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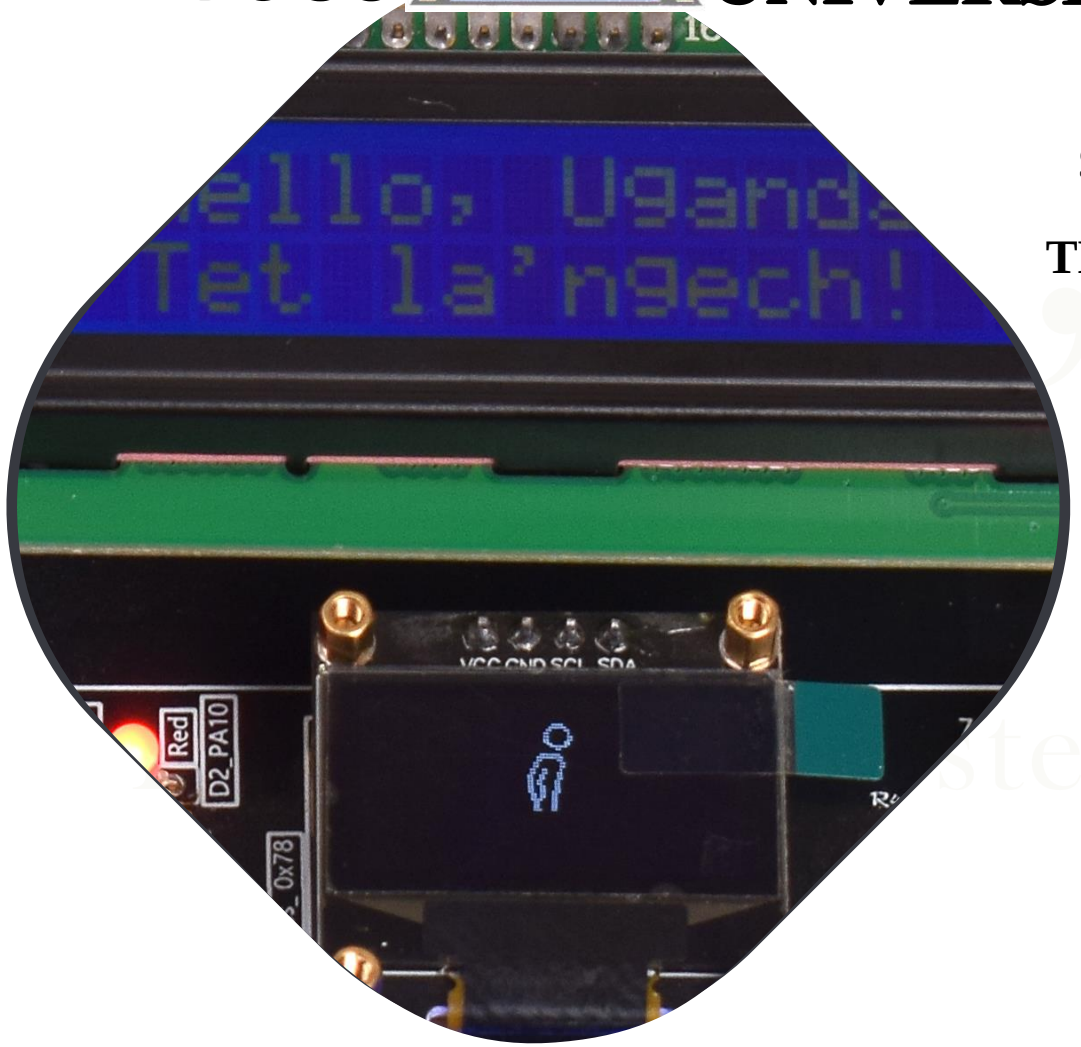

Second session – 27/08/2024

TETE 3102 MICROCONTROLLERS AND APPLICATIONS

Lecturer: Dickson Mugerwa (Ph.D.)

Prac session: Mr. Matovu Paul

Department of Electrical and Electronics Engineering

Embedded Systems

360 Degree Perspective on STM32 Firmware, Software and hands on

"Transforming Lives Through Advanced Embedded Systems Technology"

STM32 Tools and Software

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- Welcome to today's lecture on the installation of STM32 and other related tools.
- Today, we will explore how to set up a **development environment for STM32 microcontrollers**, which are widely used in embedded systems.
- By the end of this session, you will learn how to install the necessary software, including IDEs and toolchains, and configure them to begin your journey in microcontroller programming.
- This hands-on experience will give you the foundation to start creating your own projects using STM32 and similar devices.

Let's dive in and get started!

https://www.st.com/content/st_com/en/ecosystems/stm32cube-ecosystem.html

STM32 Tools and Software

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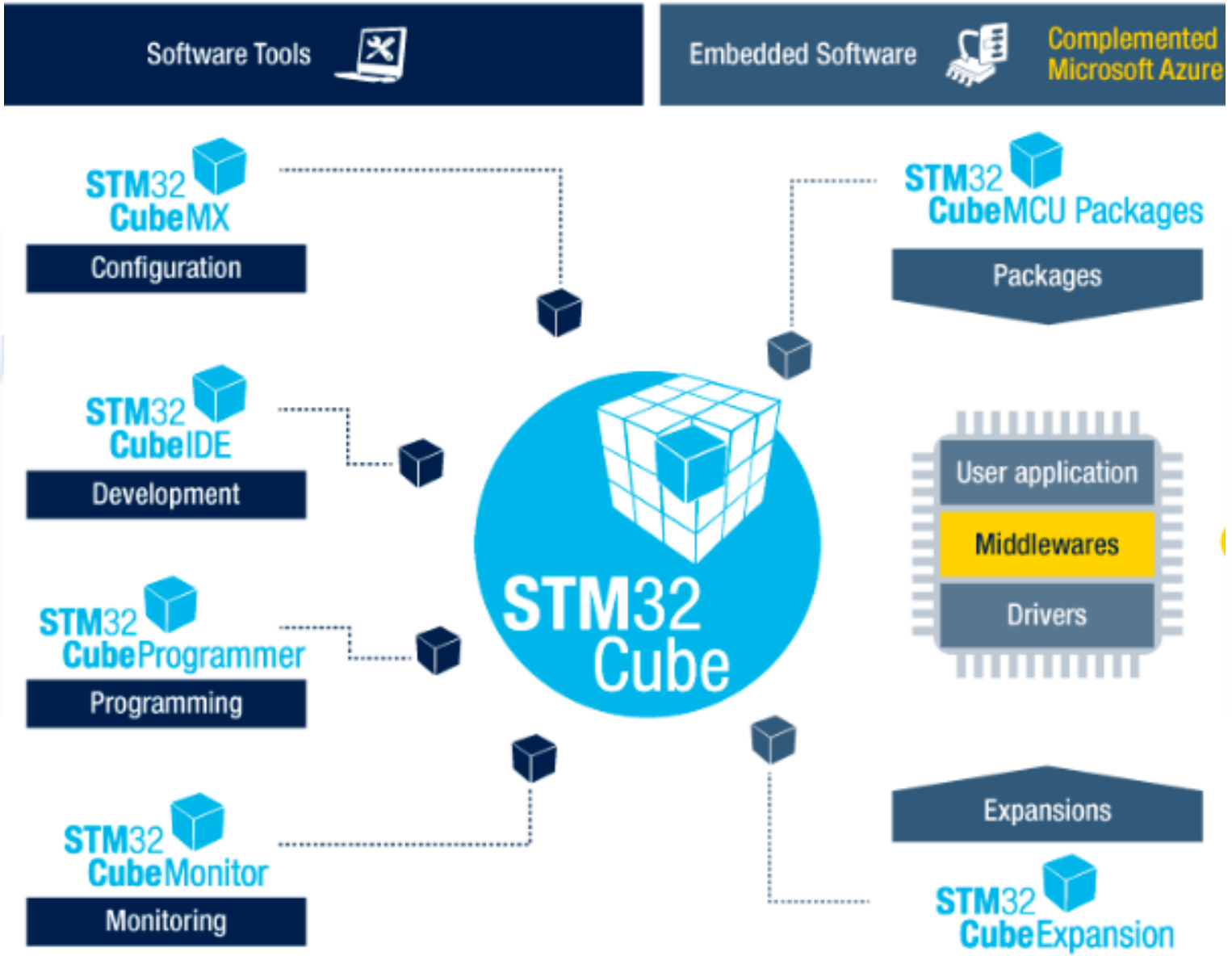

https://www.st.com/content/st_com/en/ecosystems/stm32cube-ecosystem.html

STM32CubeMX & STM32 IDEs

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- Initial project configurations (STM32CubeMX)
- Why choice of STM32CUbeIDE
- Nowadays, everything is embedded in STM32CubeIDE

Libraries for STM32

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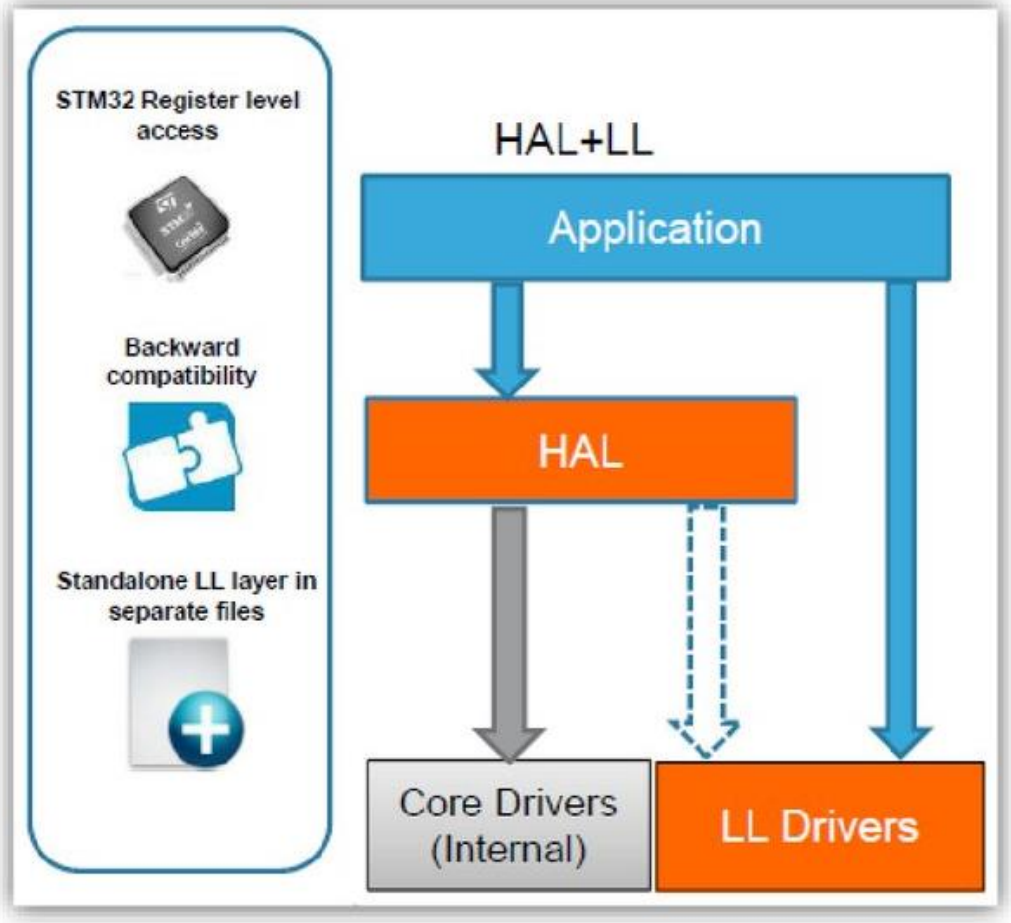
- Libraries normally contain source (.c) and header (.h) files for programming STM32 microcontrollers

Options Available

- Hardware Abstraction Layer (HAL)
- Low Level Layer (LL)
- Board Support Package (BSP)
- Register Based Programming



What can you do with STM32?

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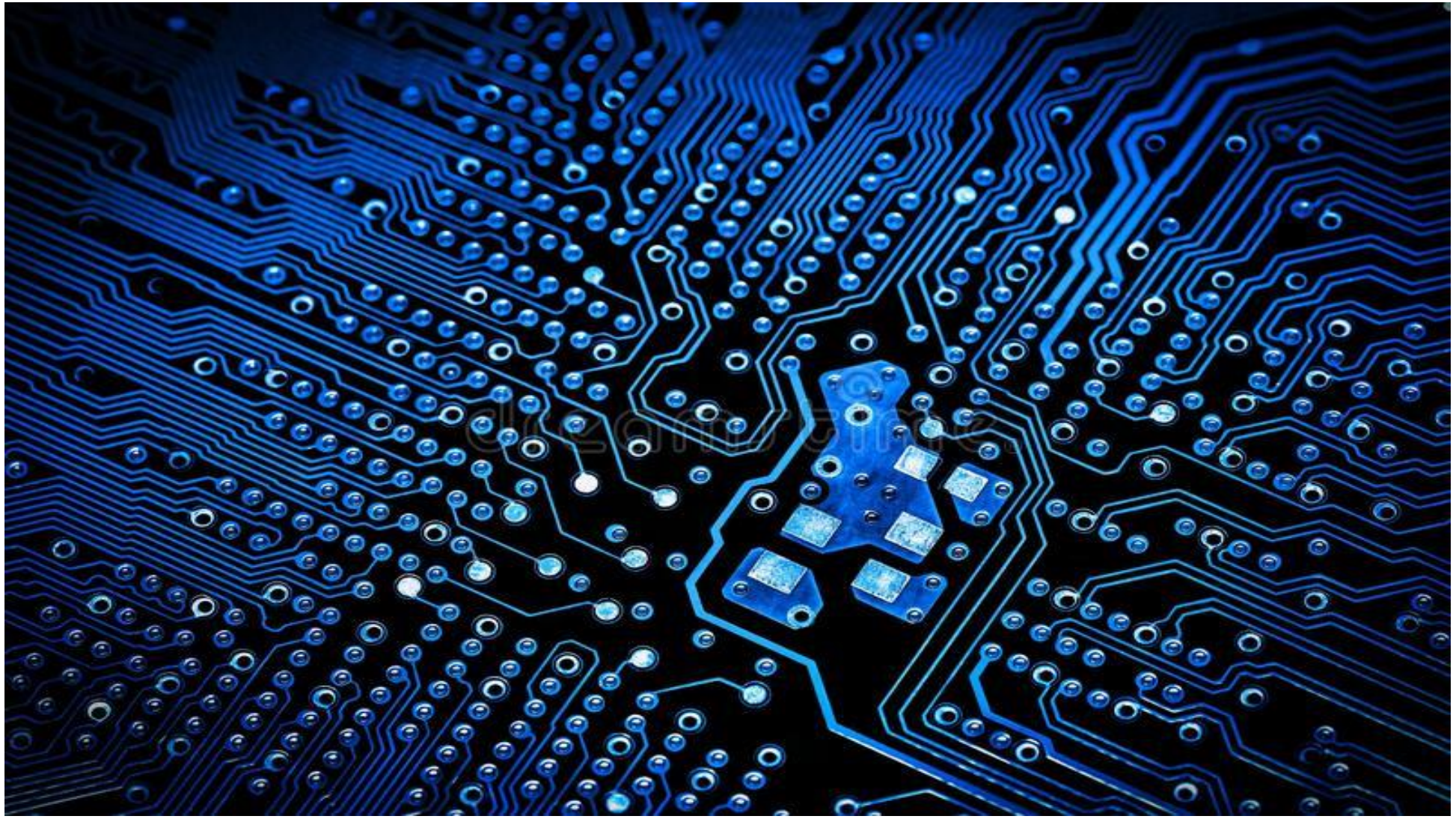

https://www.st.com/content/st_com/en.html

Common Data Types

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Common data types available for stm32 microcontrollers

1. Char
   - ❑ Character eg char somevariable = 'a';
   - ❑ Many characters eg char manychar [5] = "Hello";
2. Signed: int8_t, int16_t, int32_t, int64_t
   - ❑ Both positive and negative integers
   - ❑ int8_t (2^8 = 256, 256/2 = 128).
   - ❑ Eg int8_t used for integers that range between -128 & 128
3. Unsigned; uint8_t, uint16_t, uint32_t, uint64_t
   - ❑ Only positive integers. uint16_t (2^{16} = 65,536).
   - ❑ Eg uint16_t used for integers that range between 0 & 65,535

Installations for STM32

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- Create an account to download software from stm32 website

https://www.st.com/content/st_com/en.html

- Download STM32CubeIDE & STM32CubeProgrammer

https://www.st.com/en/development-tools/stm32cubeide.html

https://www.st.com/en/development-tools/stm32cubeprog.html

- STM32CubeMx: a tool to set and graphically program all STM32 boards and products
- STM32CubeIDE: The free IDE to develop STM32 software
- ST32CubeProgrammer: a tool to load/spy software in STM32 memory

STM32 CubeIDE

STM32 CubeMX

STM32 CubeProgrammer

STM32CubeIDE Perspectives

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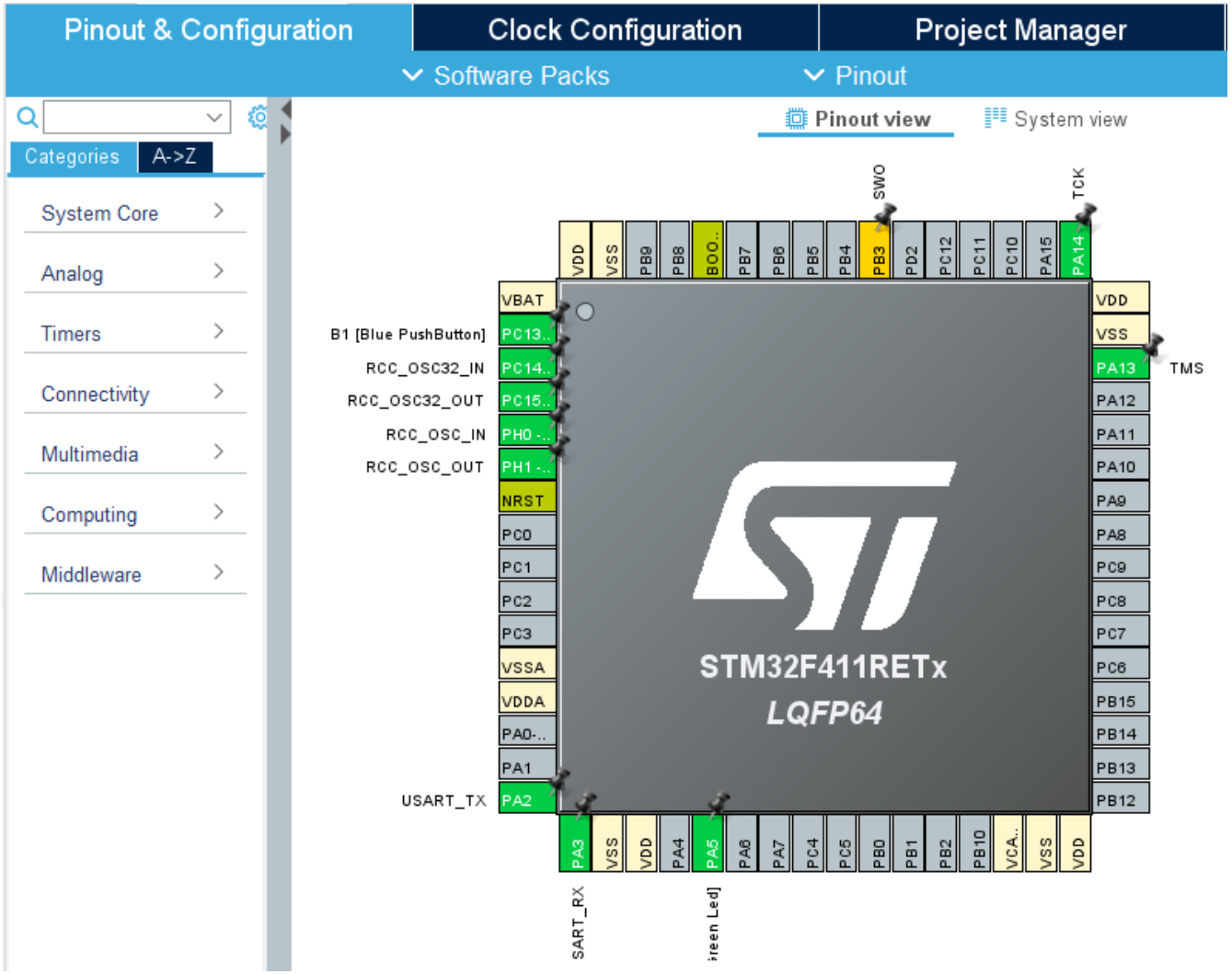
1. **Device Configuration perspective**

- ❑ Select microcontroller
- ❑ Set pinouts configuration
- ❑ Select STM32 Peripherals
- ❑ Configure initial settings
- ❑ Generate Code



STM32CubeIDE Perspectives

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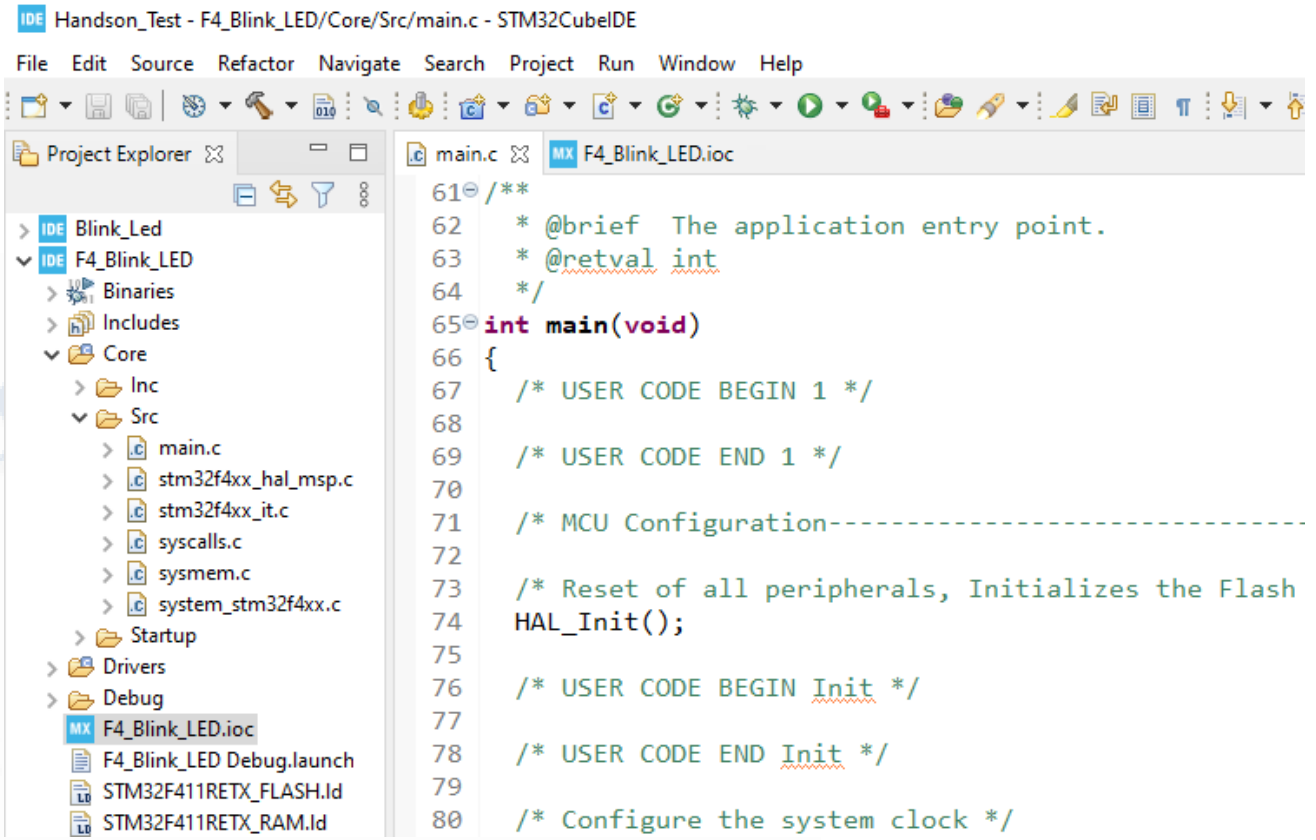
2. Programming perspective

- Program stm32 microcontroller
- Everything Performed during initial configuration is turned into code
- main file (main.c)
- Program flow in main.c
- Header files (.h files)
- Why build/compile (C/C++ faster than other programming languages)



STM32CubeIDE Perspectives

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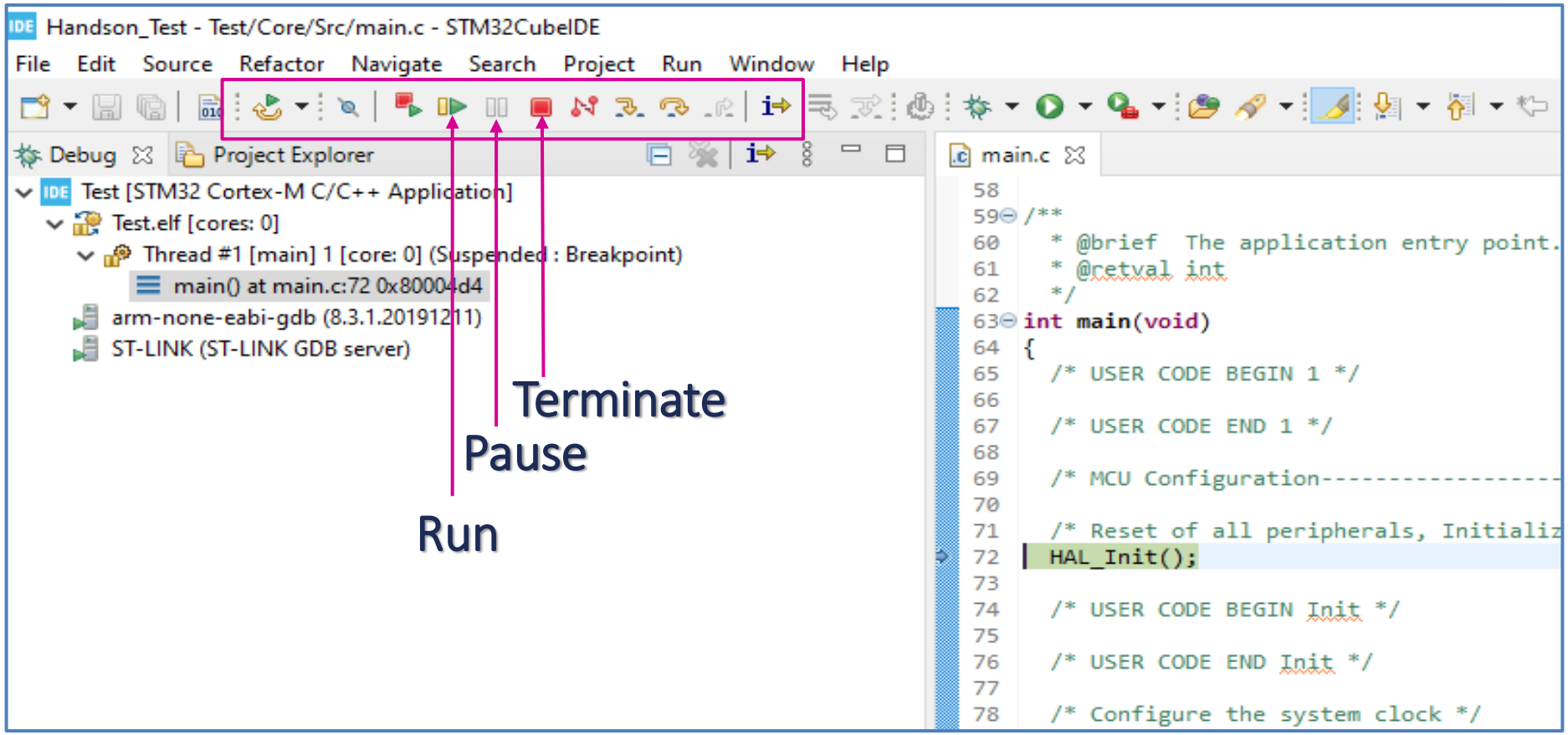
3.Debug Perspective

❑ Run, Pause, terminate program. ➪ Break points to check status of program



Blink On-board LED

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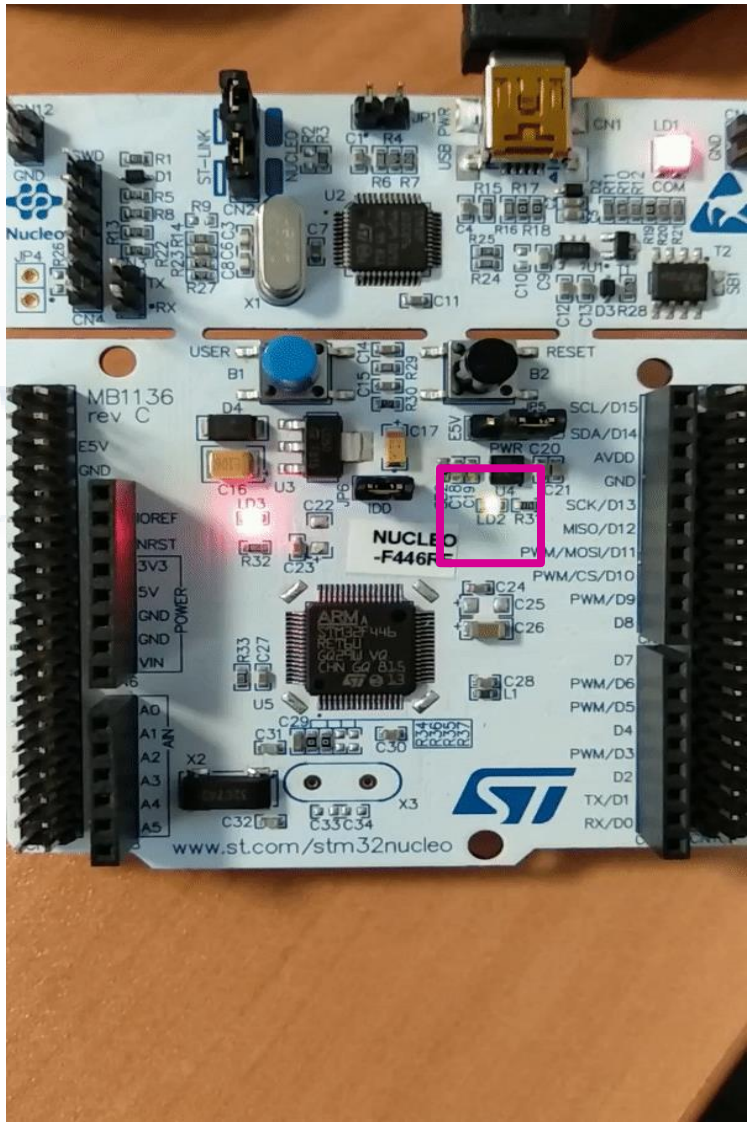
- **Toggle (Blink) – Change the status of a GPIO pin**

HAL_GPIO_TogglePin(GPIO_TypeDef* GPIOx, uint16_t GPIO_Pin)

HAL_GPIO_TogglePin(Port Number, Pin Number)

- Sample application: Blink LED (Turn LED on & off)

Hands-On



Quick Getting Started – Turn LED on & off

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Stm32 Project management

- ❑ Open project
- ❑ Close project
- ❑ Switch workspace
- ❑ Export project
- ❑ Import project
- ❑ Project properties
- ❑ User code
- ❑ Location of firmware & drivers
- ❑ Show project in file system
- ❑ Active project
- ❑ Clean, Build

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Stm32 Project management

- Examples provided by STM32
- How to load STM32 examples
- Post build files (.bin, .hex files) setting
- Reset perspective
- Debugging tools (Breakpoint, step-over, step-into, terminate, suspend, etc)
- Updates (STM32cubeide , firmware packages)
- Live Expressions

STM32CubeProgrammer

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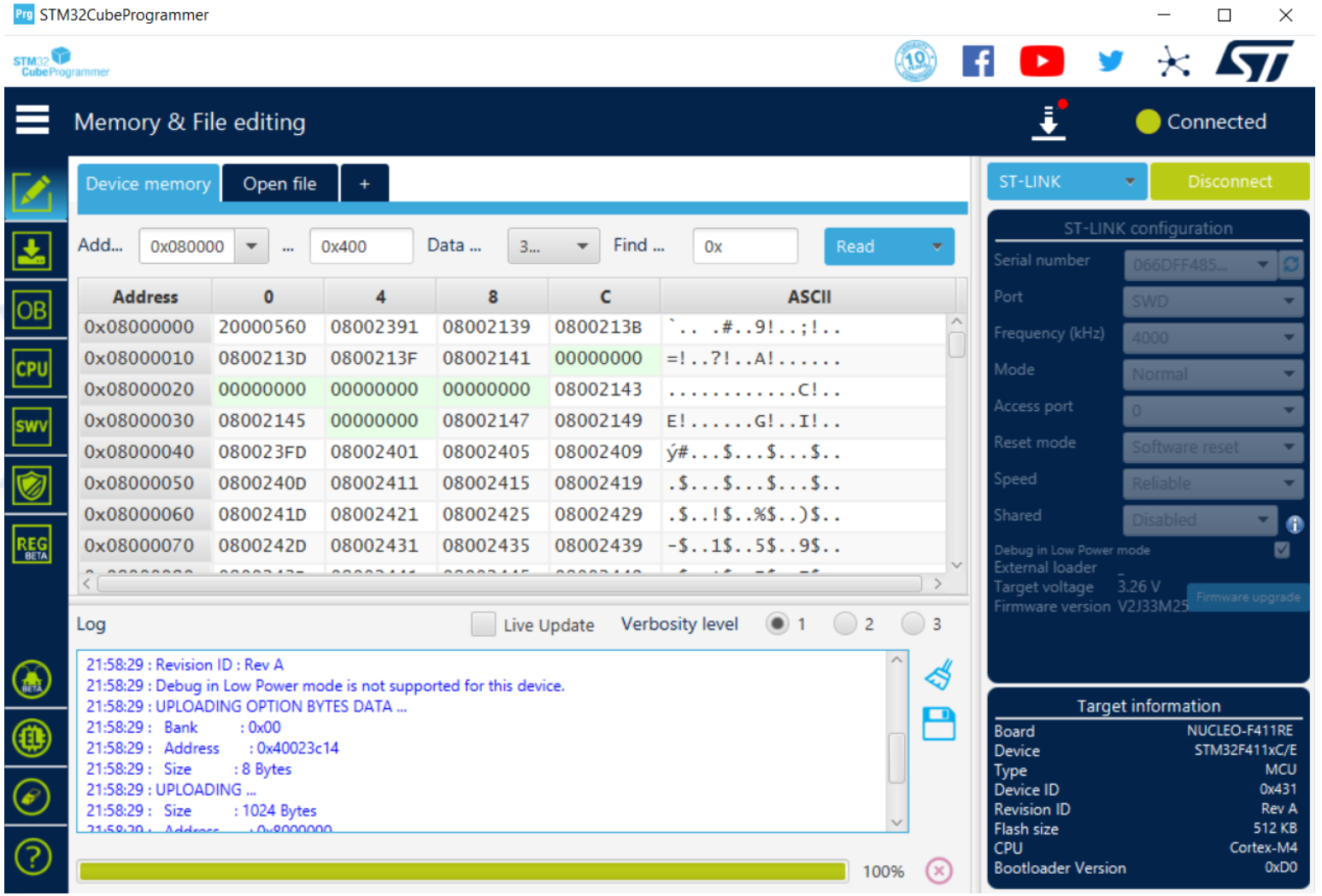
- A tool to load/spy software in STM32 memory
- Software loads code to target STM32 MCU through ST-Link debugger
- Upgrade firmware for ST-Link
- Erase data from STM32 MCU
- Set various code protection levels
- Efficient tool for custom & mass production of PCBs



Hands-On

The Internet has everything:

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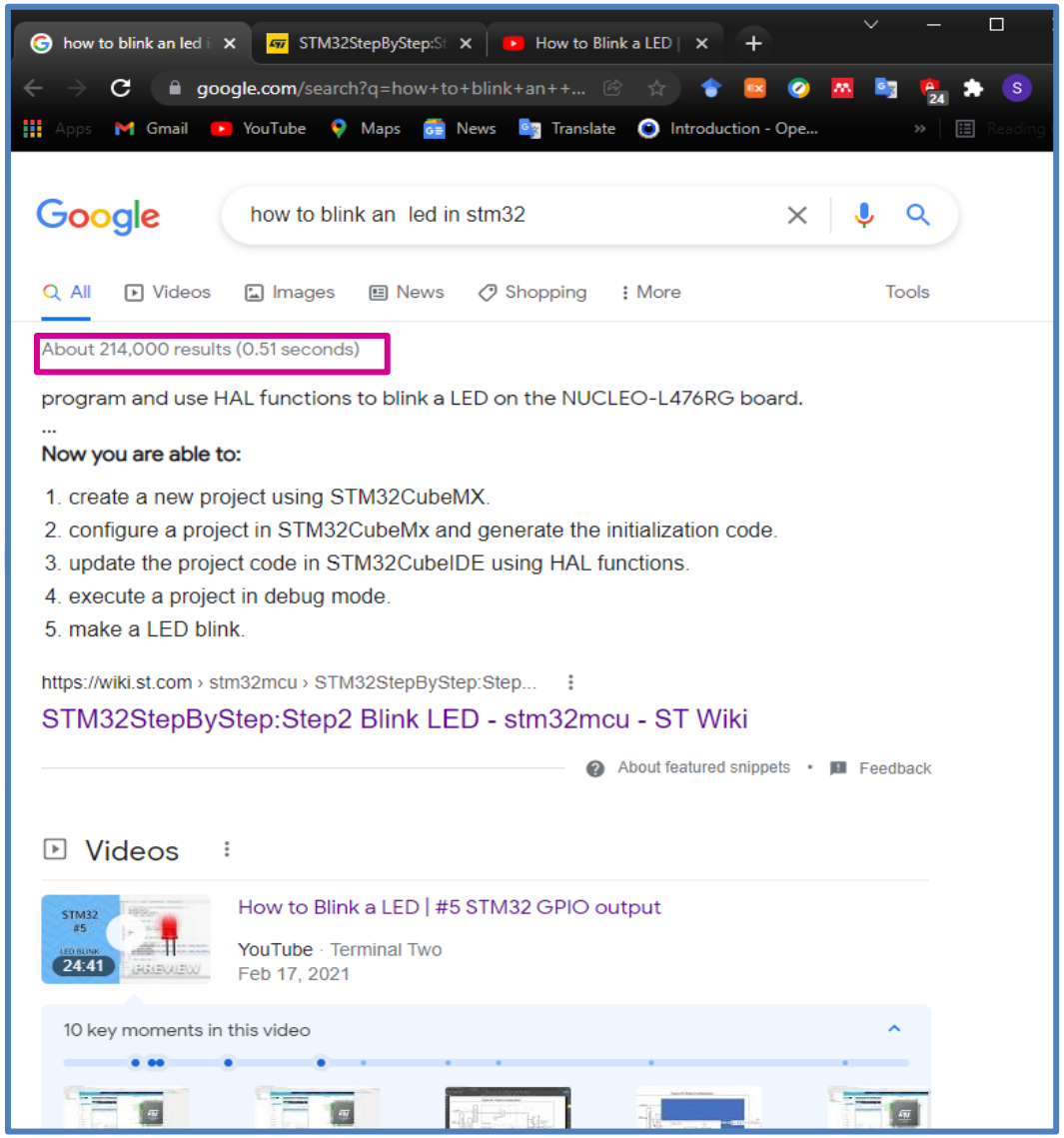
Copilot/Google/Chatgpt/YouTube it

- Give a man a fish, you feed him for a day.

  Teach him to fish, and you feed him for life.

- The internet has everything, you can get most of the code to guide you.



Task: Trainees

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- Blink the LED five times every second

Details:

- Blink the LED five times every second.
- Use a delay of one minute between the blinks.
- Get familiar with sipi

Get In Touch With Us

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