STM32CubeMX Sensor Configuration

This page documents the current STM32CubeMX configuration for the Sensor Board firmware and explains how to extend it for sensor interfaces (UART/I2C/SPI/ADC) in a way that is safe for code generation.

- **IOC File**: `components/sensor_board/firmware/firmware.ioc`
- **Generated HAL Init Files**: `components/sensor_board/firmware/Core/Src/`
- **Application Entry**: `src/sensor_board/main.c`

Current CubeMX Snapshot

Item	Value
MCU	STM32H753ZIT6 (NUCLEO-H753ZI)
CubeMX Version	6.15.0
STM32Cube FW Package	STM32Cube FW_H7 v1.12.1
Toolchain	Makefile + GCC
Post-generation Script	`../../../scripts/post_code_generation.bash`

Enabled CubeMX Components

- **CORTEX_M7** (I-Cache/D-Cache enabled, MPU configured)
- **ETH** (RMII mode)
- **LWIP** (Static IP, DHCP disabled)
- **FREERTOS** (CMSIS-RTOS v2, default task generated)
- **TIM1** (base timer)
- **SYS/NVIC/RCC** base platform configuration

Clock and Core Setup

Clock Configuration (from IOC)

Parameter	Value
Clock Source	HSE 8 MHz -> PLL
SYSCLK	72 MHz
APB1	36 MHz (DIV2)
APB2/APB3/APB4	72 MHz
TIM1 Clock	72 MHz

Cortex-M7 / MPU

- Instruction cache: enabled
- Data cache: enabled
- MPU region at `0x30000000`, size `32KB`, shareable, non-cacheable

Pinout and Peripheral Mapping

Ethernet (RMII)

Signal	Pin
ETH_REF_CLK	PA1
ETH_MDIO	PA2
ETH_CRS_DV	PA7
ETH_MDC	PC1
ETH_RXD0	PC4
ETH_RXD1	PC5
ETH_TX_EN	PG11
ETH_TXD0	PG13
ETH_TXD1	PB13

Serial / COM

Signal	Pin	Note
USART1_TX	PA9	Configured in generated `MX_GPIO_Init()`

USART1_RX	PA10	Configured in generated `MX_GPIO_Init()`
USART3_TX	PD8	Used by NUCLEO COM path (`MX_USART3_Init` in app init)
USART3_RX	PD9	Used by NUCLEO COM path (`MX_USART3_Init` in app init)

Board IO / Misc

Pin	Mode	Typical Use
PC13	GPIO Input	User button
PB0	GPIO Output	Board output line
PB7	GPIO Output	Board output line
PB14	GPIO Output	Board output line
PH0 / PH1	HSE oscillator	System clock source
PC14 / PC15	LSE oscillator	Low-speed oscillator

Timer, RTOS, and Interrupts

TIM1 Base Timer

```
htim1.Init.Prescaler = 6400 - 1;
htim1.Init.Period = 10000;
```

With a 72 MHz timer clock, this gives an update period near 0.89 s.

Interrupt Priorities (Key Entries)

IRQ	Priority	Notes
ETH_IRQn	15	Ethernet/LwIP path
TIM1_UP_IRQn	12	TIM1 update interrupt
TIM2_IRQn	7	HAL tick time base
EXTI15_10_IRQn	6	External interrupt group

Sensor Interface Status

What Is Already Configured in CubeMX

- Networking stack and RMII pinout
- Base timer and RTOS scaffolding
- Basic UART-capable pins and NUCLEO COM integration path

What Is Not Yet Fully Modeled in CubeMX (TO-DO ONCE sensors retrieved and assembled)

- Dedicated ADC channels for analog sensors (pH, load cell, pressure)
- Dedicated I2C/SPI buses for IMU and pressure variants
- Explicit sensor-specific pin labels and alternate-function assignments

Important: Current sensor drivers include placeholders for hardware access in multiple modules. When bringing up physical sensors, add the corresponding CubeMX peripherals first, then update the sensor drivers to use generated handles.

Recommended Workflow

1. Open `components/sensor_board/firmware/firmware.ioc` in STM32CubeMX.
2. Add required peripherals for the target sensor like this:

```
GPS        -> USARTx (baud/parity/stop bits to match module)
IMU        -> I2Cx or SPIx (+ optional DRDY INT GPIO)
pH         -> ADCx channel (sampling time, resolution)
Load Cell  -> ADCx channel(s) or external ADC interface
Pressure   -> ADCx or I2Cx/SPIx (depends on sensor part)
```

1. Assign and lock pins in Pinout view; avoid overlap with RMII and COM pins.
2. Configure clocks for new peripherals in Clock Configuration.
3. Set NVIC priorities for new ISR sources so Ethernet/RTOS timing remains stable.
4. Generate code with **Keep User Code** enabled.
5. Rebuild using PlatformIO and validate startup + sensor polling.

Conflict To Look Out for Before Saving .ioc file

- No conflict with ETH RMII pins (PA1, PA2, PA7, PC1, PC4, PC5, PG11, PG13, PB13)
- No conflict with debug/COM path (PA9/PA10 and PD8/PD9)

- No conflict with oscillator pins (PH0, PH1, PC14, PC15)

Related Pages

- Configuration
- Reference
- Sensor Basics Utility Library

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