



1. Description

1.1. Project

Project Name	RCT_STM32
Board Name	custom
Generated with:	STM32CubeMX 6.14.1
Date	05/06/2025

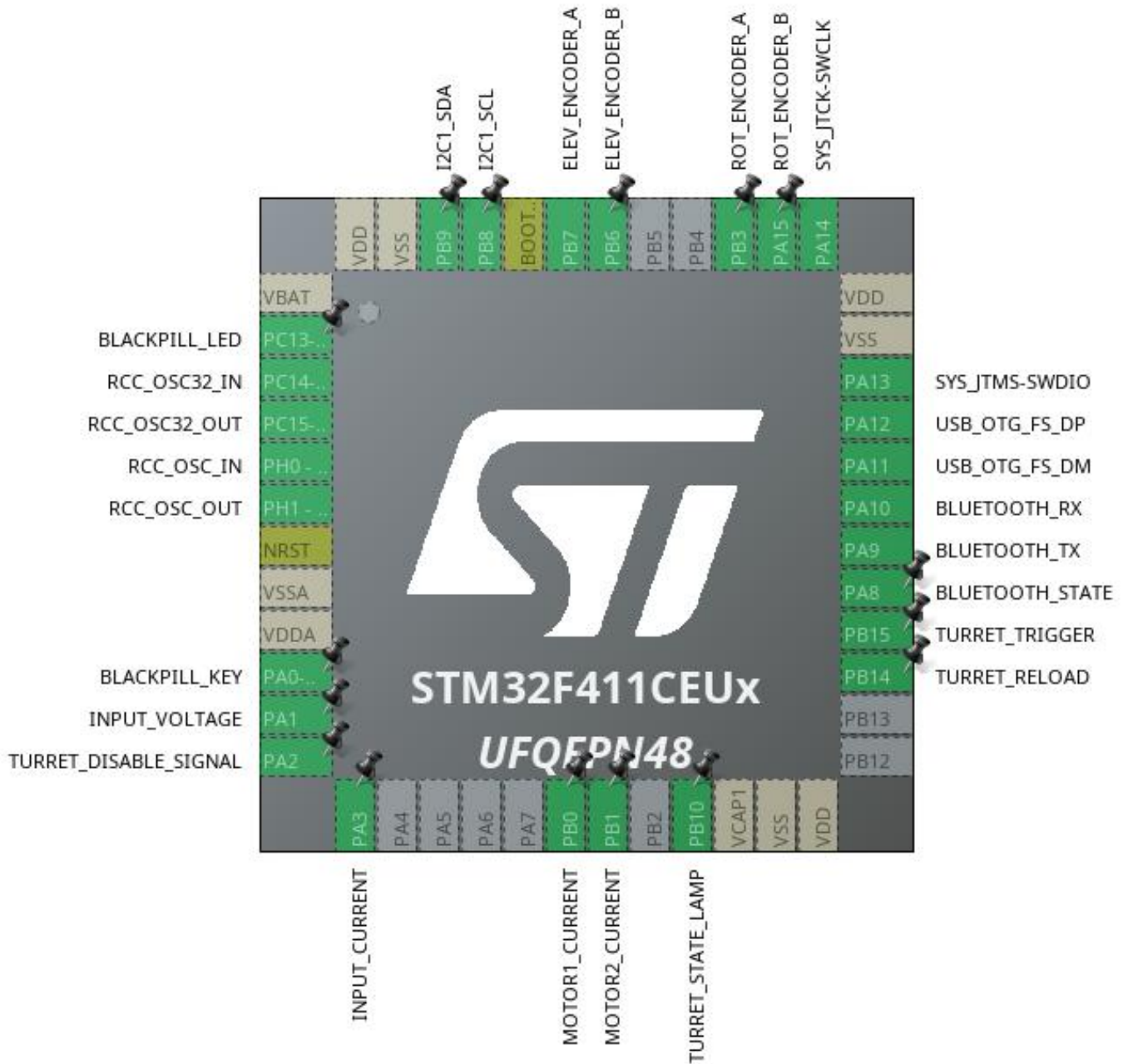
1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F411
MCU name	STM32F411CEUx
MCU Package	UFQFPN48
MCU Pin number	48

1.3. Core(s) information

Core(s)	Arm Cortex-M4
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2. Pinout Configuration



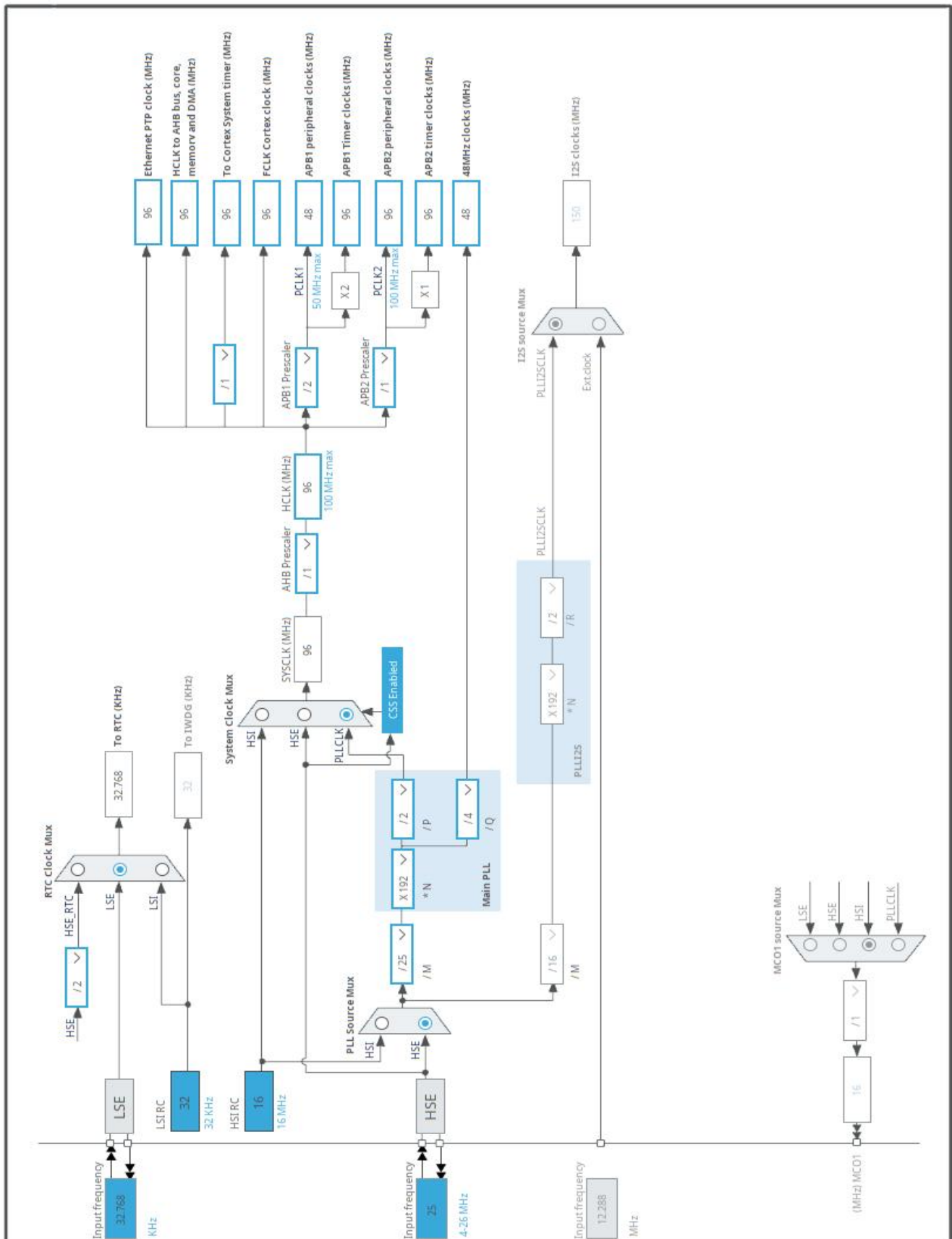
3. Pins Configuration

Pin Number UFQFPN48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13-ANTI_TAMP *	I/O	GPIO_Output	BLACKPILL_LED
3	PC14-OSC32_IN	I/O	RCC_OSC32_IN	
4	PC15-OSC32_OUT	I/O	RCC_OSC32_OUT	
5	PH0 - OSC_IN	I/O	RCC_OSC_IN	
6	PH1 - OSC_OUT	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	VSSA	Power		
9	VDDA	Power		
10	PA0-WKUP *	I/O	GPIO_Input	BLACKPILL_KEY
11	PA1	I/O	ADC1_IN1	INPUT_VOLTAGE
12	PA2	I/O	GPIO_EXTI2	TURRET_DISABLE_SIGNA L
13	PA3	I/O	ADC1_IN3	INPUT_CURRENT
18	PB0	I/O	ADC1_IN8	MOTOR1_CURRENT
19	PB1	I/O	ADC1_IN9	MOTOR2_CURRENT
21	PB10 *	I/O	GPIO_Output	TURRET_STATE_LAMP
22	VCAP1	Power		
23	VSS	Power		
24	VDD	Power		
27	PB14 *	I/O	GPIO_Output	TURRET_RELOAD
28	PB15 *	I/O	GPIO_Output	TURRET_TRIGGER
29	PA8 *	I/O	GPIO_Input	BLUETOOTH_STATE
30	PA9	I/O	USART1_TX	BLUETOOTH_TX
31	PA10	I/O	USART1_RX	BLUETOOTH_RX
32	PA11	I/O	USB_OTG_FS_DM	
33	PA12	I/O	USB_OTG_FS_DP	
34	PA13	I/O	SYS_JTMS-SWDIO	
35	VSS	Power		
36	VDD	Power		
37	PA14	I/O	SYS_JTCK-SWCLK	
38	PA15	I/O	TIM2_CH1	ROT_ENCODER_B
39	PB3	I/O	TIM2_CH2	ROT_ENCODER_A
42	PB6	I/O	TIM4_CH1	ELEV_ENCODER_B
43	PB7	I/O	TIM4_CH2	ELEV_ENCODER_A
44	BOOT0	Boot		

Pin Number UFQFPN48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
45	PB8	I/O	I2C1_SCL	
46	PB9	I/O	I2C1_SDA	
47	VSS	Power		
48	VDD	Power		

* The pin is affected with an I/O function

4. Clock Tree Configuration



1. Power Consumption Calculator report

1.1. Microcontroller Selection

Series	STM32F4
Line	STM32F411
MCU	STM32F411CEUx
Datasheet	DS10314_Rev6

1.2. Parameter Selection

Temperature	25
Vdd	1.7

1.3. Battery Selection

Battery	Li-SOCL2(A3400)
Capacity	3400.0 mAh
Self Discharge	0.08 %/month
Nominal Voltage	3.6 V
Max Cont Current	100.0 mA
Max Pulse Current	200.0 mA
Cells in series	1
Cells in parallel	1

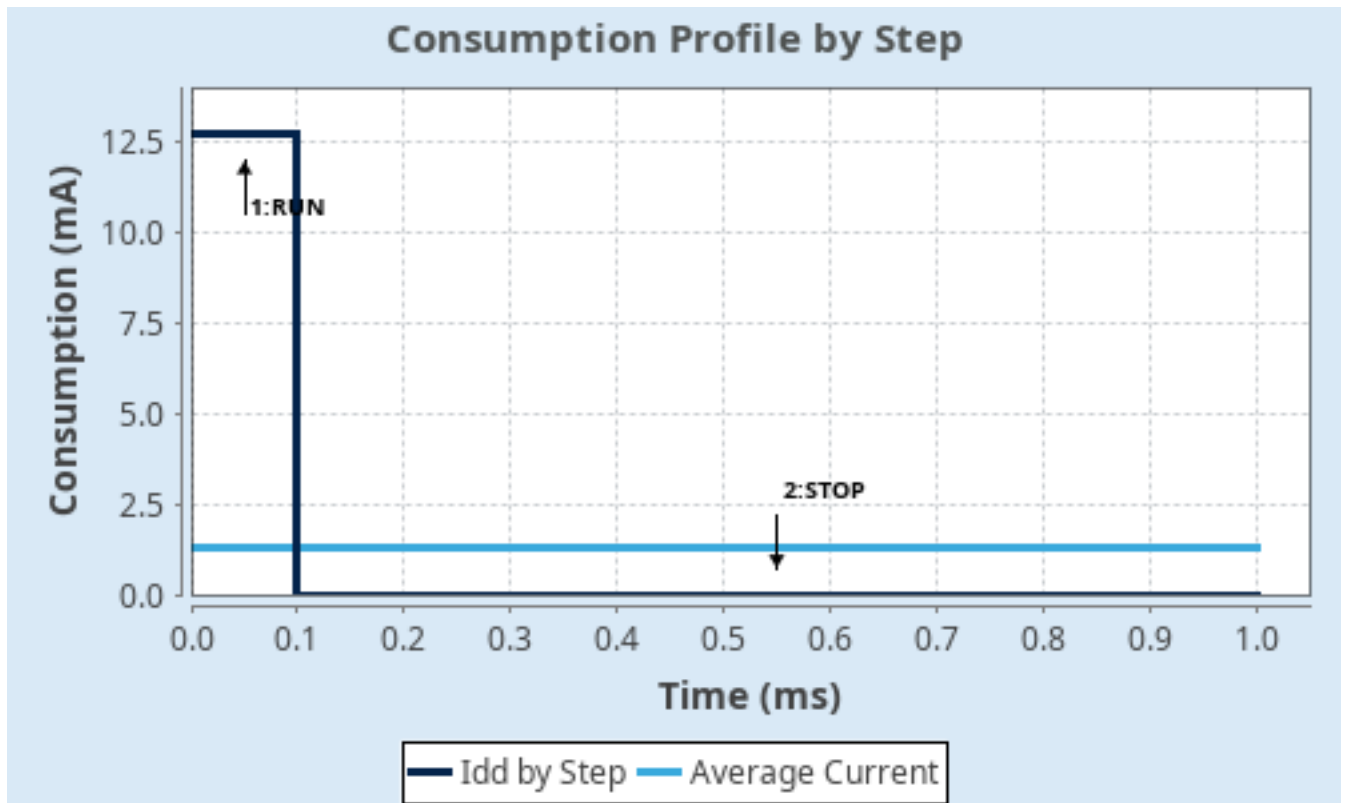
1.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	1.7	1.7
Voltage Source	Battery	Battery
Range	Scale1-High	No Scale
Fetch Type	SRAM	n/a
CPU Frequency	100 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator_LPLV Flash-PwrDwn
Clock Source Frequency	4 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	12.7 mA	9 μ A
Duration	0.1 ms	0.9 ms
DMIPS	125.0	0.0
Ta Max	104.31	105
Category	In DS Table	In DS Table

1.5. Results

Sequence Time	1 ms	Average Current	1.28 mA
Battery Life	3 months, 19 days, 6 hours	Average DMIPS	125.0 DMIPS

1.6. Chart



2. Software Project

2.1. Project Settings

Name	Value
Project Name	RCT_STM32
Project Folder	/home/stakra/Desktop/Sterowniki_Robotów/RCT_STM32
Toolchain / IDE	CMake
Firmware Package Name and Version	STM32Cube FW_F4 V1.28.1
Application Structure	Basic
Generate Under Root	No
Do not generate the main()	No
Minimum Heap Size	0x800
Minimum Stack Size	0x400

2.2. Code Generation Settings

Name	Value
STM32Cube MCU packages and embedded software	Copy all used libraries into the project folder
Generate peripheral initialization as a pair of '.c/.h' files	Yes
Backup previously generated files when re-generating	Yes
Keep User Code when re-generating	Yes
Delete previously generated files when not re-generated	No
Set all free pins as analog (to optimize the power consumption)	No
Enable Full Assert	No

2.3. Advanced Settings - Generated Function Calls

Rank	Function Name	Peripheral Instance Name
1	SystemClock_Config	RCC
2	MX_GPIO_Init	GPIO
3	MX_DMA_Init	DMA
4	MX_RTC_Init	RTC
5	MX_USB_DEVICE_Init	USB_DEVICE
6	MX_TIM11_Init	TIM11
7	MX_USART1_UART_Init	USART1
8	MX_ADC1_Init	ADC1
9	MX_I2C1_Init	I2C1
10	MX_TIM4_Init	TIM4
11	MX_TIM2_Init	TIM2

3. Peripherals and Middlewares Configuration

3.1. ADC1

mode: IN1

mode: IN3

mode: IN8

mode: IN9

3.1.1. Parameter Settings:

ADCs_Common_Settings:

Mode Independent mode

ADC_Settings:

Clock Prescaler	PCLK2 divided by 4
Resolution	12 bits (15 ADC Clock cycles)
Data Alignment	Right alignment
Scan Conversion Mode	Enabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	Disabled
End Of Conversion Selection	EOC flag at the end of single channel conversion

ADC_Regular_ConversionMode:

Number Of Conversion	4 *
External Trigger Conversion Source	Regular Conversion launched by software
External Trigger Conversion Edge	None
<u>Rank</u>	1
Channel	Channel 1
Sampling Time	112 Cycles *
<u>Rank</u>	2 *
Channel	Channel 3 *
Sampling Time	112 Cycles *
<u>Rank</u>	3 *
Channel	Channel 8 *
Sampling Time	112 Cycles *
<u>Rank</u>	4 *
Channel	Channel 9 *
Sampling Time	112 Cycles *

ADC_Injected_ConversionMode:

Number Of Conversions 0

WatchDog:

Enable Analog WatchDog Mode false

3.2. I2C1

I2C: I2C

3.2.1. Parameter Settings:

Master Features:

I2C Speed Mode	Standard Mode
I2C Clock Speed (Hz)	100000

Slave Features:

Clock No Stretch Mode	Disabled
Primary Address Length selection	7-bit
Dual Address Acknowledged	Disabled
Primary slave address	0
General Call address detection	Disabled

3.3. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

Low Speed Clock (LSE) : Crystal/Ceramic Resonator

3.3.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	3 WS (4 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
TIM Prescaler Selection	Disabled
HSE Startup Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000

Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 1
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3.4. RTC

mode: Activate Clock Source

3.4.1. Parameter Settings:

General:

Hour Format	Hourformat 24
Asynchronous Predivider value	127
Synchronous Predivider value	255

3.5. SYS

Debug: Serial Wire

Timebase Source: TIM10

3.6. TIM2

Channel3: Output Compare No Output

Channel4: Output Compare No Output

Combined Channels: Encoder Mode

3.6.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	0xFFFF *
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

Output Compare No Output Channel 3:

Mode	Active Level on match *
Pulse (32 bits value)	4*ROT_MOTOR_ENCODER_RESOLUTION *
Output compare preload	Disable
CH Polarity	High

Output Compare No Output Channel 4:

Mode	Active Level on match *
Pulse (32 bits value)	0xFFFF-(4*ROT_MOTOR_ENCODER_RESOLUTION)+1 *
Output compare preload	Disable

CH Polarity High

Encoder:

Encoder Mode

Encoder Mode TI1 and TI2 *

____ Parameters for Channel 1 ____

Polarity

Rising Edge

IC Selection

Direct

Prescaler Division Ratio

No division

Input Filter

0

____ Parameters for Channel 2 ____

Polarity

Rising Edge

IC Selection

Direct

Prescaler Division Ratio

No division

Input Filter

0

3.7. TIM4

Channel3: Output Compare No Output

Channel4: Output Compare No Output

Combined Channels: Encoder Mode

3.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)

0

Counter Mode

Up

Counter Period (AutoReload Register - 16 bits value)

65535

Internal Clock Division (CKD)

No Division

auto-reload preload

Disable

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)

Disable (Trigger input effect not delayed)

Trigger Event Selection

Reset (UG bit from TIMx_EGR)

Output Compare No Output Channel 3:

Mode

Active Level on match *

Pulse (16 bits value)

4*ELEV_MOTOR_ENCODER_RESOLUTION *

Output compare preload

Disable

CH Polarity

High

Output Compare No Output Channel 4:

Mode

Active Level on match *

Pulse (16 bits value)

0xFFFF-(4*ELEV_MOTOR_ENCODER_RESOLUTION)+1 *

Output compare preload

Disable

CH Polarity High

Encoder:

Encoder Mode

____ Parameters for Channel 1 ____

Polarity

IC Selection

Prescaler Division Ratio

Input Filter

____ Parameters for Channel 2 ____

Polarity

IC Selection

Prescaler Division Ratio

Input Filter

Encoder Mode TI1 and TI2 *

Rising Edge

Direct

No division

0

Rising Edge

Direct

No division

0

3.8. TIM11

mode: Activated

3.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)

Counter Mode

Counter Period (AutoReload Register - 16 bits value)

Internal Clock Division (CKD)

auto-reload preload

MODBUS_TIM_PRESCALER *

Up

MODBUS_TIM_PERIOD *

No Division

Disable

3.9. USART1

Mode: Asynchronous

3.9.1. Parameter Settings:

Basic Parameters:

Baud Rate

Word Length

Parity

Stop Bits

BLUETOOTH_DATA_BPS *

8 Bits (including Parity)

None

1

Advanced Parameters:

Data Direction

Over Sampling

Receive and Transmit

16 Samples

3.10. USB_OTG_FS

Mode: Device_Only

3.10.1. Parameter Settings:

Speed	Device Full Speed 12MBit/s
Low power	Disabled
Link Power Management	Disabled
VBUS sensing	Disabled
Signal start of frame	Disabled

3.11. FREERTOS

Interface: CMSIS_V2

3.11.1. Config parameters:

API:

FreeRTOS API	CMSIS v2
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Versions:

FreeRTOS version	10.3.1
CMSIS-RTOS version	2.00

MPU/FPU:

ENABLE_MPU	Disabled
ENABLE_FPU	Disabled

Kernel settings:

USE_PREEMPTION	Disabled *
CPU_CLOCK_HZ	SystemCoreClock
TICK_RATE_HZ	1000
MAX_PRIORITIES	56
MINIMAL_STACK_SIZE	128
MAX_TASK_NAME_LEN	32 *
USE_16_BIT_TICKS	Disabled
IDLE_SHOULD_YIELD	Enabled
USE_MUTEXES	Enabled
USE_RECURSIVE_MUTEXES	Enabled
USE_COUNTING_SEMAPHORES	Enabled
QUEUE_REGISTRY_SIZE	8
USE_APPLICATION_TASK_TAG	Disabled

ENABLE_BACKWARD_COMPATIBILITY	Enabled
USE_PORT_OPTIMISED_TASK_SELECTION	Disabled
USE_TICKLESS_IDLE	Disabled
USE_TASK_NOTIFICATIONS	Enabled
RECORD_STACK_HIGH_ADDRESS	Disabled

Memory management settings:

Memory Allocation	Dynamic / Static
TOTAL_HEAP_SIZE	15360
Memory Management scheme	heap_4

Hook function related definitions:

USE_IDLE_HOOK	Disabled
USE_TICK_HOOK	Disabled
USE_MALLOC_FAILED_HOOK	Disabled
USE_DAEMON_TASK_STARTUP_HOOK	Disabled
CHECK_FOR_STACK_OVERFLOW	Disabled

Run time and task stats gathering related definitions:

GENERATE_RUN_TIME_STATS	Disabled
USE_TRACE_FACILITY	Enabled
USE_STATS_FORMATTING_FUNCTIONS	Disabled

Co-routine related definitions:

USE_CO_ROUTINES	Disabled
MAX_CO_ROUTINE_PRIORITIES	2

Software timer definitions:

USE_TIMERS	Enabled
TIMER_TASK_PRIORITY	2
TIMER_QUEUE_LENGTH	10
TIMER_TASK_STACK_DEPTH	256

Interrupt nesting behaviour configuration:

LIBRARY_LOWEST_INTERRUPT_PRIORITY	15
LIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY	10 *

Added with 10.2.1 support:

MESSAGE_BUFFER_LENGTH_TYPE	size_t
USE_POSIX_ERRNO	Disabled

CMSIS-RTOS V2 flags:

USE_OS2_THREAD_SUSPEND_RESUME	Enabled
USE_OS2_THREAD_ENUMERATE	Enabled
USE_OS2_EVENTFLAGS_FROM_ISR	Enabled
USE_OS2_THREAD_FLAGS	Enabled
USE_OS2_TIMER	Enabled
USE_OS2_MUTEX	Enabled

3.11.2. Include parameters:

Include definitions:

vTaskPrioritySet	Enabled
uxTaskPriorityGet	Enabled
vTaskDelete	Enabled
vTaskCleanUpResources	Disabled
vTaskSuspend	Enabled
vTaskDelayUntil	Enabled
vTaskDelay	Enabled
xTaskGetSchedulerState	Enabled
xTaskResumeFromISR	Disabled *
xQueueGetMutexHolder	Disabled *
xSemaphoreGetMutexHolder	Enabled *
pcTaskGetTaskName	Disabled
uxTaskGetStackHighWaterMark	Enabled
xTaskGetCurrentTaskHandle	Enabled
eTaskGetState	Enabled
xEventGroupSetBitFromISR	Disabled
xTimerPendFunctionCall	Enabled
xTaskAbortDelay	Disabled
xTaskGetHandle	Disabled
uxTaskGetStackHighWaterMark2	Disabled

3.11.3. Advanced settings:

Newlib settings (see parameter description first):

USE_NEWLIB_REENTRANT	Disabled
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Project settings (see parameter description first):

Use FW pack heap file	Enabled
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3.12. USB_DEVICE

Class For FS IP: Communication Device Class (Virtual Port Com)

3.12.1. Parameter Settings:

Basic Parameters:

USBD_MAX_NUM_INTERFACES (Maximum number of supported interfaces)	1
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USBD_MAX_NUM_CONFIGURATION (Maximum number of supported configuration)	1
USBD_MAX_STR_DESC_SIZ (Maximum size for the string descriptors)	0xFF *
USBD_SELF_POWERED (Enabled self power)	Enabled
USBD_DEBUG_LEVEL (USBD Debug Level)	0: No debug message
Class Parameters:	
USB CDC Rx Buffer Size	COMM_BUFFER_SIZE *
USB CDC Tx Buffer Size	COMM_BUFFER_SIZE *

3.12.2. Device Descriptor:

Device Descriptor:

VID (Vendor Identifier)	1155
LANGID_STRING (Language Identifier)	English(United States)
MANUFACTURER_STRING (Manufacturer Identifier)	STMicroelectronics

Device Descriptor FS:

PID (Product Identifier)	22336
PRODUCT_STRING (Product Identifier)	STM32 Virtual ComPort
CONFIGURATION_STRING (Configuration Identifier)	CDC Config
INTERFACE_STRING (Interface Identifier)	CDC Interface

*** User modified value**

4. System Configuration

4.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC1	PA1	ADC1_IN1	Analog mode	No pull-up and no pull-down	n/a	INPUT_VOLTAGE
	PA3	ADC1_IN3	Analog mode	No pull-up and no pull-down	n/a	INPUT_CURRENT
	PB0	ADC1_IN8	Analog mode	No pull-up and no pull-down	n/a	MOTOR1_CURRENT
	PB1	ADC1_IN9	Analog mode	No pull-up and no pull-down	n/a	MOTOR2_CURRENT
I2C1	PB8	I2C1_SCL	Alternate Function Open Drain	No pull-up and no pull-down	Very High *	
	PB9	I2C1_SDA	Alternate Function Open Drain	No pull-up and no pull-down	Very High *	
RCC	PC14-OSC32_IN	RCC_OSC32_IN	n/a	n/a	n/a	
	PC15-OSC32_OUT	RCC_OSC32_OUT	n/a	n/a	n/a	
	PH0 - OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PH1 - OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	
TIM2	PA15	TIM2_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	ROT_ENCODER_B
	PB3	TIM2_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	ROT_ENCODER_A
TIM4	PB6	TIM4_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	ELEV_ENCODER_B
	PB7	TIM4_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	ELEV_ENCODER_A
USART1	PA9	USART1_TX	Alternate Function Push Pull	Pull-up *	Very High *	BLUETOOTH_TX
	PA10	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	BLUETOOTH_RX
USB_OTG_FS	PA11	USB_OTG_FS_DM	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PA12	USB_OTG_FS_DP	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
GPIO	PC13-ANTI_TAMP	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BLACKPILL_LED
	PA0-WKUP	GPIO_Input	Input mode	Pull-up *	n/a	BLACKPILL_KEY

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PA2	GPIO_EXTI2	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	TURRET_DISABLE_SIGNAL
	PB10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	TURRET_STATE_LAMP
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	TURRET_RELOAD
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	TURRET_TRIGGER
	PA8	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	BLUETOOTH_STATE

4.2. DMA configuration

DMA request	Stream	Direction	Priority
ADC1	DMA2_Stream0	Peripheral To Memory	Medium *

ADC1: DMA2_Stream0 DMA request Settings:

Mode: **Circular ***
Use fifo: Disable
Peripheral Increment: Disable
Memory Increment: **Enable ***
Peripheral Data Width: Half Word
Memory Data Width: Half Word

4.3. NVIC configuration

4.3.1. NVIC

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
Memory management fault	true	0	0
Pre-fetch fault, memory access fault	true	0	0
Undefined instruction or illegal state	true	0	0
System service call via SWI instruction	true	0	0
Debug monitor	true	0	0
Pendable request for system service	true	15	0
System tick timer	true	15	0
EXTI line2 interrupt	true	9	0
TIM1 update interrupt and TIM10 global interrupt	true	11	0
TIM1 trigger and commutation interrupts and TIM11 global interrupt	true	11	0
TIM2 global interrupt	true	9	0
TIM4 global interrupt	true	9	0
I2C1 event interrupt	true	9	0
I2C1 error interrupt	true	9	0
USART1 global interrupt	true	10	0
DMA2 stream0 global interrupt	true	10	0
USB On The Go FS global interrupt	true	10	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
ADC1 global interrupt	unused		
FPU global interrupt	unused		

4.3.2. NVIC Code generation

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	true
Hard fault interrupt	false	true	false
Memory management fault	false	true	false
Pre-fetch fault, memory access fault	false	true	false
Undefined instruction or illegal state	false	true	false
System service call via SWI instruction	false	false	false
Debug monitor	false	true	false

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Pendable request for system service	false	false	false
System tick timer	false	false	true
EXTI line2 interrupt	false	true	true
TIM1 update interrupt and TIM10 global interrupt	false	true	true
TIM1 trigger and commutation interrupts and TIM11 global interrupt	false	true	true
TIM2 global interrupt	false	true	true
TIM4 global interrupt	false	true	true
I2C1 event interrupt	false	true	true
I2C1 error interrupt	false	true	true
USART1 global interrupt	false	true	true
DMA2 stream0 global interrupt	false	true	true
USB On The Go FS global interrupt	false	true	true

* User modified value

5. System Views

5.1. Category view

5.1.1. Current

Middleware					
FREERTOS					
USB_DEVICE					
System Core	Analog	Timers	Connectivity	Multimedia	Computing
DMA	ADC1	RTC	I2C1		
GPIO		TIM2	USART1		
NVIC		TIM4	USB_FS		
RCC		TIM11			
SYS					

6. Docs & Resources

Type	Link
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32f411_bsd1.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32f411_ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32f4-svd.zip
Presentations	https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32_eval_tools_portfolio.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf
Presentations	https://www.st.com/resource/en/product_presentation/microcontrollers-stm32-family-overview.pdf
Brochures	https://www.st.com/resource/en/brochure/products-and-solutions-for-plcs-and-smart-i-os.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32f4x1.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32nucleo.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32trust.pdf
Product Certifications	https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf
Application Notes	https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2945-stm8s-and-stm32-mcus-a-consistent-832bit-product-line-for-painless-migration-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3070-managing-the-

driver-enable-signal-for-rs485-and-iolink-communications-with-the-stm32s-usart-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an3126-audio-and-waveform-generation-using-the-dac-in-stm32-products-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an3154-can-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an3155-usart-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an3156-usb-dfu-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an3364-migration-and-compatibility-guidelines-for-stm32-microcontroller-applications-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an3997-audio-playback-and-recording-using-the-stm32f4discovery-stmicroelectronics.pdf

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