Embedded System and Microcomputer Principle

LAB1 STM32 Software and Hardware

2021 Fall
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Basic Information

1. Basic Information

💬 Contact

- Sakai: CS301-2021Fall
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- Office Hour: Thursday, 09:00~11:30;
  Room 110, South Tower, College of Engineering

群名称: CS301-2021Fall
群 号: 295640611

✒ Lab Grading Criteria

- 50% class practice + 20% lab assignment + 30% project
- Class practice: 1 or 2 practices in class (*1.0 if completed in class; *0.7 if completed in 1 week; *0.2 if completed over 2 weeks)
- Lab assignment: 3 or 4 assignments this semester on Sakai site
- Project: a complete system run on MiniSTM32 board

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Experimental Objective

2. Experimental Objective

- Install STM32CubeIDE

- Get MiniSTM32 board

- Run first lab demo on MiniSTM32 board

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Hardware: MiniSTM32

- What does it look like?
- How to connect to PC?

3. Hardware : MiniSTM32
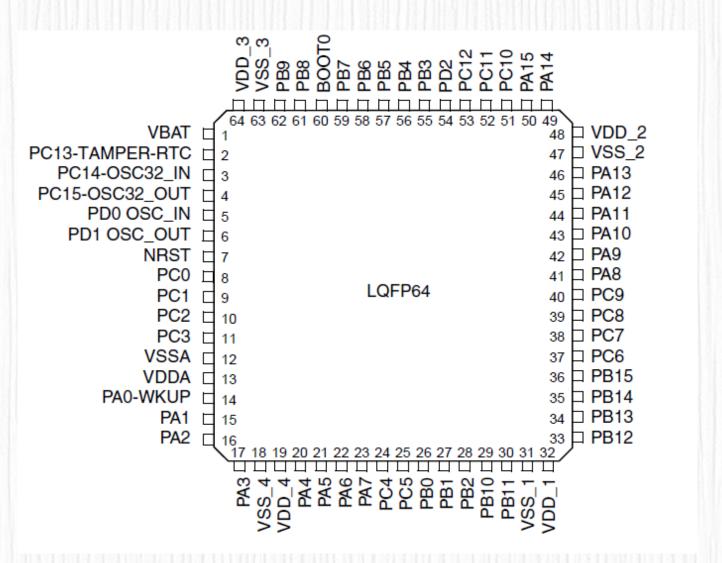
- CMU: **STM32F103RCT6**

- Stm32F1 belongs to **Cortex-M3** core in Cortex-M series and adopts ARMv7-M architecture; the traditional ARM7 series adopts ARMv4T architecture.

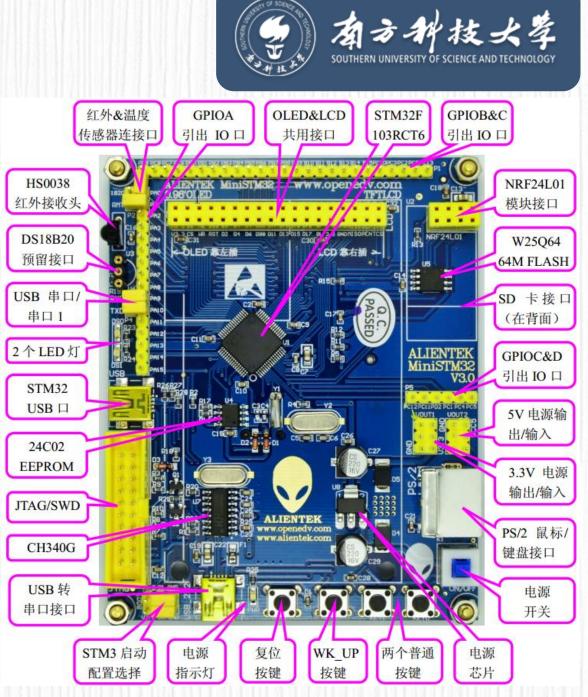- High performance, low voltage, low power consumption, innovative core and peripherals

3. Hardware : MiniSTM32

STM32F103RCT6

3. Hardware : MiniSTM32

示例: STM32 F 103 C 8 T 6

产品系列 — product series
STM32 = 基于ARM®的32位微控制器

产品类型 — product type
F = 通用类型

产品子系列 — product sub-series
101 = 基本型
102 = USB基本型，USB 2.0全速设备
103 = 增强型 — 103 = advanced
105或107 = 互联型

引脚数目 — pin count
T = 36脚
C = 48脚
R = 64脚
V = 100脚
Z = 144脚

STM32F103RCT6

闪存存储器容量 — Flash memory capacity
4 = 16K字节的闪存存储器
6 = 32K字节的闪存存储器
8 = 64K字节的闪存存储器
B = 128K字节的闪存存储器
C = 256K字节的闪存存储器 — C = 256K bytes
D = 384K字节的闪存存储器
E = 512K字节的闪存存储器

封装 — package type
H = BGA
T = LQFP
U = VFQFPN
Y = WLCSP64

温度范围 — temperature range
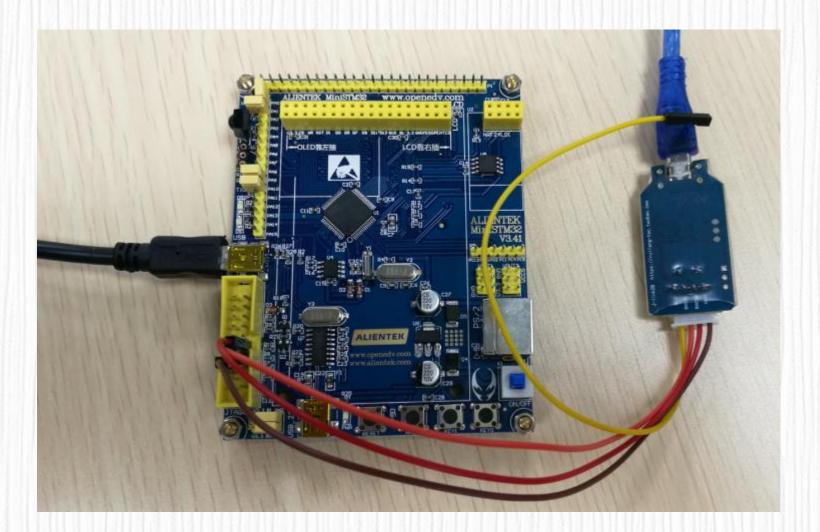6 = 工业级温度范围，-40°C~85°C
7 = 工业级温度范围，-40°C~105°C

Pin Count	Part Number	CPU Max. Clock (MHz)	Program Memory (bytes)	RAM (bytes)	FSMC	Timer 16-bit General Purpose (IC/OC/PWM)	16-bit Advance Control (IC/OC/PWM)	16-bit Basic	SPI	I2C	USART* +UART	USB FS	CAN 2.0B	Ether-net	CEC	I2C	SDIO	12-bit ADC (CH.)	12-bit DAC (CH.)	I/O Ports	Package
36	STM32F103T4	72	16K	6K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(10)		26	VFQFPN36(6x6)
	STM32F103T6	72	32K	10K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(10)		26	
	STM32F103T8	72	64K	20K		3(12/12/12)	1(4/4/6)		1	1	2	1	1					2/(10)		26	
	STM32F103TB	72	128K	20K		3(12/12/12)	1(4/4/6)		1	1	2	1	1					2/(10)		26	
48	STM32F103C4	72	16K	6K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(10)		37	LQFP48(7x7)/ VFQFPN48(7x7)
	STM32F103C6	72	32K	10K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(10)		37	
	STM32F103C8	72	64K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(10)		37	
	STM32F103CB	72	128K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(10)		37	
64	STM32F103R4	72	16K	6K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(16)		51	LQFP64(10x10) TFBGA64(5x5)
	STM32F103R6	72	32K	10K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(16)		51	
	STM32F103R8	72	64K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		51	
	STM32F103RB	72	128K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		51	
	STM32F103RC	72	256K	48K		4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	51	LQFP64(10x10) WLCSP64(4.5x4.4)
	STM32F103RD	72	384K	64K		4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	51	
	STM32F103RE	72	512K	64K		4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	51	
	STM32F103RF	72	768K	96K		10(24/24/24)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	51	LQFP64(10x10)
	STM32F103RG	72	1024K	96K		10(24/24/24)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	51	
100	STM32F103V8	72	64K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		80	LQFP100(14x14) LFBGA100(10x10)
	STM32F103VB	72	128K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		80	
	STM32F103VC	72	256K	48K	•	4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	80	
	STM32F103VD	72	384K	64K	•	4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	80	
	STM32F103VE	72	512K	64K	•	4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	80	
	STM32F103VF	72	768K	96K	•	10(24/24/24)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	80	LQFP100(14x14)
	STM32F103VG	72	1024K	96K	•	10(24/24/24)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(16)	2	80	
144	STM32F103ZC	72	256K	48K	•	4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(21)	2	112	LQFP144(20x20) BGA144(10x10)
	STM32F103ZD	72	384K	64K	•	4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(21)	2	112	
	STM32F103ZE	72	512K	64K	•	4(16/16/16)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(21)	2	112	
	STM32F103ZF	72	768K	96K	•	10(24/24/24)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(21)	2	112	
	STM32F103ZG	72	1024K	96K	•	10(24/24/24)	2(8/8/12)		2	3	2	3+2	1	1		2	1	3/(21)	2	112	

3. Hardware : MiniSTM32

- STM32F103RCT6
- 64 Pins, 51 I/O ports
- Support both SWD and JTAG debugging
- 256K Flash，48K SRAM
- 11 Timers
- 13 communication interfaces
- Learn more about MiniSTM32 board:
  - http://www.openedv.com/thread-308948-1-1.html
  - http://www.stmcu.org

3. Hardware : MiniSTM32

- Connect to PC

04

Software: STM32CubeIDE

- What is it?
- How to own it?
- How to use it?

4. Software : STM32CubeIDE
-- What is it?

- Integration of services from STM32CubeMX:
  - STM32 microcontroller, microprocessor, development platform and example
  - project selection
  - Pinout, clock, peripheral, and middleware configuration
  - Project creation and generation of the initialization code
  - Software and middleware completed with enhanced STM32Cube Expansion Packages

4. Software : STM32CubeIDE
-- What is it? (continued)

- Based on Eclipse ® /CDT, with support of Eclipse ® add-ons, GNU C/C++ for Arm ® toolchain and GDB debugger
- Additional advanced debug features including:
  - CPU core, peripheral register, and memory views
  - Live variable watch view
  - System analysis and real-time tracing (SWV)
  - CPU fault analysis tool
- Support of ST-LINK (STMicroelectronics) and J-Link (SEGGER) debug probes

4. Software : STM32CubeIDE
-- What is it? (continued)

- Import project from Atollic ® TrueSTUDIO ® and AC6 System Workbench for STM32(SW4STM32)
- Multi-OS support: Windows ® , Linux ® , and macOS ® , 64-bit versions only
- **KEYWORDS:**
  - STM32 MCU and MPU
  - C/C++ development platform
  - Support of ST-Link and J-Link debug probes

4. Software : STM32CubeIDE
-- How to own it?

- Download URL:
  - https://www.st.com/zh/development-tools/stm32cubeide.html

获取软件

	产品型号 ▲	一般描述	Latest version	下载	All versions
+	STM32CubeIDE-DEB	STM32CubeIDE Debian Linux Installer	1.7.0	Get latest	选择版本
+	STM32CubeIDE-Lnx	STM32CubeIDE Generic Linux Installer	1.7.0	Get latest	选择版本
+	STM32CubeIDE-Mac	STM32CubeIDE macOS Installer	1.7.0	Get latest	选择版本
+	STM32CubeIDE-RPM	STM32CubeIDE RPM Linux Installer	1.7.0	Get latest	选择版本
+	STM32CubeIDE-Win	STM32CubeIDE Windows Installer	1.7.0	Get latest	选择版本

4. Software : STM32CubeIDE
-- How to own it? (continued)

- NOTES
  - Both the name and the location of setup package should be all in **ASCII characters** (no Chinese characters)
  - workspace and project names must contain only **ASCII characters**. This is also valid for the path to the workspace.
  - The support package corresponding to the CMU chip needs to be loaded in STM32CubeIDE (this will be done by itself after the initial configuration, so don't worry about it.)

4. Software : STM32CubeIDE
-- How to use it?
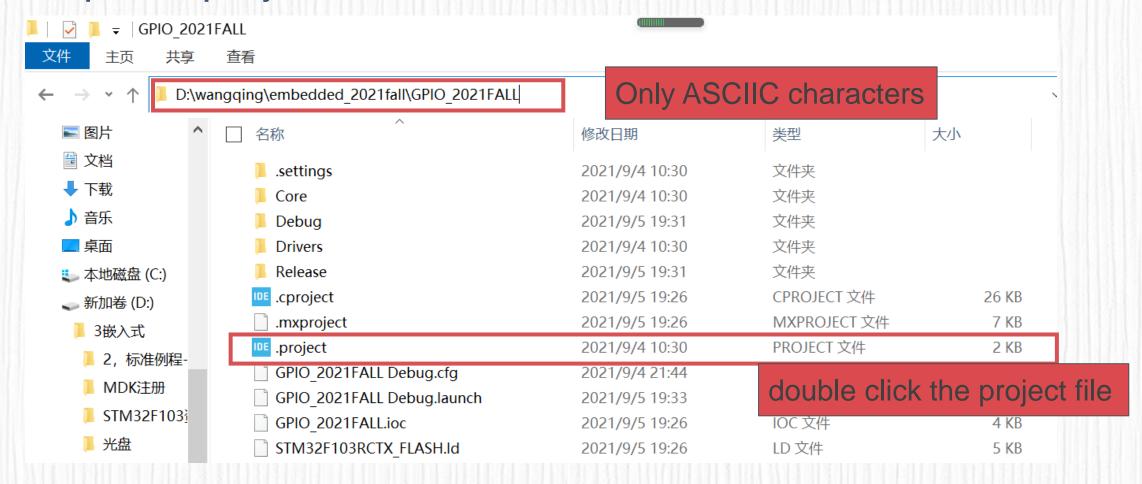
- Create a new project
- Enter your code
- Debug your project
- Run on MiniSTM32 board
- All these steps will be on next lab, on this lab, we just need to **open a project**, and the demo project is on Sakai site

4. Software : STM32CubeIDE
-- How to use it? (continued)

- Open a project

Only ASCIIC characters

double click the project file

- Build the project
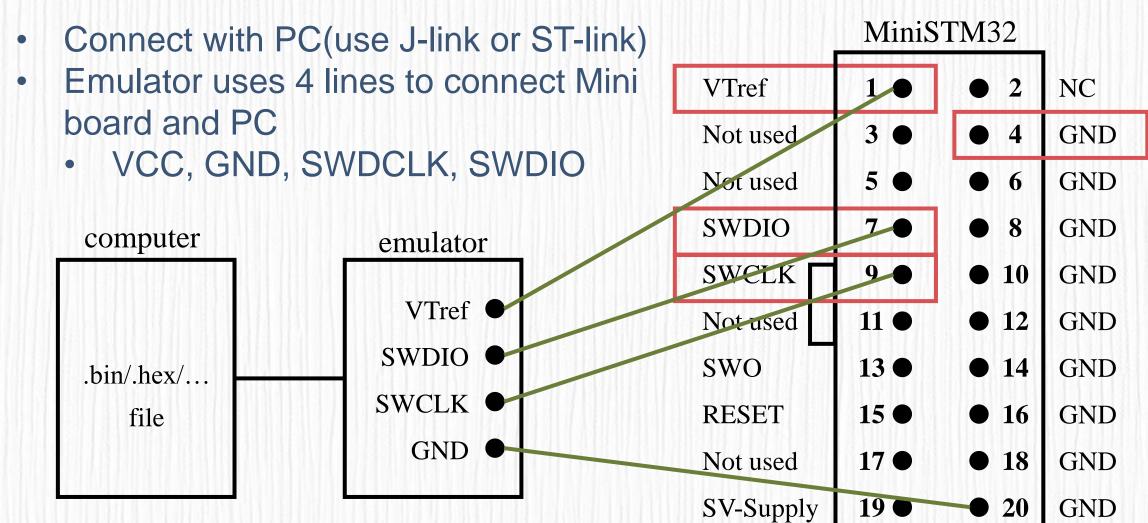
Use the two buttons to build the project (any one is OK)

Click the arrow to choose debug or release version

4. Software : STM32CubeIDE
-- How to use it? (continued)

- Connect with PC(use J-link or ST-link)
- Emulator uses 4 lines to connect Mini board and PC
  - VCC, GND, SWDCLK, SWDIO

MiniSTM32

VTref	**1**	●	●	**2**	NC
Not used	**3**	●	●	**4**	GND
Not used	**5**	●	●	**6**	GND
SWDIO	**7**	●	●	**8**	GND
SWCLK	**9**	●	●	**10**	GND
Not used	**11**	●	●	**12**	GND
SWO	**13**	●	●	**14**	GND
RESET	**15**	●	●	**16**	GND
Not used	**17**	●	●	**18**	GND
SV-Supply	**19**	●	●	**20**	GND

computer

.bin/.hex/…
file

emulator

VTref ●
SWDIO ●
SWCLK ●
GND ●

4. Software : STM32CubeIDE
-- How to use it? (continued)
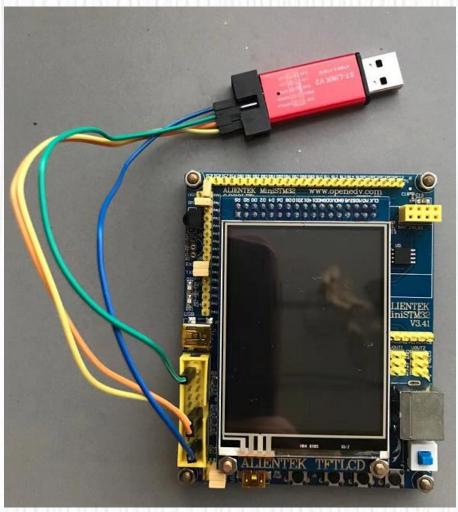
- Connect with PC (use J-link)

4. Software : STM32CubeIDE
-- How to use it? (continued)
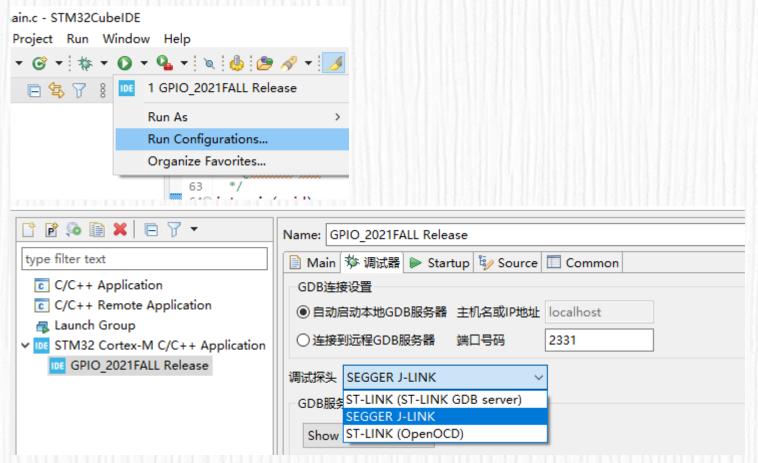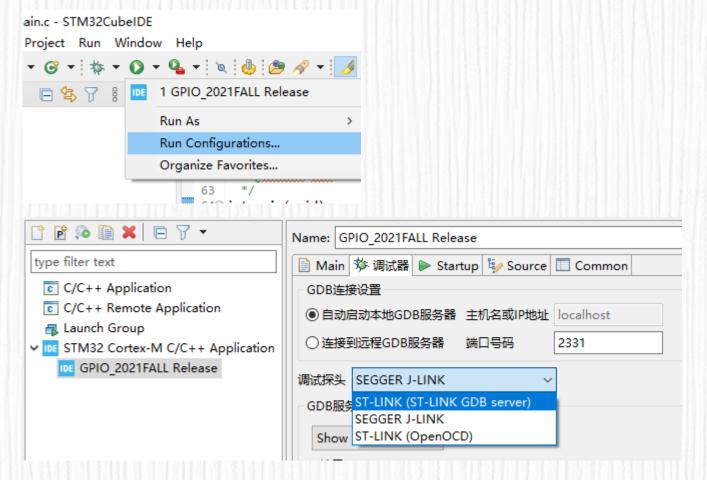
- Connect with PC (use ST-link)
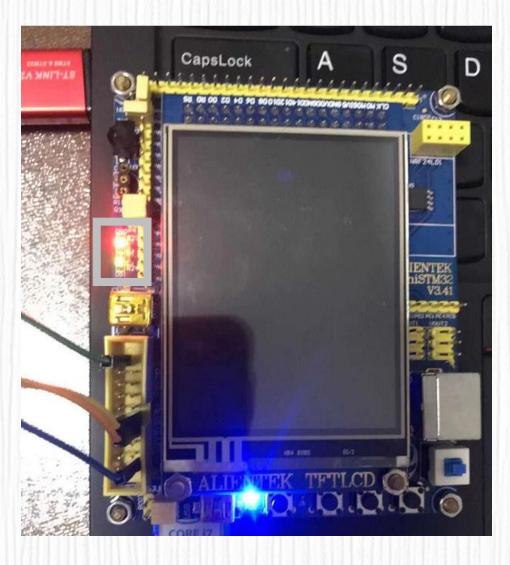
5. Run My First Project

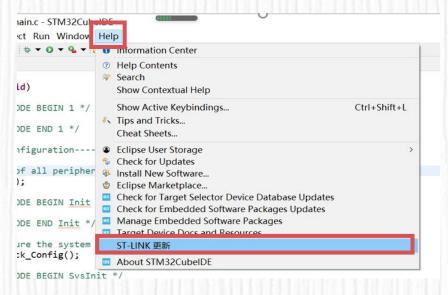- Run the project
  - Click the run button

- Click the arrow to configure
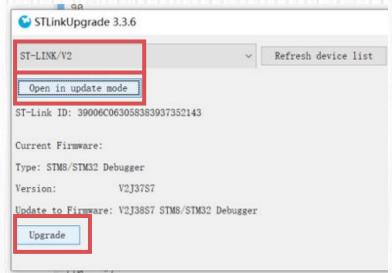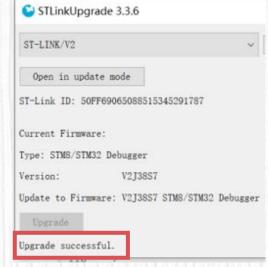- Runs on MiniSTM32 board

5. Run My First Project

- ### What to do if ST-link doesn't work?
  - 1. Unplug ST-link
  - 2. Plug in ST-link again
  - 3. Click ST-LINK update instead of other items
  - 4. Click *open in update mode* -> *update*, wait until success

Do some surveys about the background

- Company
- CMU chip types
- Development environment
- ......