

Introduction to IoT

LAB Exercises

2023

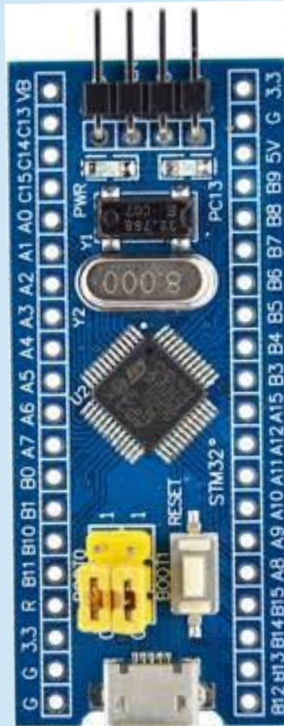
IoT LAB - Outline

- Hardware overview
- IDE
- Environmnet setup

Hardware Overview

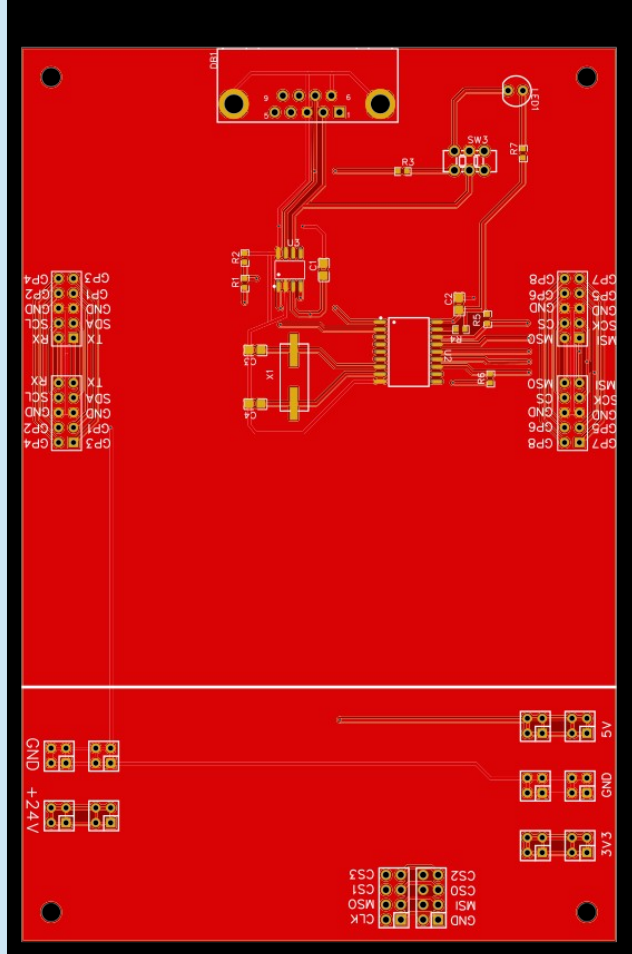
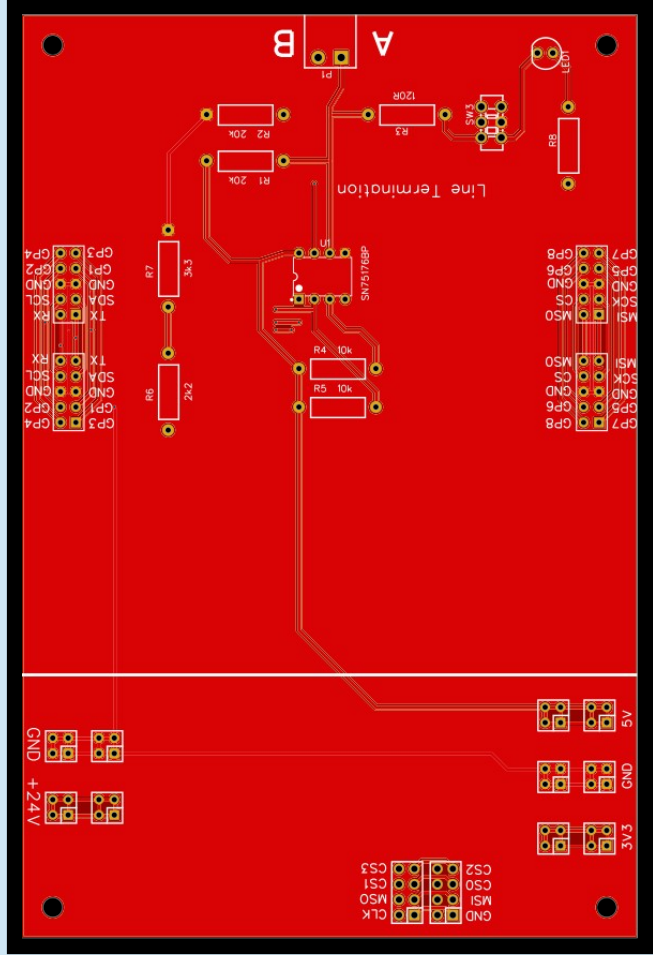
- Building blocks consisting of:
 - Base board (green)
 - Communication board (red)
 - Application board (blue)
- Interconnection – cabling
- Supplemental items – uSD
- Debugging tools – logic analyzer

Hardware - MCUs



Hardware - Communication

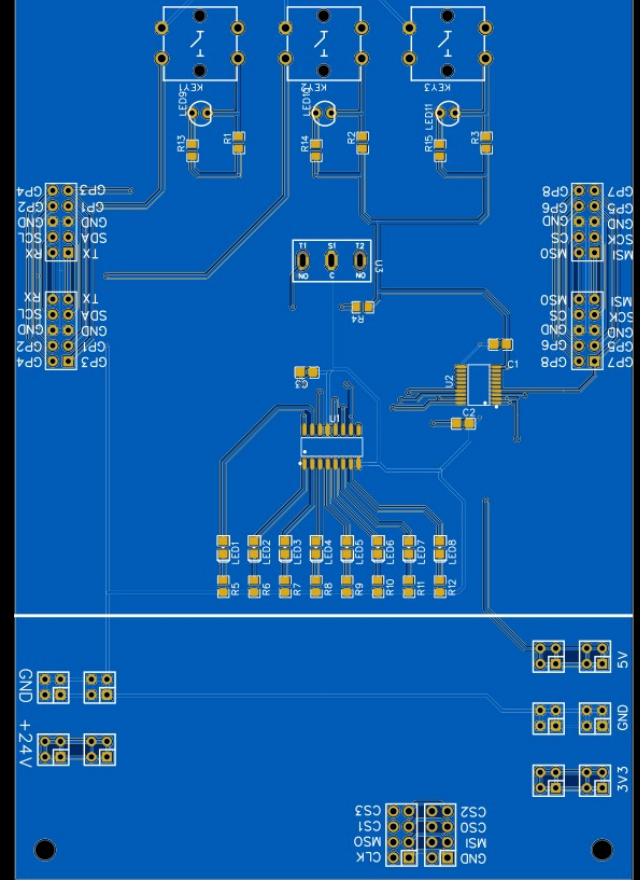
RS - 485



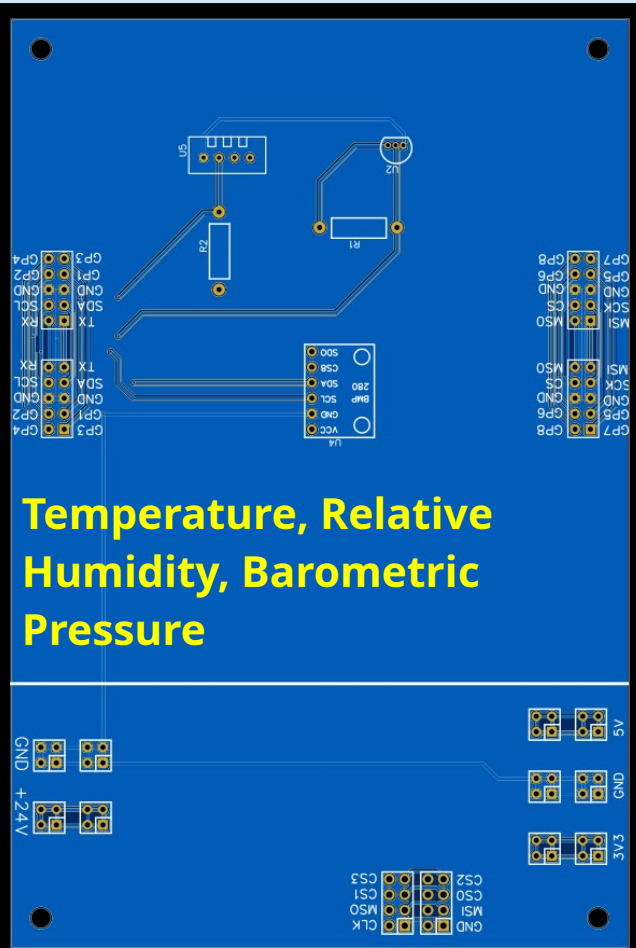
CANBUS

Hardware - Applications

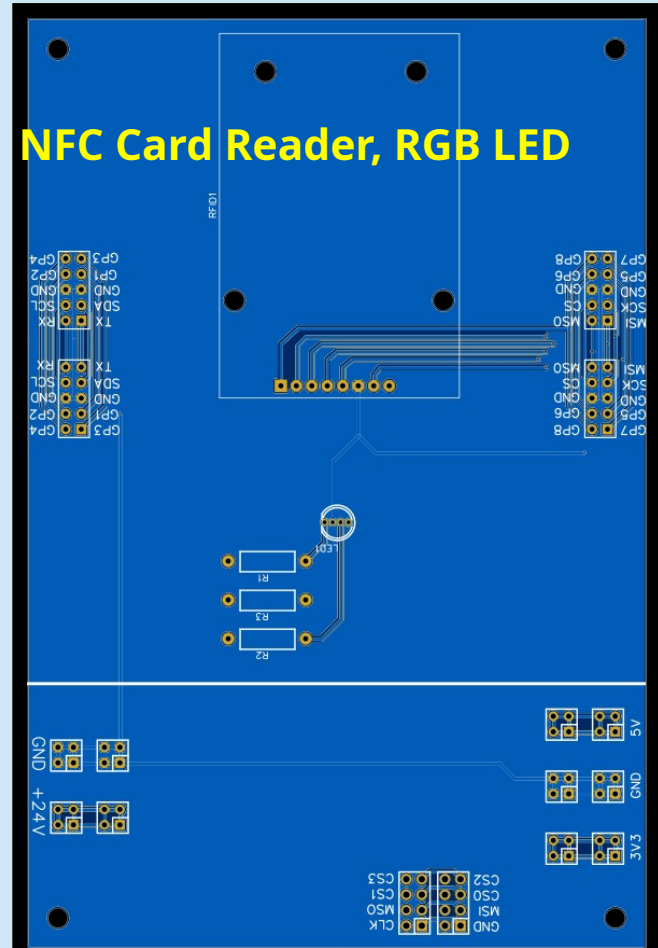
Push Buttons, Switch, LEDs



Temperature, Relative Humidity, Barometric Pressure



NFC Card Reader, RGB LED



IDE

- For bare-metal programming
- Lightweight – Arduino IDE
- Heavy duty – STM Cube

Environment setup

- Use your fi.muni account
 - <https://www.fi.muni.cz/tech/account.html.cs>
- Data should be stored in cloud
- Today configuration and test of the IDE
- Application: just blinking the LED

Arduino IDE



- File → Preferences
- Additional Boards Manager URLs:
 - http://dan.drown.org/stm32duino/package_STM32duino_index.json
- Tools → Board → Boards Manager
 - STM32F1xx/GD32F1xx
- Tools → Board → STM32F1 Boards (Arduino_STM32)
 - Generic STM32F103C series

Arduino IDE

- File → Examples → 0.1 Basic → Blink
- Tools → Upload Method: → STLink
- Sketch → Verify/Compile
- Sketch → Upload

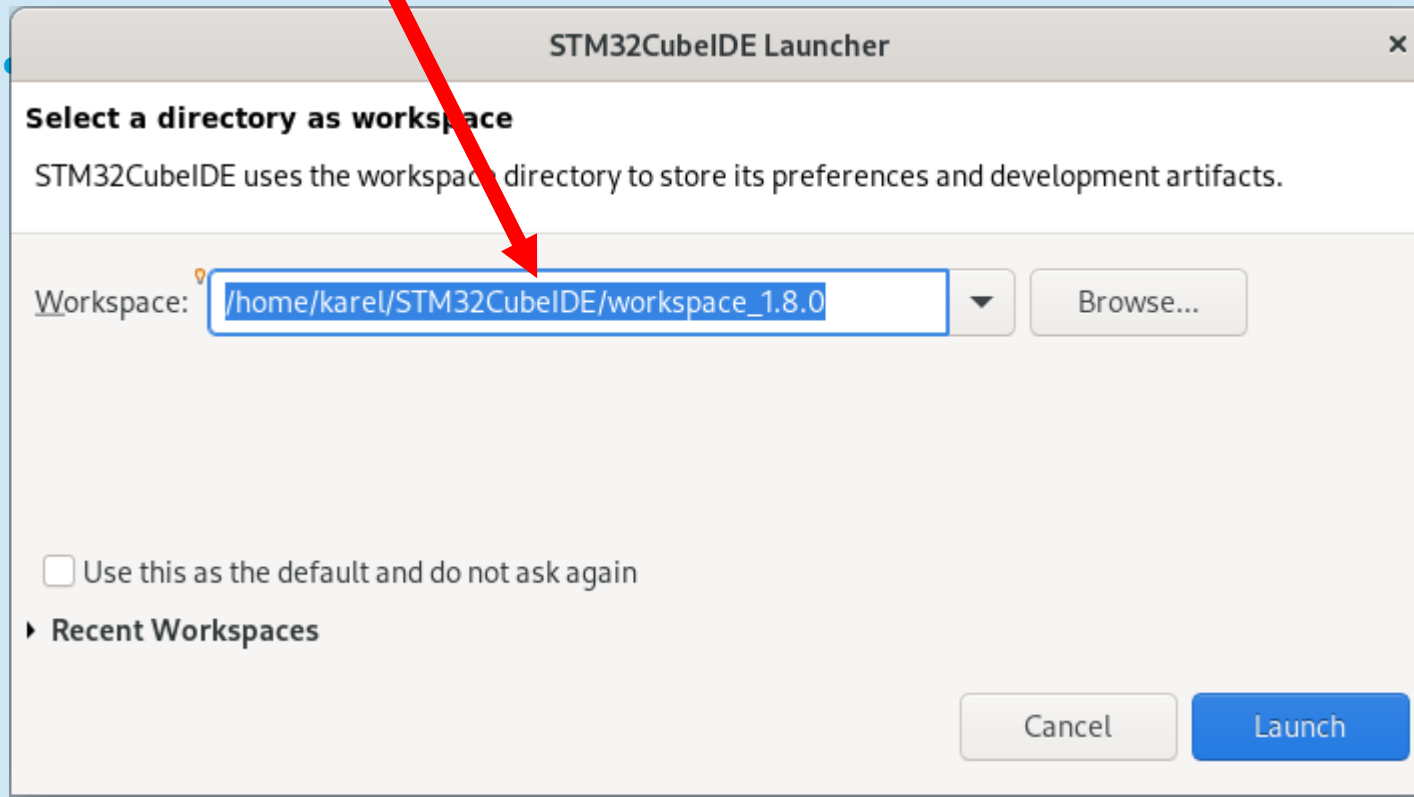
Arduino IDE

```
void loop() {  
    digitalWrite(led, HIGH); // turn the LED on  
    delay(1000);           // wait for a second  
    digitalWrite(led, LOW); // turn the LED off  
    delay(1000);           // wait for a second  
}
```

STM Cube



- **H:_profile\Documents\stm**



STM Cube – getting started

The screenshot shows the STM32CubeIDE Home page. The window title is "LAB - STM32CubeIDE". The menu bar includes "File", "Edit", "Source", "Refactor", "Navigate", "Search", "Project", "Run", "Window", and "Help". The page content is organized as follows:

- Information Center:** "STM32CubeIDE Home"
- Left Sidebar:** A vertical list of buttons for project management:
 - Start new STM32 project:** This button is highlighted with a red rectangle.
 - Start new project from STM32CubeMX file (.ioc)
 - Import project
 - Import STM32Cube example
- Main Content:**
 - Header: "Welcome to STM32CubeIDE"
 - Section: "What's new" featuring a banner for the "STM32U5 ultra-low-power MCU series with comprehensive STM32Cube ecosystem".
 - Section: "Quick links" with three buttons:
 - Access to Videos
 - Read STM32CubeIDE Documentation
 - Getting Started with STM32CubeIDE
- Right Sidebar:**
 - Support & Community:** Includes links for Twitter, Facebook, Youtube, ST Home, ST Community, and ST Longevity Commitment.
 - Standalone STM32 Tools:** Lists tools like STM32CubeMX, STM32CubeMonitor, STM32CubeMon-Pwr, STM32CubeMon-RF, STM32CubeMon-UCPD, and STM32CubeProg.
 - Application Tools:** Lists tools like eDesignSuite, AlgoBuilder, and ST-MC-Suite.

STM Cube – getting started

STM32F103C8T6

Target Selection

⚠ STM32 target or STM32Cube example selection is required

MCU/MPU Selector | Board Selector | Example Selector | Cross Selector

MCU/MPU Filters

★ 📁 🔍 ↻

Part Number

Core

Check/Uncheck All

- Arm Cortex-A7 + Arm Cortex-M4
- Arm Cortex-M0
- Arm Cortex-M0+
- Arm Cortex-M3
- Arm Cortex-M4
- Arm Cortex-M4 + Arm Cortex-M0+
- Arm Cortex-M7
- Arm Cortex-M7 + Arm Cortex-M4
- Arm Cortex-M33

Series

Check/Uncheck All

- STM32F0
- STM32F1
- STM32F2
- STM32F3
- STM32F4
- STM32F7
- STM32G0
- STM32G4
- STM32H7
- STM32L0

Features | Block Diagram | Docs & Resources | Datasheet | Buy

STM32Cube

STM32U5 ultra-low-power MCU series with comprehensive STM32Cube ecosystem

ST

MCUs/MPUs List: 1912 items

Display similar items

Export

*	Part No	Reference	Marketin...	Unit Price...	Board	Package	Flash	RAM	IO	Freq.
☆	STM32F03...	STM32F03...	Active	0.722		LQFP48	32 kBytes	4 kBytes	39	48 MHz
☆	STM32F03...	STM32F03...	Active	0.874		LQFP48	64 kBytes	8 kBytes	39	48 MHz
☆	STM32F03...	STM32F03...	Active	1.331		LQFP48	256 kBytes	32 kBytes	37	48 MHz
☆	STM32F03...	STM32F03...	Active	0.513		TSSOP20	16 kBytes	4 kBytes	15	48 MHz
☆	STM32F03...	STM32F03...	Active	0.627		LQFP32	32 kBytes	4 kBytes	25	48 MHz
☆	STM32F03...	STM32F03...	Active	0.912	NUCL...STM3...	LQFP64	64 kBytes	8 kBytes	55	48 MHz
☆	STM32F03...	STM32F03...	Active	1.464		LQFP64	256 kBytes	32 kBytes	51	48 MHz
☆	STM32F03...	STM32F03...	Active	1.174		LQFP48	16 kBytes	4 kBytes	39	48 MHz
☆	STM32F03...	STM32F03...	Active	1.226		LQFP48	32 kBytes	4 kBytes	39	48 MHz
☆	STM32F03...	STM32F03...	Active	0.939		WLCSP25	32 kBytes	4 kBytes	20	48 MHz
☆	STM32F03...	STM32F03...	Active	0.861		TSSOP20	16 kBytes	4 kBytes	15	48 MHz
☆	STM32F03...	STM32F03...	Active	0.913		TSSOP20	32 kBytes	4 kBytes	15	48 MHz
☆	STM32F03...	STM32F03...	Active	0.887		UFQFPN28	16 kBytes	4 kBytes	23	48 MHz

< Back | Next > | Cancel | Finish

STM Cube – getting started

STM32 Project ×

× Empty project name is not supported **IDE**

Project

Project Name:

Use default location

Location:

Options

Targeted Language

C C++

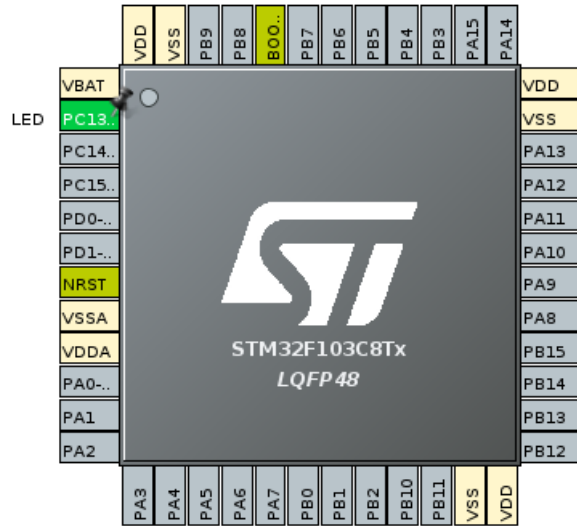
Targeted Binary Type

Executable Static Library

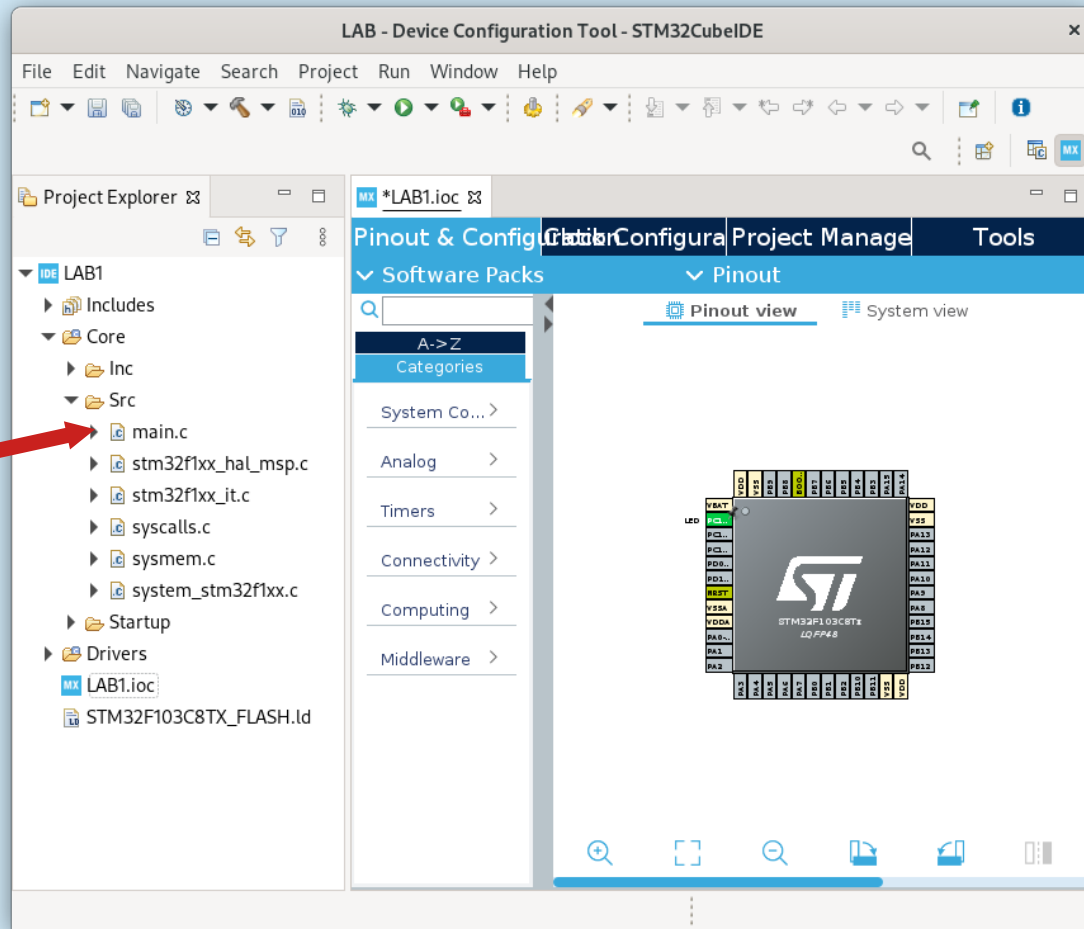
Targeted Project Type

STM32Cube Empty

STM Cube – getting started



STM Cube – getting started



STM Cube – C programming

- Main.c

```
while (1)
```

```
{
```

```
    // LED OFF
```

```
    HAL_GPIO_WritePin(GPIOC, GPIO_PIN_13, GPIO_PIN_SET);
```

```
    HAL_Delay(100);
```

```
    // LED ON
```

```
    HAL_GPIO_WritePin(GPIOC, GPIO_PIN_13, GPIO_PIN_RESET);
```

```
    HAL_Delay(100);
```

```
}
```

**Please consider both Arduino IDE and STM
Cube**