1. Description

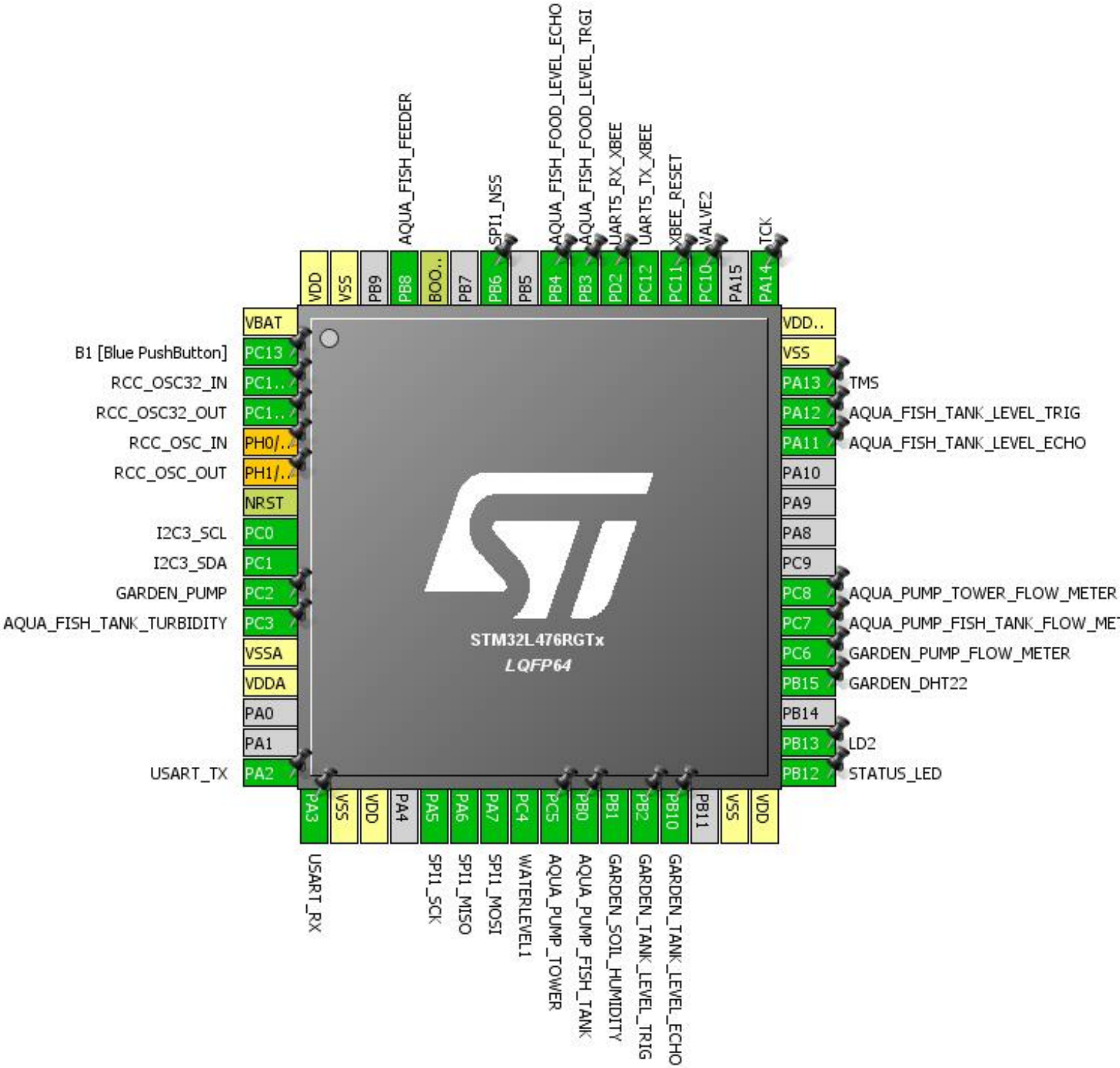
1.1. Project

Project Name	EndDevice
Board Name	NUCLEO-L476RG
Generated with:	STM32CubeMX 4.17.0
Date	11/20/2016

1.2. MCU

MCU Series	STM32L4
MCU Line	STM32L4x6
MCU name	STM32L476RGTx
MCU Package	LQFP64
MCU Pin number	64

2. Pinout Configuration



3. Pins Configuration

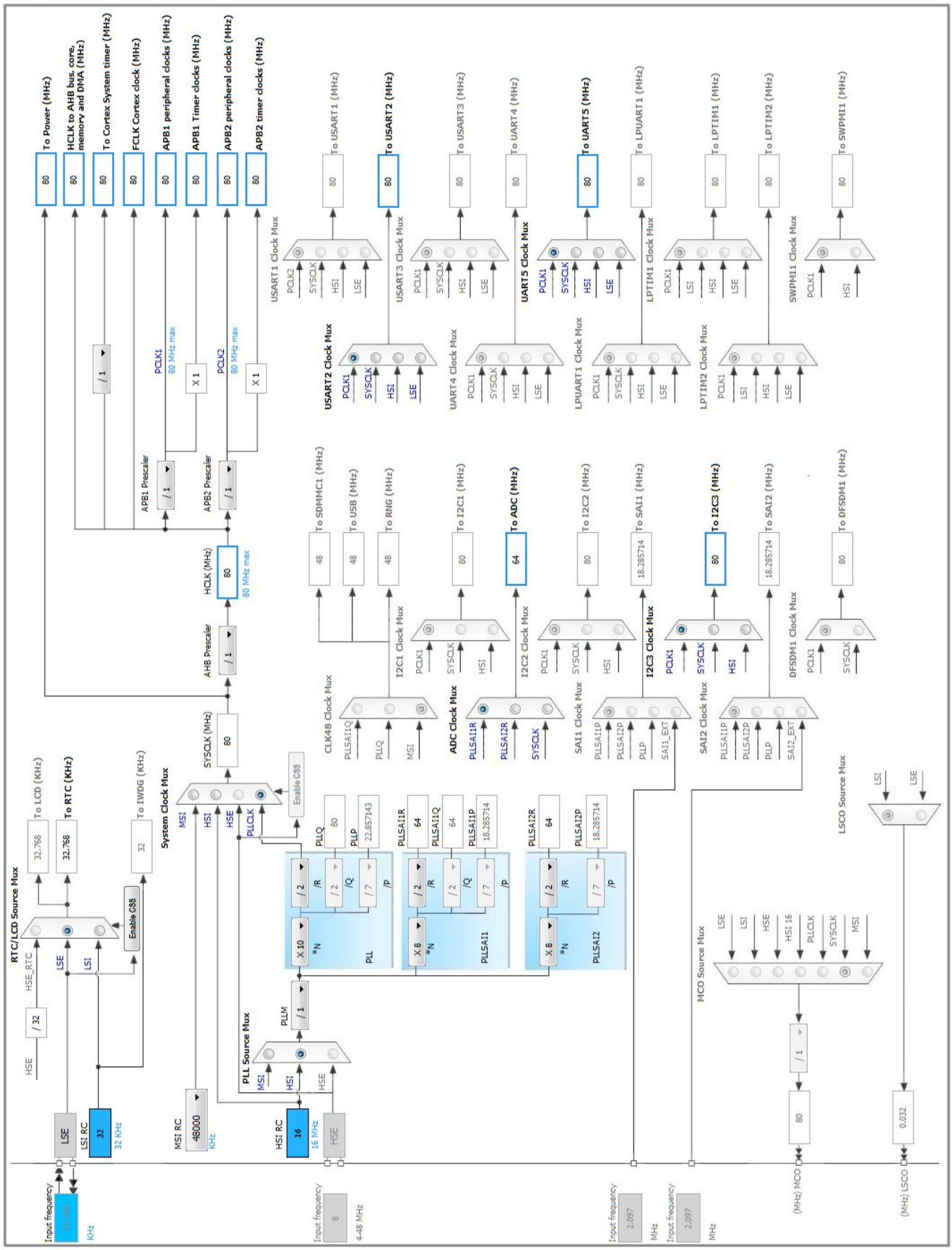
Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13	I/O	GPIO_EXTI13	B1 [Blue PushButton]
3	PC14/OSC32_IN	I/O	RCC_OSC32_IN	
4	PC15/OSC32_OUT	I/O	RCC_OSC32_OUT	
5	PH0/OSC_IN *	I/O	RCC_OSC_IN	
6	PH1/OSC_OUT *	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	PC0	I/O	I2C3_SCL	
9	PC1	I/O	I2C3_SDA	
10	PC2 **	I/O	GPIO_Output	GARDEN_PUMP
11	PC3	I/O	ADC3_IN4	AQUA_FISH_TANK_TURBIDITY
12	VSSA	Power		
13	VDDA	Power		
16	PA2	I/O	USART2_TX	USART_TX
17	PA3	I/O	USART2_RX	USART_RX
18	VSS	Power		
19	VDD	Power		
21	PA5	I/O	SPI1_SCK	
22	PA6	I/O	SPI1_MISO	
23	PA7	I/O	SPI1_MOSI	
24	PC4	I/O	ADC1_IN13	WATERLEVEL1
25	PC5 **	I/O	GPIO_Output	AQUA_PUMP_TOWER
26	PB0 **	I/O	GPIO_Output	AQUA_PUMP_FISH_TANK
27	PB1	I/O	ADC2_IN16	GARDEN_SOIL_HUMIDITY
28	PB2 **	I/O	GPIO_Output	GARDEN_TANK_LEVEL_TRIG
29	PB10	I/O	GPIO_EXTI10	GARDEN_TANK_LEVEL_ECHO
31	VSS	Power		
32	VDD	Power		
33	PB12 **	I/O	GPIO_Output	STATUS_LED
34	PB13 **	I/O	GPIO_Output	LD2
36	PB15 **	I/O	GPIO_Output	GARDEN_DHT22
37	PC6	I/O	TIM3_CH1	GARDEN_PUMP_FLOW_METER

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
38	PC7	I/O	TIM3_CH2	AQUA_PUMP_FISH_TANK_FLOW_METER
39	PC8	I/O	TIM3_CH3	AQUA_PUMP_TOWER_FLOW_METER
44	PA11	I/O	GPIO_EXTI11	AQUA_FISH_TANK_LEVEL_ECHO
45	PA12 **	I/O	GPIO_Output	AQUA_FISH_TANK_LEVEL_TRIG
46	PA13	I/O	SYS_JTMS-SWDIO	TMS
47	VSS	Power		
48	VDDUSB	Power		
49	PA14	I/O	SYS_JTCK-SWCLK	TCK
51	PC10 **	I/O	GPIO_Output	VALVE2
52	PC11 **	I/O	GPIO_Output	XBEE_RESET
53	PC12	I/O	UART5_TX	UART5_TX_XBEE
54	PD2	I/O	UART5_RX	UART5_RX_XBEE
55	PB3 **	I/O	GPIO_Output	AQUA_FISH_FOOD_LEVEL_TRGI
56	PB4	I/O	GPIO_EXTI4	AQUA_FISH_FOOD_LEVEL_ECHO
58	PB6 **	I/O	GPIO_Output	SPI1_NSS
60	BOOT0	Boot		
61	PB8	I/O	TIM4_CH3	AQUA_FISH_FEEDER
63	VSS	Power		
64	VDD	Power		

** The pin is affected with an I/O function

* The pin is affected with a peripheral function but no peripheral mode is activated

4. Clock Tree Configuration



5. IPs and Middleware Configuration

5.1. ADC1

IN13: IN13 Single-ended

5.1.1. Parameter Settings:

ADCs_Common_Settings:

Mode	Independent mode

ADC_Settings:

Clock Prescaler	Asynchronous clock mode divided by 1
Resolution	ADC 12-bit resolution
Data Alignment	Right alignment
Scan Conversion Mode	Disabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	Disabled
End Of Conversion Selection	End of single conversion
Overrun behaviour	Overrun data preserved
Low Power Auto Wait	Disabled

ADC_Regular_ConversionMode:

Enable Regular Conversions	Enable
Enable Regular Oversampling	Disable
Number Of Conversion	1
External Trigger Conversion Edge	None
External Trigger Conversion Source	Software Trigger
Rank	1
Channel	Channel 13
Sampling Time	2.5 Cycles
Offset Number	No offset

ADC_Injected_ConversionMode:

Enable Injected Conversions	Disable

Analog Watchdog 1:

Enable Analog WatchDog1 Mode	false

Analog Watchdog 2:

Enable Analog WatchDog2 Mode	false

Analog Watchdog 3:

Enable Analog WatchDog3 Mode	false

5.2. ADC2

mode: IN16 Single-ended

5.2.1. Parameter Settings:

ADCs_Common_Settings:

Mode	Independent mode

ADC_Settings:

Clock Prescaler	Asynchronous clock mode divided by 1
Resolution	ADC 12-bit resolution
Data Alignment	Right alignment
Scan Conversion Mode	Disabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	Disabled
End Of Conversion Selection	End of single conversion
Overrun behaviour	Overrun data preserved
Low Power Auto Wait	Disabled

ADC_Regular_ConversionMode:

Enable Regular Conversions	Enable
Enable Regular Oversampling	Disable
Number Of Conversion	1
External Trigger Conversion Edge	None
External Trigger Conversion Source	Software Trigger
Rank	1
Channel	Channel 16
Sampling Time	2.5 Cycles
Offset Number	No offset

ADC_Injected_ConversionMode:

Enable Injected Conversions	Disable

Analog Watchdog 1:

Enable Analog WatchDog1 Mode	false

Analog Watchdog 2:

Enable Analog WatchDog2 Mode	false

Analog Watchdog 3:

Enable Analog WatchDog3 Mode	false

5.3. ADC3

mode: IN4

5.3.1. Parameter Settings:

ADC_Settings:

Clock Prescaler	Asynchronous clock mode divided by 1
Resolution	ADC 12-bit resolution
Data Alignment	Right alignment
Scan Conversion Mode	Disabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	Disabled
End Of Conversion Selection	End of single conversion
Overrun behaviour	Overrun data preserved
Low Power Auto Wait	Disabled

ADC_Regular_ConversionMode:

Enable Regular Conversions	Enable
Enable Regular Oversampling	Disable
Number Of Conversion	1
External Trigger Conversion Edge	None
External Trigger Conversion Source	Software Trigger
Rank	1
Channel	Channel 4
Sampling Time	2.5 Cycles
Offset Number	No offset

ADC_Injected_ConversionMode:

Enable Injected Conversions	Disable

Analog Watchdog 1:

Enable Analog WatchDog1 Mode	false

Analog Watchdog 2:

Enable Analog WatchDog2 Mode	false

Analog Watchdog 3:

Enable Analog WatchDog3 Mode	false

5.4. I2C3

I2C: I2C

5.4.1. Parameter Settings:

Timing configuration:

I2C Speed Mode	Standard Mode
I2C Speed Frequency (KHz)	100
Rise Time (ns)	0
Fall Time (ns)	0
Coefficient of Digital Filter	0
Analog Filter	Enabled
Timing	0x10909CEC

Slave Features:

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

5.5. RCC

Low Speed Clock (LSE) : Crystal/Ceramic Resonator

5.5.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	**Enabled ***
Data Cache	Enabled
Flash Latency(WS)	4 WS (5 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
MSI Calibration Value	0
MSI Auto Calibration	Disabled
HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000

Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 1

5.6. RTC

mode: Activate Clock Source

mode: Activate Calendar

Alarm A: Internal Alarm A

Alarm B: Internal Alarm B

5.6.1. Parameter Settings:

General:

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

Calendar Time:

Data Format	BCD data format
Hours	0
Minutes	0
Seconds	0
Day Light Saving: value of hour adjustment	Daylightsaving None
Store Operation	Storeoperation Reset

Calendar Date:

Week Day	Monday
Month	January
Date	1
Year	0

Alarm A:

Hours	0
Minutes	0
Seconds	0
Sub Seconds	0
Alarm Mask Date Week day	Disable
Alarm Mask Hours	Disable
Alarm Mask Minutes	Disable
Alarm Mask Seconds	Disable
Alarm Sub Second Mask	All Alarm SS fields are masked.
Alarm Date Week Day Sel	Date
Alarm Date	1

Alarm B:

Hours	0

Minutes	0
Seconds	0
Sub Seconds	0
Alarm Mask Date Week day	Disable
Alarm Mask Hours	Disable
Alarm Mask Minutes	Disable
Alarm Mask Seconds	Disable
Alarm Sub Second Mask	All Alarm SS fields are masked.
Alarm Date Week Day Sel	Date
Alarm Date	1

5.7. SPI1

Mode: Full-Duplex Master

5.7.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	4 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	2
Baud Rate	**40.0 MBits/s ***
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSSP Mode	Enabled
NSS Signal Type	Software

5.8. SYS

Debug: Serial Wire

Timebase Source: TIM1

5.9. TIM2

Clock Source : Internal Clock

5.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**0x60 ***
Internal Clock Division (CKD)	No Division

Trigger Output (TRGO) Parameters:

Master/Slave Mode	Disable (no sync between this TIM (Master) and its Slaves
Trigger Event Selection TRGO	Reset (UG bit from TIMx_EGR)

5.10. TIM3

Clock Source : Internal Clock

Channel1: Input Capture direct mode

Channel2: Input Capture direct mode

Channel3: Input Capture direct mode

5.10.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	0
Internal Clock Division (CKD)	No Division

Trigger Output (TRGO) Parameters:

Master/Slave Mode	Disable (no sync between this TIM (Master) and its Slaves
Trigger Event Selection TRGO	Reset (UG bit from TIMx_EGR)

Input Capture Channel 1:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter (4 bits value)	0

Input Capture Channel 2:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division

Input Filter (4 bits value)	0

Input Capture Channel 3:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter (4 bits value)	0

5.11. TIM4

Channel3: PWM Generation CH3

5.11.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	0
Internal Clock Division (CKD)	No Division

Trigger Output (TRGO) Parameters:

Master/Slave Mode	Disable (no sync between this TIM (Master) and its Slaves
Trigger Event Selection TRGO	Reset (UG bit from TIMx_EGR)

Clear Input:

Clear Input Source	Disable

PWM Generation Channel 3:

Mode	PWM mode 1
Pulse (16 bits value)	0
Fast Mode	Disable
CH Polarity	High

5.12. UART5

Mode: Asynchronous

5.12.1. Parameter Settings:

Basic Parameters:

Baud Rate	**9600 ***
Word Length	**8 Bits (including Parity) ***

Parity	None
Stop Bits	1

Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples
Single Sample	Disable

Advanced Features:

Auto Baudrate	Disable
TX Pin Active Level Inversion	Disable
RX Pin Active Level Inversion	Disable
Data Inversion	Disable
TX and RX Pins Swapping	Disable
Overrun	Enable
DMA on RX Error	Enable
MSB First	Disable

5.13. USART2

Mode: Asynchronous

5.13.1. Parameter Settings:

Basic Parameters:

Baud Rate	115200
Word Length	**8 Bits (including Parity) ***
Parity	None
Stop Bits	1

Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples
Single Sample	Disable

Advanced Features:

Auto Baudrate	Disable
TX Pin Active Level Inversion	Disable
RX Pin Active Level Inversion	Disable
Data Inversion	Disable
TX and RX Pins Swapping	Disable
Overrun	Enable
DMA on RX Error	Enable
MSB First	Disable

5.14. FREERTOS

mode: Enabled

5.14.1. Config parameters:

Versions:

CMSIS-RTOS version	1.02
FreeRTOS version	8.2.3

Kernel settings:

USE_PREEMPTION	Enabled
CPU_CLOCK_HZ	SystemCoreClock
TICK_RATE_HZ	1000
MAX_PRIORITIES	7
MINIMAL_STACK_SIZE	128
MAX_TASK_NAME_LEN	16
USE_16_BIT_TICKS	Disabled
IDLE_SHOULD_YIELD	Enabled
USE_MUTEXES	Enabled
USE_RECURSIVE_MUTEXES	Disabled
USE_COUNTING_SEMAPHORES	Disabled
QUEUE_REGISTRY_SIZE	8
USE_APPLICATION_TASK_TAG	Disabled
TOTAL_HEAP_SIZE	**8000 ***
Memory Management scheme	heap_4
USE_ALTERNATIVE_API	Disabled
ENABLE_BACKWARD_COMPATIBILITY	Enabled
USE_PORT_OPTIMISED_TASK_SELECTION	Disabled
USE_TICKLESS_IDLE	Disabled
USE_TASK_NOTIFICATIONS	Enabled

Hook function related definitions:

USE_IDLE_HOOK	Disabled
USE_TICK_HOOK	Disabled
USE_MALLOC_FAILED_HOOK	Disabled
CHECK_FOR_STACK_OVERFLOW	Disabled

Run time and task stats gathering related definitions:

USE_TRACE_FACILITY	Enabled
GENERATE_RUN_TIME_STATS	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	5

5.14.2. Include parameters:

Include definitions:

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

*** User modified value**

6. System Configuration

6.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC1	PC4	ADC1_IN13	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	WATERLEVEL1
ADC2	PB1	ADC2_IN16	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	GARDEN_SOIL_HUMIDITY
ADC3	PC3	ADC3_IN4	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	AQUA_FISH_TANK_TURBIDITY
I2C3	PC0	I2C3_SCL	Alternate Function Open Drain	Pull-up	**Very High ***	
	PC1	I2C3_SDA	Alternate Function Open Drain	Pull-up	**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	
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PA6	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	TMS
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	TCK
TIM3	PC6	TIM3_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	GARDEN_PUMP_FLOW_METER
	PC7	TIM3_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	AQUA_PUMP_FISH_TANK_FLOW_METER
	PC8	TIM3_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	AQUA_PUMP_TOWER_FLOW_METER
TIM4	PB8	TIM4_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	AQUA_FISH_FEEDER
UART5	PC12	UART5_TX	Alternate Function Push Pull	Pull-up	**Very High ***	UART5_TX_XBEE
	PD2	UART5_RX	Alternate Function Push Pull	Pull-up	**Very High ***	UART5_RX_XBEE

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
USART2	PA2	USART2_TX	Alternate Function Push Pull	*	**Very High ***	USART_TX
	PA3	USART2_RX	Alternate Function Push Pull	*	**Very High ***	USART_RX
Single Mapped Signals	PH0/OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PH1/OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
GPIO	PC13	GPIO_EXTI13	**External Event Mode with Rising edge trigger detection ***	No pull-up and no pull-down	n/a	B1 [Blue PushButton]
	PC2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	GARDEN_PUMP
	PC5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	AQUA_PUMP_TOWER
	PB0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	AQUA_PUMP_FISH_TANK
	PB2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	GARDEN_TANK_LEVEL_TRIG
	PB10	GPIO_EXTI10	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	GARDEN_TANK_LEVEL_ECHO
	PB12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	STATUS_LED
	PB13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LD2
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	GARDEN_DHT22
	PA11	GPIO_EXTI11	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	AQUA_FISH_TANK_LEVEL_ECHO
	PA12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	AQUA_FISH_TANK_LEVEL_TRIG
	PC10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	VALVE2
	PC11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	XBEE_RESET
	PB3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	AQUA_FISH_FOOD_LEVEL_TRGI
	PB4	GPIO_EXTI4	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	AQUA_FISH_FOOD_LEVEL_ECHO
	PB6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SPI1_NSS

6.2. DMA configuration

nothing configured in DMA service

6.3. NVIC configuration

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
Memory management fault	true	0	0
Prefetch 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
ADC1 and ADC2 interrupts	true	0	0
TIM1 update interrupt and TIM16 global interrupt	true	0	0
SPI1 global interrupt	true	0	0
USART2 global interrupt	true	5	0
RTC alarm interrupt through EXTI line 18	true	5	0
UART5 global interrupt	true	5	0
PVD/PVM1/PVM2/PVM3/PVM4 interrupts through EXTI lines 16/35/36/37/38	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
EXTI line4 interrupt	unused		
TIM2 global interrupt	unused		
TIM3 global interrupt	unused		
TIM4 global interrupt	unused		
EXTI line[15:10] interrupts	unused		
ADC3 global interrupt	unused		
I2C3 event interrupt	unused		
I2C3 error interrupt	unused		
FPU global interrupt	unused		

*** User modified value**

7. Power Consumption Calculator report

7.1. Microcontroller Selection

Series	STM32L4
Line	STM32L4x6
MCU	STM32L476RGTx
Datasheet	025976_Rev4

7.2. Parameter Selection

Temperature	25
Vdd	3.0

8. Software Project

8.1. Project Settings

Name	Value
Project Name	EndDevice
Project Folder	D:\Guiller files\ELEX FILES\GM Electronics
Toolchain / IDE	MDK-ARM V5
Firmware Package Name and Version	STM32Cube FW_L4 V1.5.0

8.2. Code Generation Settings

Name	Value
STM32Cube Firmware Library Package	Copy all used libraries into the project folder
Generate peripheral initialization as a pair of '.c/.h' files	No
Backup previously generated files when re-generating	No
Delete previously generated files when not re-generated	Yes
Set all free pins as analog (to optimize the power consumption)	No