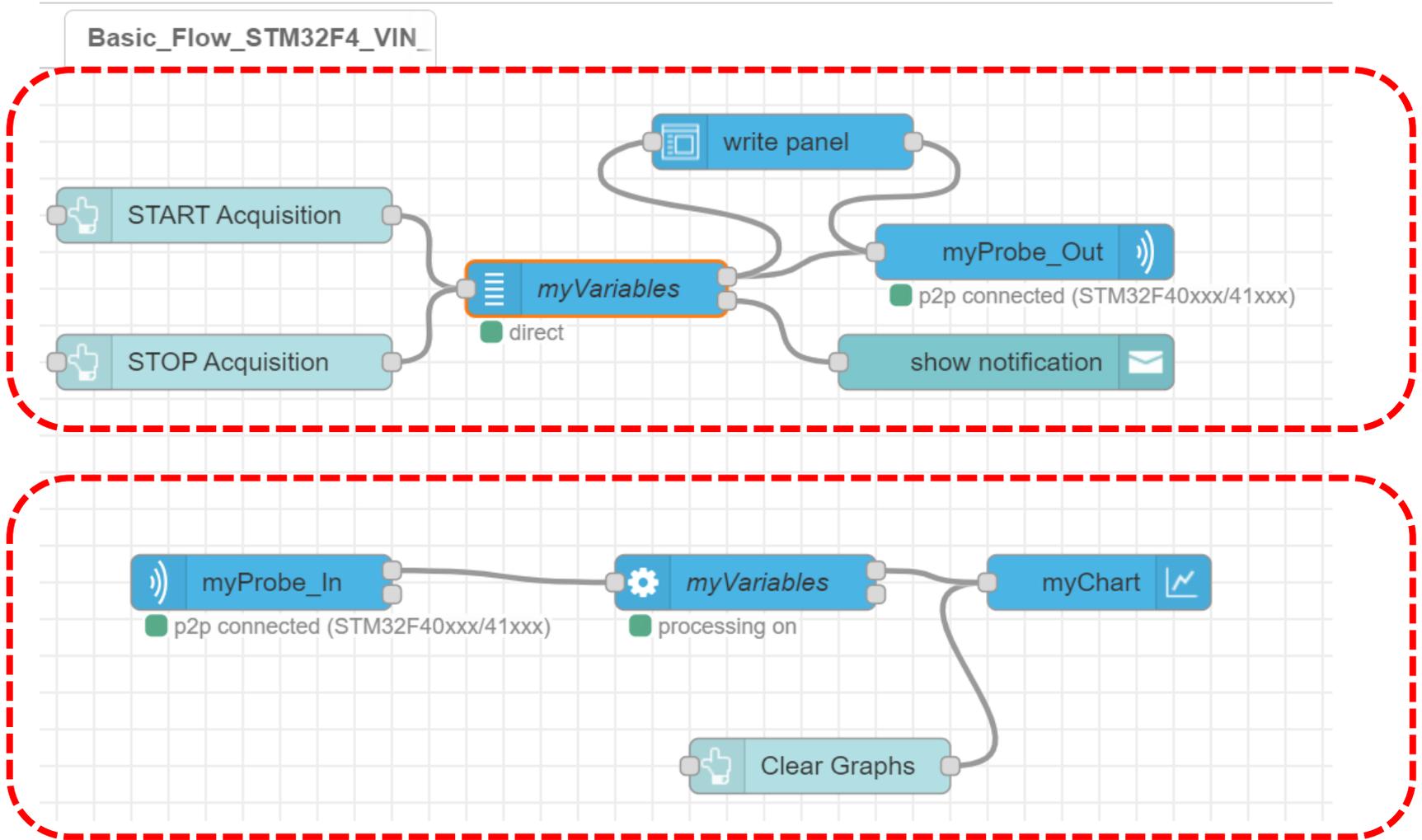
```

> Binaries
> Includes
v Core
  > Components
  v Inc
    > ft5336_conf.h
    > main.h
    > mt25tl01g_conf.h
    > mt48lc4m32b2_conf.h
    > stm32_lcd.h
    > stm32h750b_discovery_bus.h
    > stm32h750b_discovery_conf.h
    > stm32h750b_discovery_errno.h
    > stm32h750b_discovery_lcd.h
    > stm32h750b_discovery_qspi.h
    > stm32h750b_discovery_sdram.h
    > stm32h750b_discovery_ts.h
    > stm32h750b_discovery.h
    > stm32h7xx_hal_conf.h
    > stm32h7xx_it.h
  > Src
    > main.c
    > stm32_lcd.c
    > stm32h750b_discovery_bus.c
    > stm32h750b_discovery_lcd.c
    > stm32h750b_discovery_qspi.c
    > stm32h750b_discovery_sdram.c
    > stm32h750b_discovery_ts.c
    > stm32h750b_discovery.c
    > stm32h7xx_hal_msp.c
    > stm32h7xx_it.c
    > syscalls.c
    > systemem.c
    > system_stm32h7xx.c
    > touchscreen.c
  
```

```

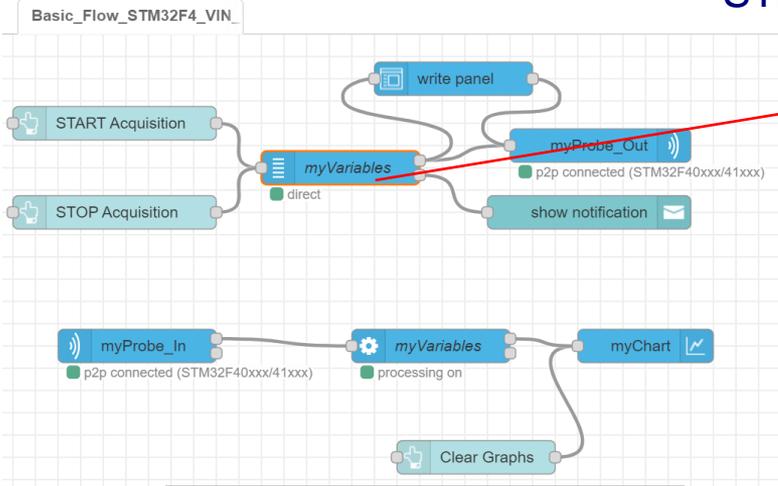
v STM32H750B-DK_VIN_Basic
  > Binaries
  > Includes
  v Core
    > Inc
      > main.h
      > stm32h7xx_hal_conf.h
      > stm32h7xx_it.h
    > Src
      > main.c
      > stm32h7xx_hal_msp.c
      > stm32h7xx_it.c
      > syscalls.c
      > systemem.c
      > system_stm32h7xx.c
  
```

STM32CubeMonitor



<https://wiki.stmicroelectronics.cn/stm32mcu/wiki/Category:STM32CubeMonitor>

STM32CubeMonitor



DEPLOY DASHBOARD



Edit variables node > Edit exe-config node

Delete Cancel Update

Properties

Name: MyVariables

Folder: D:\Delovni\CubeIDE\Sluzba\STM32F4_Discovery_VIN_Prc

File: STM32F4_GPIO_PWM_SPI_I2C_C_Demo.elf

Expand Variable List

Variable List

| Select | Name | Start Address | Type |
|-------------------------------------|--------------------------|---------------|-----------------|
| <input type="checkbox"/> | __sbrk_heap_end | 0x200003d0 | Unsigned 32-bit |
| <input checked="" type="checkbox"/> | AccelX | 0x2000036f | Signed 8-bit |
| <input checked="" type="checkbox"/> | AccelY | 0x20000370 | Signed 8-bit |
| <input checked="" type="checkbox"/> | AccelZ | 0x20000371 | Signed 8-bit |
| <input type="checkbox"/> | AHBPrescTable[0] | 0x0800b8cc | Unsigned 8-bit |
| <input checked="" type="checkbox"/> | AnalogValue1 | 0x20000374 | Signed 32-bit |
| <input type="checkbox"/> | APBPrescTable[0] | 0x0800b8dc | Unsigned 8-bit |
| <input type="checkbox"/> | CDCCmdEpAdd | 0x20000099 | Unsigned 8-bit |
| <input type="checkbox"/> | CDCInEpAdd | 0x20000097 | Unsigned 8-bit |
| <input type="checkbox"/> | CDCOutEpAdd | 0x20000098 | Unsigned 8-bit |
| <input checked="" type="checkbox"/> | ChipID | 0x20000360 | Unsigned 8-bit |
| <input type="checkbox"/> | Counter | 0x20000350 | Signed 32-bit |
| <input checked="" type="checkbox"/> | Duty | 0x20000358 | Signed 32-bit |
| <input type="checkbox"/> | FS_Drvr_CatConfiguration | 0x20000004 | Unsigned 32-bit |

12. VIN projekt in SensorTile.box

- Praktična naloga - VIN Projekt
 - Razvojne plošče
 - Viri (gradiva, posnetki, primeri, ...)
 - Osnovna projekta v CubeIDE:
 - CubeMX (HAL knjižnica, BSP) – STM32H7, STM32F4
 - CubeMX – osnovni projekt (GPIO – tipka, LED diode, USART)
 - BSP – osnovni projekt (Touch, LCD)

- SensorTile.box (kompaktna razvojna platforma)

STEVAL-MKSBOX1V1 SensorTile.box razvojni sistem

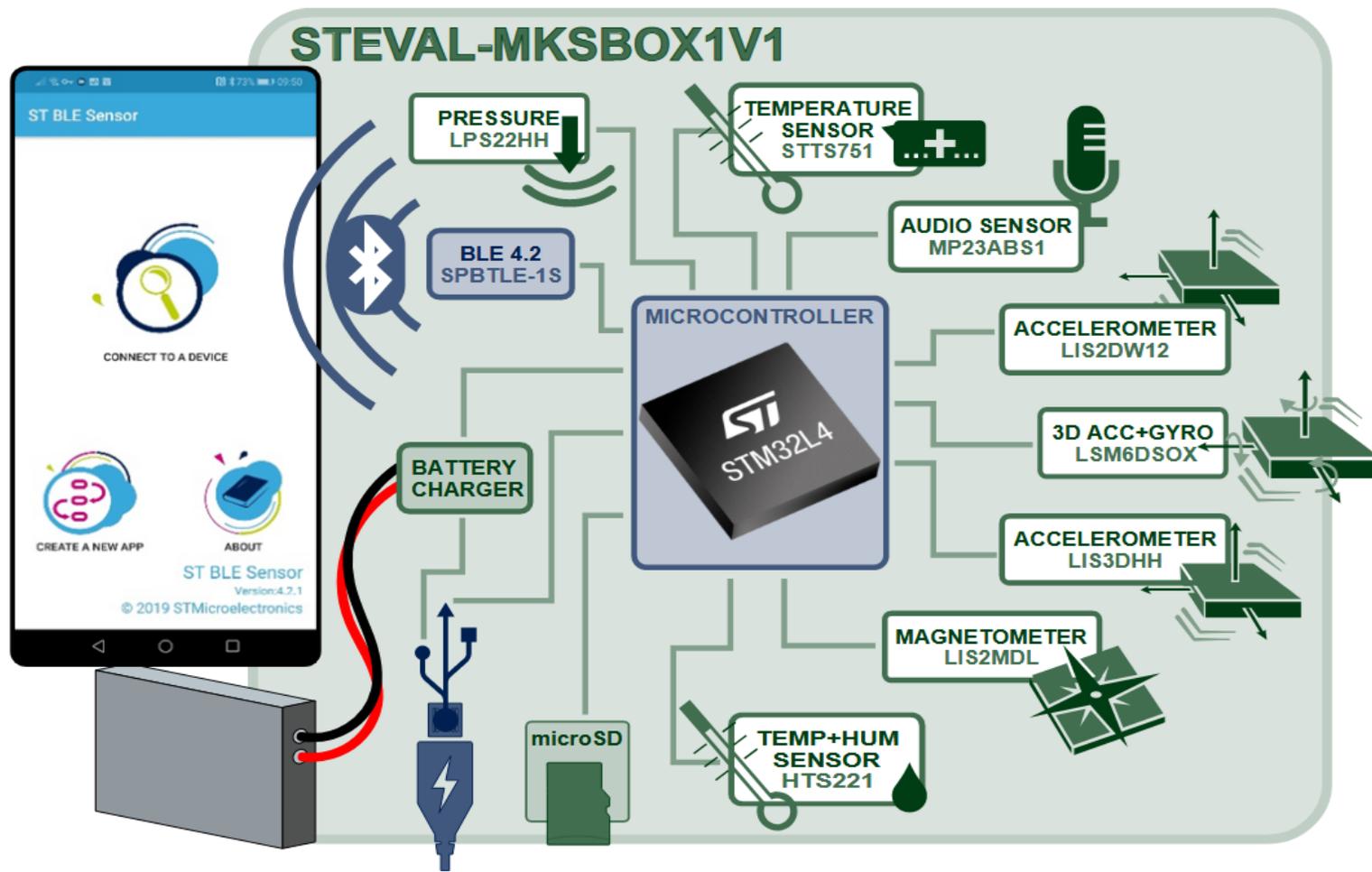
All features

- 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/steval-mksbox1v1.html>

STEVAL-MKSBOX1V1 SensorTile.box razvojni sistem



<https://www.st.com/en/evaluation-tools/steval-mksbox1v1.html>

STEVAL-MKSBOX1V1 SensorTile.box razvojni sistem

SensorTile.box wireless multi sensor development kit with user friendly app for IoT and wearable sensor applications

Z naslova <<https://www.st.com/en/evaluation-tools/steval-mksbox1v1.html>>

https://www.st.com/resource/en/data_brief/steval-mksbox1v1.pdf

How to use the wireless multi-sensor development kit with customizable app for IoT and wearable sensor applications

https://www.st.com/resource/en/user_manual/um2580-how-to-use-the-wireless-multi-sensor-development-kit-with-customizable-app-for-iot-and-wearable-sensor-applications-stmicroelectronics.pdf

Getting started with the SensorTile.Box (STEVAL-MKSBOX1V1)

Z naslova <https://www.youtube.com/watch?v=jJZNM5NRG1U&ab_channel=STMicroelectronics>

SensorTile.Box : Basic Mode

Z naslova <https://www.youtube.com/watch?v=svbT6e0T5_A&ab_channel=STMicroelectronics>

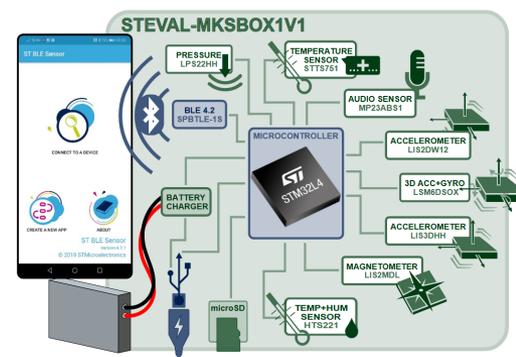
SensorTile.Box : Pro mode

Z naslova <https://www.youtube.com/watch?v=SHY-izcRNY&ab_channel=STMicroelectronics>

SensorTile.box : Expert Mode

Z naslova <https://www.youtube.com/watch?v=A3lj1VXh9SM&ab_channel=STMicroelectronics>

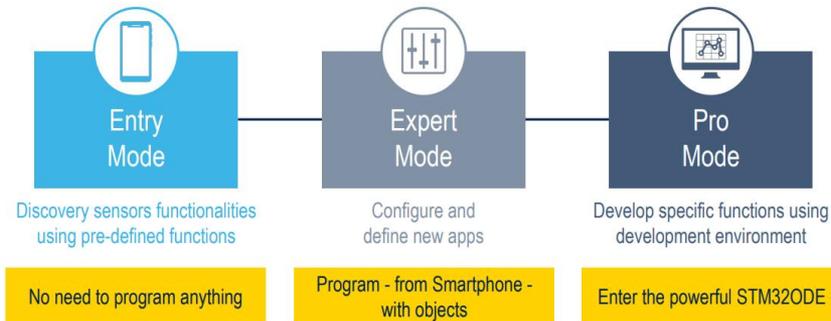
<https://www.st.com/en/evaluation-tools/steval-mksbox1v1.html>



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
- Barometriška 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/steval-mksbox1v1.html>



SENSORTILE.BOX

BERNARD KUCHLER

SPLOŠNO

- Ultra-low-power ARM Cortex-M4 microcontroller (STM32L4R9) 120 MHz
- Baterija
- Bluetooth
- Aplikacija za mobilno izvajanje nad vrednostmi iz tipal
- Programska oprema za grafično programiranje



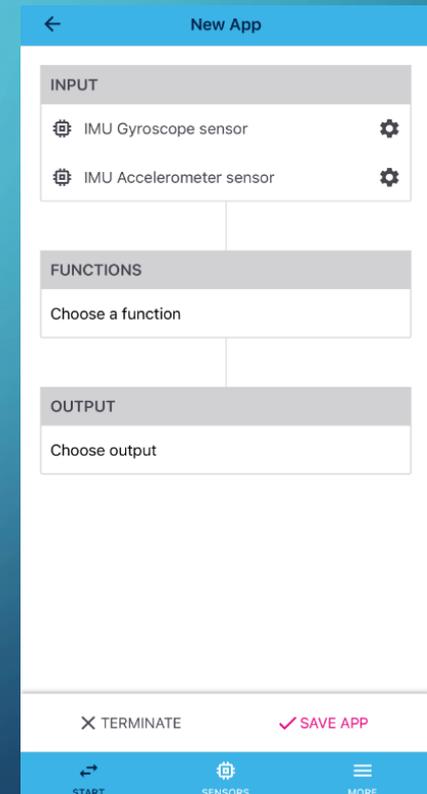
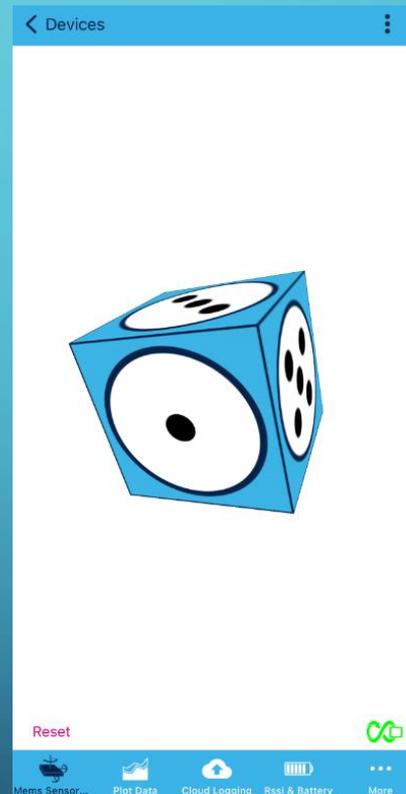
TIPALA

- Digitalni temperaturni senzor (STTS751)
- 6-osni „inertial measurement unit“ (LSM6DSOX)
- 3-osni pospeškomer (LIS2DW12 ali LIS3DHH)
- 3-osni magnetometer (LIS2MDL)
- Altimeter / senzor tlaka (LPS22HH)
- Mikrofon / audio senzor (MP23ABS1)
- Senzor vlage (HTS221)



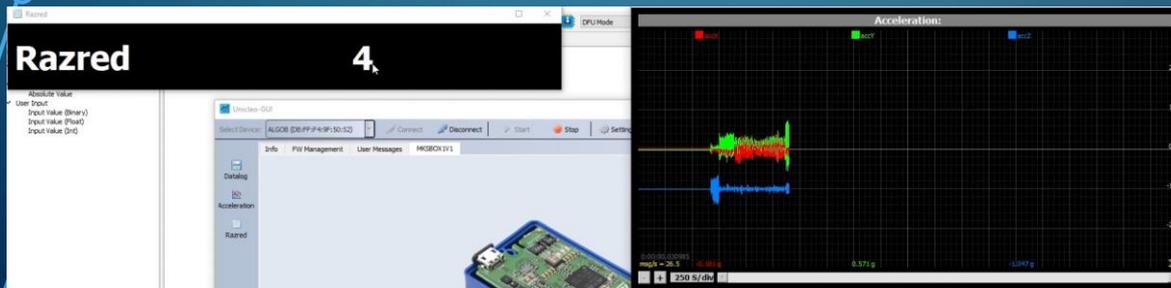
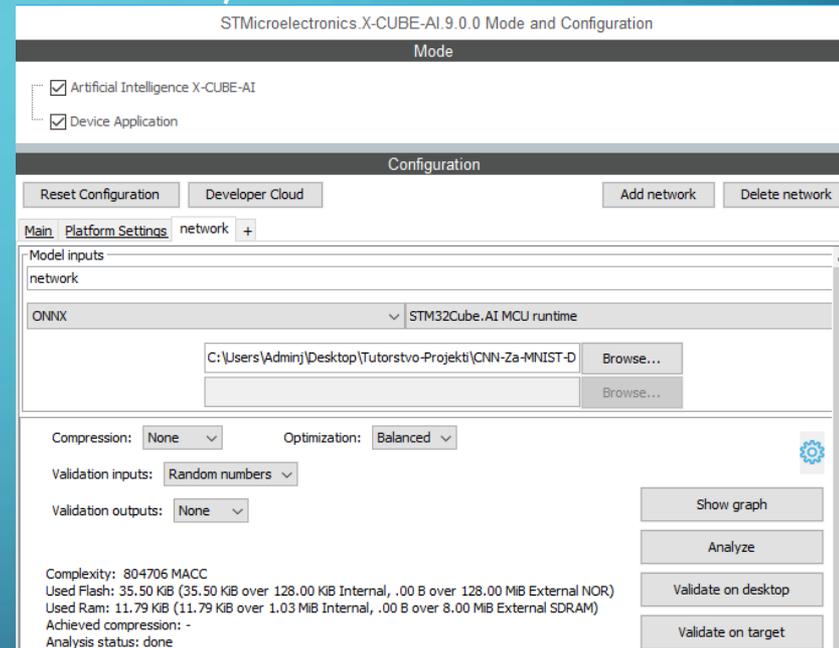
ST BLE SENSOR CLASSIC

- Aplikacije (sensor fusion)
- Expert view (lastne aplikacije)
- Geslo: 123456



STROJNO UČENJE

- AlgoBuilder, Unicleo-GUI, Unico-GUI (Odločitvena drevesa)
- X-CUBE-AI (ONNX, Keras, TFlite)
- Emlearn (C-koda)
- STM32CubeProgrammer (ločene uteži)



STM32H750B-DK PROJEKT

- Flash: 128 KB + 2×512 MB zunanji NOR flash (Quad SPI)
- LCD zaslon na dotik
- STM32H750XBH6 (480 MHz CPE)
- Pytorch in X-CUBE-AI (ONNX)
- 200 KB nevronska mreža

