

RobotROS

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Chapter 1

Robot ROS

1.1 Externe documentation

[Documentation about the pinout of the robot I2C protocole for VLX530X](#)

1.2 Principal function

function [main](#) : init function and start kernel.

function [microros_task](#) : Create the publishers and the subscribers and exploit them.

function [task_Motor_Left](#) : Control the left motor.

function [task_Motor_Right](#) : Control the right motor.

function [task_VL53](#) : Get the VL53 measure and put it in the queue.

function [task_Grove_LCD](#) : Get the information from the queue and print it on the LCD.

function [task_Supervision](#) : The brain's robot decide of the action depending of data receive from microROS.

1.3 Secondary function

function [createPublisher](#) : use to create a default publisher.

function [createSubscriber](#) : use to create a default subscriber.

function [CHECKMRRET](#) : Test if a microRos function success else print error message.

function [SubscriberCallbackFunction](#) : callback call when message is receive.

1.4 Test function

function [test_uart2](#) : Test printf and scanf.

function [test_vl53](#) : Test VL53 sensors.

function [test_motor](#) : Test correcteur.

1.5 Config define

1.5.1 Config exo

1.5.2 Config param

Author

titouan melon

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Chapter 2

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Chapter 3

File Index

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R8/system/src/retarget/">https://github.com/cnoviello/mastering-stm32/blob/master/nucleo-f030↔ R8/system/src/retarget/	35
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C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base↔ _robot/Core/Src/ retarget.c : Contain function to add printf and scanf function use the UART2 All credit to Carmine Noviello for this code <a href="https://github.com/cnoviello/mastering-stm32/blob/master/nucleo-f030↔
R8/system/src/retarget/">https://github.com/cnoviello/mastering-stm32/blob/master/nucleo-f030↔ R8/system/src/retarget/	120
C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base↔ _robot/Core/Src/ stm32f4xx_hal_msp.c : function to configure the pinout of STM32	125
C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base↔ _robot/Core/Src/ stm32f4xx_hal_timebase_tim.c HAL time base based on the hardware TIM	134
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Chapter 4

Data Structure Documentation

4.1 AMessage Struct Reference

Data Fields

- char [command](#)
- int [data](#)

4.1.1 Detailed Description

Use to send data to lcd's task

Definition at line [111](#) of file [main.c](#).

4.1.2 Field Documentation

4.1.2.1 command

```
char command
```

Represent the direction of the robot

Definition at line [113](#) of file [main.c](#).

4.1.2.2 data

```
int data
```

Represent the mode of the robot

Definition at line [114](#) of file [main.c](#).

The documentation for this struct was generated from the following file:

- C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base↵
_robot/Core/Src/[main.c](#)

4.2 MicroRosPubMsg Struct Reference

Data Fields

- char [dir](#)
- int [mode](#)
- int [speed](#)

4.2.1 Detailed Description

Use to send information from the task decision to microRos task

Definition at line [120](#) of file [main.c](#).

4.2.2 Field Documentation

4.2.2.1 dir

```
char dir
```

Represent the direction of the robot

Definition at line [122](#) of file [main.c](#).

4.2.2.2 mode

```
int mode
```

Represent the mode of the robot

Definition at line [123](#) of file [main.c](#).

4.2.2.3 speed

```
int speed
```

Represent the speed of the robot

Definition at line [124](#) of file [main.c](#).

The documentation for this struct was generated from the following file:

- C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base↔
_robot/Core/Src/[main.c](#)

4.3 MicroRosSubMsg Struct Reference

Data Fields

- int [dir](#)
- int [x](#)
- int [y](#)
- int [mode](#)
- int [speed](#)

4.3.1 Detailed Description

Use to send information get by microRos to decision task

Definition at line [130](#) of file [main.c](#).

4.3.2 Field Documentation

4.3.2.1 dir

```
int dir
```

Represent the direction send by the IHM

Definition at line [132](#) of file [main.c](#).

4.3.2.2 mode

```
int mode
```

Represent the mode send by the IHM

Definition at line [135](#) of file [main.c](#).

4.3.2.3 speed

```
int speed
```

Represent the speed send by the IHM

Definition at line [136](#) of file [main.c](#).

4.3.2.4 x

```
int x
```

Represent the x position send by the camera

Definition at line [133](#) of file [main.c](#).

4.3.2.5 y

```
int y
```

Represent the y position send by the camera

Definition at line 134 of file [main.c](#).

The documentation for this struct was generated from the following file:

- C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base_↔
_robot/Core/Src/[main.c](#)

4.4 SequenceStepEnables Struct Reference

Data Fields

- uint8_t [tcc](#)
- uint8_t [msrc](#)
- uint8_t [dss](#)
- uint8_t [pre_range](#)
- uint8_t [final_range](#)

4.4.1 Detailed Description

Definition at line 304 of file [VL53L0X.h](#).

4.4.2 Field Documentation

4.4.2.1 dss

```
uint8_t dss
```

Definition at line 305 of file [VL53L0X.h](#).

4.4.2.2 final_range

```
uint8_t final_range
```

Definition at line 305 of file [VL53L0X.h](#).

4.4.2.3 msrc

```
uint8_t msrc
```

Definition at line 305 of file [VL53L0X.h](#).

4.4.2.4 pre_range

```
uint8_t pre_range
```

Definition at line 305 of file [VL53L0X.h](#).

4.4.2.5 tcc

```
uint8_t tcc
```

Definition at line 305 of file [VL53L0X.h](#).

The documentation for this struct was generated from the following file:

- C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base↵_robot/Core/Inc/[VL53L0X.h](#)

4.5 SequenceStepTimeouts Struct Reference

Data Fields

- uint16_t [pre_range_vcsel_period_pclks](#)
- uint16_t [final_range_vcsel_period_pclks](#)
- uint16_t [msrc_dss_tcc_mclks](#)
- uint16_t [pre_range_mclks](#)
- uint16_t [final_range_mclks](#)
- uint32_t [msrc_dss_tcc_us](#)
- uint32_t [pre_range_us](#)
- uint32_t [final_range_us](#)

4.5.1 Detailed Description

Definition at line 308 of file [VL53L0X.h](#).

4.5.2 Field Documentation

4.5.2.1 final_range_mclks

```
uint16_t final_range_mclks
```

Definition at line 311 of file [VL53L0X.h](#).

4.5.2.2 final_range_us

```
uint32_t final_range_us
```

Definition at line 312 of file [VL53L0X.h](#).

4.5.2.3 final_range_vcsel_period_pclks

```
uint16_t final_range_vcsel_period_pclks
```

Definition at line 309 of file [VL53L0X.h](#).

4.5.2.4 msrc_dss_tcc_mclks

```
uint16_t msrc_dss_tcc_mclks
```

Definition at line 311 of file [VL53L0X.h](#).

4.5.2.5 msrc_dss_tcc_us

```
uint32_t msrc_dss_tcc_us
```

Definition at line 312 of file [VL53L0X.h](#).

4.5.2.6 pre_range_mclks

```
uint16_t pre_range_mclks
```

Definition at line 311 of file [VL53L0X.h](#).

4.5.2.7 pre_range_us

```
uint32_t pre_range_us
```

Definition at line 312 of file [VL53L0X.h](#).

4.5.2.8 pre_range_vcsel_period_pclks

```
uint16_t pre_range_vcsel_period_pclks
```

Definition at line 309 of file [VL53L0X.h](#).

The documentation for this struct was generated from the following file:

- [C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base/_robot/Core/Inc/VL53L0X.h](#)

4.6 statInfo_t Struct Reference

Data Fields

- uint16_t [rawDistance](#)
- uint16_t [signalCnt](#)
- uint16_t [ambientCnt](#)
- uint16_t [spadCnt](#)
- uint8_t [rangeStatus](#)

4.6.1 Detailed Description

Definition at line 206 of file [VL53L0X.h](#).

4.6.2 Field Documentation

4.6.2.1 ambientCnt

```
uint16_t ambientCnt
```

Definition at line 209 of file [VL53L0X.h](#).

4.6.2.2 rangeStatus

```
uint8_t rangeStatus
```

Definition at line 211 of file [VL53L0X.h](#).

4.6.2.3 rawDistance

```
uint16_t rawDistance
```

Definition at line 207 of file [VL53L0X.h](#).

4.6.2.4 signalCnt

```
uint16_t signalCnt
```

Definition at line 208 of file [VL53L0X.h](#).

4.6.2.5 spadCnt

```
uint16_t spadCnt
```

Definition at line 210 of file [VL53L0X.h](#).

The documentation for this struct was generated from the following file:

- C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base↵_robot/Core/Inc/[VL53L0X.h](#)

Chapter 5

File Documentation

5.1 captDistIR.h

```
00001 /*
00002  * IRMeasure.h
00003  */
00004
00005 #ifndef INC_CAPTDISTIR_H_
00006 #define INC_CAPTDISTIR_H_
00007
00008 #include "main.h"
00009
00010
00011 void captDistIR_Init(void);
00012 int captDistIR_Get(int*);
00013
00014
00015 #endif /* INC_CAPTDISTIR_H_ */
```

5.2 config.h

```
00001 /*
00002  * config.h
00003  */
00004
00005 #ifndef INC_CONFIG_H_
00006 #define INC_CONFIG_H_
00007
00008 //=====
00009 // USART : CHOIX DE LA LIAISON SERIE
00010 // USART2 : USART_STLINK (cable)
00011 // USART6 : USART_ZIGBEE (sans fil)
00012 //=====
00013 #define USE_USART_STLINK 1 // A Commenter pour utiliser stlink dans term_printf !! faire un
clean
00014 // #define USE_USART_ZIGBEE 1
00015
00016 #define NB_CAR_TO_RECEIVE 1 // nombre de caractères à recevoir pour déclencher une
interruption
00017
00018 #define USART2_BAUDRATE 115200
00019 #define USART6_BAUDRATE 9600
00020 //=====
00021 // LIAISON I2C
00022 //=====
00023 #define I2C1_CLOCKSPEED 100000
00024 #define I2C2_CLOCKSPEED 100000
00025
00026 // CAPTEUR I2C DISTANCE ULTRASON SRF02
00027 #define CAPT_US_LEFT_ADDRESS 0xE0
00028 #define CAPT_US_RIGHT_ADDRESS 0xE2
00029
00030 // IMU MPU9250
00031 #define MPU9250_ADDRESS 0x68
00032 #define AK8963_ADDRESS 0x0C
00033
00034 // ECRAN LCD
```


5.5 drv_uart.h

```

00001 /*
00002  * drv_uart.h
00003  *
00004  * Created on: Mar 13, 2023
00005  * Author: kerhoas
00006  */
00007
00008 #ifndef INC_DRV_UART_H_
00009 #define INC_DRV_UART_H_
00010
00011 void MX_USART1_UART_Init(void);
00012 void MX_USART2_UART_Init(void);
00013 void MX_DMA_Init(void);
00014
00015
00016
00017
00018 #endif /* INC_DRV_UART_H_ */

```

5.6 FreeRTOSConfig.h

```

00001 /* USER CODE BEGIN Header */
00002 /*
00003  * FreeRTOS Kernel V10.3.1
00004  * Portion Copyright (C) 2017 Amazon.com, Inc. or its affiliates. All Rights Reserved.
00005  * Portion Copyright (C) 2019 STMicroelectronics, Inc. All Rights Reserved.
00006  *
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00016  *
00017  * THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR
00018  * IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS
00019  * FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR
00020  * COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER
00021  * IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN
00022  * CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.
00023  *
00024  * http://www.FreeRTOS.org
00025  * http://aws.amazon.com/freertos
00026  *
00027  * 1 tab == 4 spaces!
00028  */
00029 /* USER CODE END Header */
00030
00031 #ifndef FREERTOS_CONFIG_H
00032 #define FREERTOS_CONFIG_H
00033
00034 /*-----
00035  * Application specific definitions.
00036  *
00037  * These definitions should be adjusted for your particular hardware and
00038  * application requirements.
00039  *
00040  * These parameters and more are described within the 'configuration' section of the
00041  * FreeRTOS API documentation available on the FreeRTOS.org web site.
00042  *
00043  * See http://www.freertos.org/a00110.html
00044  *-----*/
00045
00046 /* USER CODE BEGIN Includes */
00047 /* Section where include file can be added */
00048 /* USER CODE END Includes */
00049
00050 /* Ensure definitions are only used by the compiler, and not by the assembler. */
00051 #if defined(__ICCARM__) || defined(__CC_ARM) || defined(__GNUC__)
00052 #include <stdint.h>
00053 extern uint32_t SystemCoreClock;
00054 #endif
00055 #ifndef CMSIS_device_header
00056 #define CMSIS_device_header "stm32f4xx.h"
00057 #endif /* CMSIS_device_header */
00058
00059 #define configENABLE_FPU 0
00060 #define configENABLE_MPU 0

```

```

00061
00062 #define configUSE_PREEMPTION 1
00063 #define configSUPPORT_STATIC_ALLOCATION 1
00064 #define configSUPPORT_DYNAMIC_ALLOCATION 1
00065 #define configUSE_IDLE_HOOK 0
00066 #define configUSE_TICK_HOOK 0
00067 #define configCPU_CLOCK_HZ ( SystemCoreClock )
00068 #define configTICK_RATE_HZ ((TickType_t)1000)
00069 #define configMAX_PRIORITIES ( 56 )
00070 #define configMINIMAL_STACK_SIZE ((uint16_t)128)
00071 #define configTOTAL_HEAP_SIZE ((size_t)16384) //((size_t)15360)
00072 #define configMAX_TASK_NAME_LEN ( 16 )
00073 #define configUSE_TRACE_FACILITY 1
00074 #define configUSE_16_BIT_TICKS 0
00075 #define configUSE_MUTEXES 1
00076 #define configQUEUE_REGISTRY_SIZE 8
00077 #define configUSE_RECURSIVE_MUTEXES 1
00078 #define configUSE_COUNTING_SEMAPHORES 1
00079 #define configUSE_PORT_OPTIMISED_TASK_SELECTION 0
00080 /* USER CODE BEGIN MESSAGE_BUFFER_LENGTH_TYPE */
00081 /* Defaults to size_t for backward compatibility, but can be changed
00082 if lengths will always be less than the number of bytes in a size_t. */
00083 #define configMESSAGE_BUFFER_LENGTH_TYPE size_t
00084 /* USER CODE END MESSAGE_BUFFER_LENGTH_TYPE */
00085
00086 /* Co-routine definitions. */
00087 #define configUSE_CO_ROUTINES 0
00088 #define configMAX_CO_ROUTINE_PRIORITIES ( 2 )
00089
00090 /* Software timer definitions. */
00091 #define configUSE_TIMERS 1
00092 #define configTIMER_TASK_PRIORITY ( 2 )
00093 #define configTIMER_QUEUE_LENGTH 10
00094 #define configTIMER_TASK_STACK_DEPTH 256
00095
00096 /* The following flag must be enabled only when using newlib */
00097 #define configUSE_NEWLIB_REENTRANT 1
00098
00099 /* CMSIS-RTOS V2 flags */
00100 #define configUSE_OS2_THREAD_SUSPEND_RESUME 1
00101 #define configUSE_OS2_THREAD_ENUMERATE 1
00102 #define configUSE_OS2_EVENTFLAGS_FROM_ISR 1
00103 #define configUSE_OS2_THREAD_FLAGS 1
00104 #define configUSE_OS2_TIMER 1
00105 #define configUSE_OS2_MUTEX 1
00106
00107 /* Set the following definitions to 1 to include the API function, or zero
00108 to exclude the API function. */
00109 #define INCLUDE_vTaskPrioritySet 1
00110 #define INCLUDE_uxTaskPriorityGet 1
00111 #define INCLUDE_vTaskDelete 1
00112 #define INCLUDE_vTaskCleanUpResources 0
00113 #define INCLUDE_vTaskSuspend 1
00114 #define INCLUDE_vTaskDelayUntil 1
00115 #define INCLUDE_vTaskDelay 1
00116 #define INCLUDE_xTaskGetSchedulerState 1
00117 #define INCLUDE_xTimerPendFunctionCall 1
00118 #define INCLUDE_xQueueGetMutexHolder 1
00119 #define INCLUDE_uxTaskGetStackHighWaterMark 1
00120 #define INCLUDE_xTaskGetCurrentTaskHandle 1
00121 #define INCLUDE_eTaskGetState 1
00122
00123 /*
00124 * The CMSIS-RTOS V2 FreeRTOS wrapper is dependent on the heap implementation used
00125 * by the application thus the correct define need to be enabled below
00126 */
00127 #define USE_FreeRTOS_HEAP_4
00128
00129 /* Cortex-M specific definitions. */
00130 #ifndef __NVIC_PRIO_BITS
00131 /* __BVIC_PRIO_BITS will be specified when CMSIS is being used. */
00132 #define configPRIO_BITS __NVIC_PRIO_BITS
00133 #else
00134 #define configPRIO_BITS 4
00135 #endif
00136
00137 /* The lowest interrupt priority that can be used in a call to a "set priority"
00138 function. */
00139 #define configLIBRARY_LOWEST_INTERRUPT_PRIORITY 15
00140
00141 /* The highest interrupt priority that can be used by any interrupt service
00142 routine that makes calls to interrupt safe FreeRTOS API functions. DO NOT CALL
00143 INTERRUPT SAFE FREERTOS API FUNCTIONS FROM ANY INTERRUPT THAT HAS A HIGHER
00144 PRIORITY THAN THIS! (higher priorities are lower numeric values. */
00145 #define configLIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY 5
00146
00147 /* Interrupt priorities used by the kernel port layer itself. These are generic

```

```

00148 to all Cortex-M ports, and do not rely on any particular library functions. */
00149 #define configKERNEL_INTERRUPT_PRIORITY      ( configLIBRARY_LOWEST_INTERRUPT_PRIORITY « (8 -
configPRIO_BITS) )
00150 /* !!!! configMAX_SYSCALL_INTERRUPT_PRIORITY must not be set to zero !!!!
00151 See http://www.FreeRTOS.org/RTOS-Cortex-M3-M4.html. */
00152 #define configMAX_SYSCALL_INTERRUPT_PRIORITY      ( configLIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY « (8 -
configPRIO_BITS) )
00153
00154 /* Normal assert() semantics without relying on the provision of an assert.h
00155 header file. */
00156 /* USER CODE BEGIN 1 */
00157 #define configASSERT( x ) if ( (x) == 0 ) {taskDISABLE_INTERRUPTS(); for( ;; );}
00158 /* USER CODE END 1 */
00159
00160 /* Definitions that map the FreeRTOS port interrupt handlers to their CMSIS
00161 standard names. */
00162 #define vPortSVCHandler      SVC_Handler
00163 #define xPortPendSVHandler   PendSV_Handler
00164
00165 /* IMPORTANT: After 10.3.1 update, SysTick_Handler comes from NVIC (if SYS timebase = systick),
otherwise from cmsis_os2.c */
00166
00167 #define USE_CUSTOM_SYSTICK_HANDLER_IMPLEMENTATION 0
00168
00169 /* USER CODE BEGIN Defines */
00170 /* Section where parameter definitions can be added (for instance, to override default ones in
FreeRTOS.h) */
00171 /* USER CODE END Defines */
00172
00173 #endif /* FREERTOS_CONFIG_H */

```

5.7 groveLCD.h

```

00001 /*
00002  * groveLCD.h
00003  *
00004  * Created on: Oct 16, 2019
00005  * Author: kerhoas
00006  */
00007 #ifndef INC_GROVELCD_H_
00008 #define INC_GROVELCD_H_
00009
00010 #include "main.h"
00011
00012 // Device I2C Address
00013 #define LCD_ADDRESS      (0x7c)
00014 #define RGB_ADDRESS      (0xc4)
00015
00016
00017 // color define
00018 #define WHITE      0
00019 #define RED      1
00020 #define GREEN      2
00021 #define BLUE      3
00022
00023 #define REG_RED      0x04      // pwm2
00024 #define REG_GREEN      0x03      // pwm1
00025 #define REG_BLUE      0x02      // pwm0
00026
00027 #define REG_MODE1      0x00
00028 #define REG_MODE2      0x01
00029 #define REG_OUTPUT      0x08
00030
00031 // commands
00032 #define LCD_CLEARDISPLAY 0x01
00033 #define LCD_RETURNHOME 0x02
00034 #define LCD_ENTRYMODESET 0x04
00035 #define LCD_DISPLAYCONTROL 0x08
00036 #define LCD_CURSORSHIFT 0x10
00037 #define LCD_FUNCTIONSET 0x20
00038 #define LCD_SETCGRAMADDR 0x40
00039 #define LCD_SETDRAMADDR 0x80
00040
00041 // flags for display entry mode
00042 #define LCD_ENTRYRIGHT 0x00
00043 #define LCD_ENTRYLEFT 0x02
00044 #define LCD_ENTRYSHIFTINCREMENT 0x01
00045 #define LCD_ENTRYSHIFTDECREMENT 0x00
00046
00047 // flags for display on/off control
00048 #define LCD_DISPLAYON 0x04
00049 #define LCD_DISPLAYOFF 0x00
00050 #define LCD_CURSORON 0x02

```

```

00051 #define LCD_CURSOROFF 0x00
00052 #define LCD_BLINKON 0x01
00053 #define LCD_BLINKOFF 0x00
00054
00055 // flags for display/cursor shift
00056 #define LCD_DISPLAYMOVE 0x08
00057 #define LCD_CURSORMOVE 0x00
00058 #define LCD_MOVERIGHT 0x04
00059 #define LCD_MOVELEFT 0x00
00060
00061 // flags for function set
00062 #define LCD_8BITMODE 0x10
00063 #define LCD_4BITMODE 0x00
00064 #define LCD_2LINE 0x08
00065 #define LCD_1LINE 0x00
00066 #define LCD_5x10DOTS 0x04
00067 #define LCD_5x8DOTS 0x00
00068
00069 void groveLCD_test();
00070 void groveLCD_begin(uint8_t cols, uint8_t lines, uint8_t dotsize);
00071 void groveLCD_setColorAll();
00072 void groveLCD_setColorWhite();
00073 void groveLCD_clear();
00074 void groveLCD_home();
00075 void groveLCD_setCursor(uint8_t col, uint8_t row);
00076 void groveLCD_noDisplay();
00077 void groveLCD_display();
00078 void groveLCD_noCursor();
00079 void groveLCD_cursor();
00080 void groveLCD_noBlink();
00081 void groveLCD_blink();
00082 void groveLCD_scrollDisplayLeft(void);
00083 void groveLCD_scrollDisplayRight(void);
00084 void groveLCD_leftToRight(void);
00085 void groveLCD_rightToLeft(void);
00086 void groveLCD_autoscroll(void);
00087 void groveLCD_noAutoscroll(void);
00088 void groveLCD_createChar(uint8_t location, uint8_t charmap[]);
00089 void groveLCD_blinkLED(void);
00090 void groveLCD_noBlinkLED(void);
00091 void groveLCD_command(uint8_t value);
00092 int groveLCD_write(uint8_t value);
00093 void groveLCD_setReg(unsigned char addr, unsigned char dta);
00094 void groveLCD_setRGB(unsigned char r, unsigned char g, unsigned char b);
00095 void groveLCD_setColor(unsigned char color);
00096 void groveLCD_putString(char* s);
00097 void groveLCD_term_printf(const char* fmt, ...);
00098
00099
00100
00101 #endif /* INC_GROVELCD_H_ */

```

5.8 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_↔ Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Inc/main.h File Reference

: Header for [main.c](#) file. This file contains the common defines of the application.

```

#include "stm32f4xx_hal.h"
#include <stdio.h>
#include <rcl/rcl.h>
#include <rcl/error_handling.h>
#include <rcl/rclc.h>
#include <rclc/executor.h>
#include <uxr/client/transport.h>
#include <rmw_microxrcedds_c/config.h>
#include <rmw_microros/rmw_microros.h>
#include <std_msgs/msg/int32.h>
#include <std_msgs/msg/string.h>
#include <std_msgs/msg/header.h>
#include "FreeRTOS.h"

```

```
#include "task.h"
#include "queue.h"
#include "semphr.h"
#include "systemclock.h"
#include "drv_uart.h"
#include "drv_gpio.h"
#include "drv_i2c.h"
#include "cmsis_os.h"
#include "microROS.h"
#include "retarget.h"
```

Macros

- #define [B1_Pin](#) GPIO_PIN_13
- #define [B1_GPIO_Port](#) GPIOC
- #define [USART_TX_Pin](#) GPIO_PIN_2
- #define [USART_TX_GPIO_Port](#) GPIOA
- #define [USART_RX_Pin](#) GPIO_PIN_3
- #define [USART_RX_GPIO_Port](#) GPIOA
- #define [LD2_Pin](#) GPIO_PIN_5
- #define [LD2_GPIO_Port](#) GPIOA
- #define [TMS_Pin](#) GPIO_PIN_13
- #define [TMS_GPIO_Port](#) GPIOA
- #define [TCK_Pin](#) GPIO_PIN_14
- #define [TCK_GPIO_Port](#) GPIOA
- #define [SWO_Pin](#) GPIO_PIN_3
- #define [SWO_GPIO_Port](#) GPIOB

Functions

- void [Error_Handler](#) (void)
- void [CHECKMRRET](#) (rcl_ret_t ret, char *msg)
- void [SubscriberCallbackFunction](#) (const void *msgin)
- void [microros_task](#) (void *argument)
- void [task_Motor_Left](#) (void *pvParameters)
- void [task_Motor_Right](#) (void *pvParameters)
- void [task_VL53](#) (void *pvParameters)
- void [task_Grove_LCD](#) (void *pvParameters)
- void [task_Supervision](#) (void *pvParameters)
- int [main](#) (void)

Test function

- void [test_uart2](#) (void *pvParameters)
- void [test_vl53](#) (void *pvParameters)
- void [test_motor](#) (void *pvParameters)

5.8.1 Detailed Description

: Header for [main.c](#) file. This file contains the common defines of the application.

Definition in file [main.h](#).

5.8.2 Macro Definition Documentation

5.8.2.1 B1_GPIO_Port

```
#define B1_GPIO_Port GPIOC
```

Definition at line 220 of file [main.h](#).

5.8.2.2 B1_Pin

```
#define B1_Pin GPIO_PIN_13
```

Definition at line 219 of file [main.h](#).

5.8.2.3 LD2_GPIO_Port

```
#define LD2_GPIO_Port GPIOA
```

Definition at line 226 of file [main.h](#).

5.8.2.4 LD2_Pin

```
#define LD2_Pin GPIO_PIN_5
```

Definition at line 225 of file [main.h](#).

5.8.2.5 SWO_GPIO_Port

```
#define SWO_GPIO_Port GPIOB
```

Definition at line 232 of file [main.h](#).

5.8.2.6 SWO_Pin

```
#define SWO_Pin GPIO_PIN_3
```

Definition at line 231 of file [main.h](#).

5.8.2.7 TCK_GPIO_Port

```
#define TCK_GPIO_Port GPIOA
```

Definition at line 230 of file [main.h](#).

5.8.2.8 TCK_Pin

```
#define TCK_Pin GPIO_PIN_14
```

Definition at line 229 of file [main.h](#).

5.8.2.9 TMS_GPIO_Port

```
#define TMS_GPIO_Port GPIOA
```

Definition at line 228 of file [main.h](#).

5.8.2.10 TMS_Pin

```
#define TMS_Pin GPIO_PIN_13
```

Definition at line 227 of file [main.h](#).

5.8.2.11 USART_RX_GPIO_Port

```
#define USART_RX_GPIO_Port GPIOA
```

Definition at line 224 of file [main.h](#).

5.8.2.12 USART_RX_Pin

```
#define USART_RX_Pin GPIO_PIN_3
```

Definition at line 223 of file [main.h](#).

5.8.2.13 USART_TX_GPIO_Port

```
#define USART_TX_GPIO_Port GPIOA
```

Definition at line 222 of file [main.h](#).

5.8.2.14 USART_TX_Pin

```
#define USART_TX_Pin GPIO_PIN_2
```

Definition at line 221 of file [main.h](#).

5.8.3 Function Documentation

5.8.3.1 CHECKMRRET()

```
void CHECKMRRET (
    rcl_ret_t ret,
    char * msg )
```

check if microRos function success else print msg in console

Parameters

<i>ret</i>	return value of microRos function
<i>msg</i>	message to print if fail

Definition at line 154 of file [main.c](#).

5.8.3.2 Error_Handler()

```
void Error_Handler (
    void )
```

Definition at line 914 of file [main.c](#).

5.8.3.3 main()

```
int main (
    void )
```

Init all GPIO and drivers, start the task, init semaphore and queue and launch the kernel

- Config EXSTARTUP
 - Launch microRos, supervision, left motor, right motor and lcd task
- Config EXTEST_UART2
 - Launch test_uart2 task
- Config EXCORRECTOR
 - Launch test_motor task
- Config EXTESTCORRECTOR
 - Launch supervision, left motor and right motor task
- Config EXTEST_VL53
 - Launch test_vl53 task
- Config EXTEST_MICROROS
 - Launch microRos task
- Config EXFINAL
 - Launch microRos, supervision, left motor, right motor, vl53 and lcd task

Definition at line 752 of file [main.c](#).

5.8.3.4 microros_task()

```
void microros_task (
    void * argument )
```

- All config
 - Create the node *STM32_node*
 - Set the Domain id of microRos
- Config EXSTARTUP :
 - Create a publisher and send a message on it
- Config EXTEST_MICROROS :
 - Create a publisher, a subscriber and an executor
 - Init the executor and add the subscriber to it
 - Run the executor and send the receive message on the publisher
- Config EXFINAL :
 - Create 3 publishers, 5 subscriber and an executor
 - Init the executor and add the 5 subscribers to it
 - run the executor and if they are no elements waiting to be read by the task decision put the receive information in the queue If decison task send data then publish data to microRos

Parameters

<i>argument</i>	
-----------------	--

Definition at line 168 of file [main.c](#).

5.8.3.5 SubscriberCallbackFunction()

```
void SubscriberCallbackFunction (
    const void * msgin )
```

callback call by microros when a message is receive here use as debug and just print the receive msg

Parameters

<i>message</i>	receive
----------------	---------

Definition at line 156 of file [main.c](#).

5.8.3.6 task_Grove_LCD()

```
void task_Grove_LCD (
    void * pvParameters )
```

Task use to write information on LCD depending of the data in the LCD queue

- Config EXSTARTUP :
 - Print 'TEST' LCD on screen
- Config EXFINAL :
 - Print different messages depending of the actual mode

Parameters

<i>argument</i>	
-----------------	--

Definition at line [463](#) of file [main.c](#).

5.8.3.7 task_Motor_Left()

```
void task_Motor_Left (
    void * pvParameters )
```

Task use to control the left motor of the robot

Parameters

<i>argument</i>	
-----------------	--

Definition at line [385](#) of file [main.c](#).

5.8.3.8 task_Motor_Right()

```
void task_Motor_Right (
    void * pvParameters )
```

Task use to control the right motor of the robot

Parameters

<i>argument</i>	
-----------------	--

Definition at line [411](#) of file [main.c](#).

5.8.3.9 task_Supervision()

```
void task_Supervision (
    void * pvParameters )
```

Brain of the robot. get information for MicroRos and VL53 task, then send speed to left and right motor, lcd and microRos task

- Config EXSTARTUP :

- Make the robot drive forward until an obstacle are found
- Config EXTESTCORRECTOR :
 - Make the robot drive forward at speed set by config
- Config EXFINAL :
 - Make robot switch between 3 behaviour depending of the mode
 - Obstacle : drive and avoid obstacles
 - Manual : drive in direction set in ihm
 - Camera : follow an object

Parameters

<i>argument</i>	
-----------------	--

Definition at line 498 of file [main.c](#).

5.8.3.10 task_VL53()

```
void task_VL53 (  
    void * pvParameters )
```

task that get the value of the VL53 sensor and put it on the VL53 queue

Parameters

<i>argument</i>	
-----------------	--

Definition at line 438 of file [main.c](#).

5.8.3.11 test_motor()

```
void test_motor (  
    void * pvParameters )
```

Use to set the duty cycle and register the motor speed at each Te

Definition at line 868 of file [main.c](#).

5.8.3.12 test_uart2()

```
void test_uart2 (  
    void * pvParameters )
```

Use to test printf and scanf function

Definition at line 845 of file [main.c](#).

5.8.3.13 test_vl53()

```
void test_vl53 (
    void * pvParameters )
```

Use to test the VL53 sensor

Definition at line 857 of file [main.c](#).

5.9 main.h

[Go to the documentation of this file.](#)

```
00001 /* USER CODE BEGIN Header */
00048 /* USER CODE END Header */
00049
00050 /* Define to prevent recursive inclusion -----*/
00051 #ifndef __MAIN_H
00052 #define __MAIN_H
00053
00054 #ifdef __cplusplus
00055 extern "C" {
00056 #endif
00057
00058 /* Includes -----*/
00059 #include "stm32f4xx_hal.h"
00060
00061 #include <stdio.h>
00062 #include <rcl/rcl.h>
00063 #include <rcl/error_handling.h>
00064 #include <rcl/rclc.h>
00065 #include <rclc/executor.h>
00066 #include <uxr/client/transport.h>
00067 #include <rmw_microxrcedds_c/config.h>
00068 #include <rmw_microros/rmw_microros.h>
00069
00070 #include <std_msgs/msg/int32.h>
00071 #include <std_msgs/msg/string.h>
00072 #include <std_msgs/msg/header.h>
00073
00074 #include "FreeRTOS.h"
00075 #include "task.h"
00076 #include "queue.h"
00077 #include "semphr.h"
00078
00079 #include "systemclock.h"
00080 #include "drv_uart.h"
00081 #include "drv_gpio.h"
00082 #include "drv_i2c.h"
00083 #include "cmsis_os.h"
00084
00085 #include "microROS.h" //Custom microRos utils
00086 #include "retarget.h" //To redirect printf and scanf on UART2
00087
00088 /* Private includes -----*/
00089 /* USER CODE BEGIN Includes */
00090
00091 /* USER CODE END Includes */
00092
00093 /* Exported types -----*/
00094 /* USER CODE BEGIN ET */
00095
00096 /* USER CODE END ET */
00097
00098 /* Exported constants -----*/
00099 /* USER CODE BEGIN EC */
00100
00101 /* USER CODE END EC */
00102
00103 /* Exported macro -----*/
00104 /* USER CODE BEGIN EM */
00105
00106 /* USER CODE END EM */
00107
00108 /* Exported functions prototypes -----*/
00109 void Error_Handler(void);
00110
00111 /* USER CODE BEGIN EFP */
```

```

00116 void CHECKMRRET(rcl_ret_t ret, char* msg);
00117
00122 void SubscriberCallbackFunction(const void *msgin);
00123
00142 void microros_task(void *argument);
00143
00148 void task_Motor_Left(void *pvParameters);
00149
00154 void task_Motor_Right(void *pvParameters);
00155
00160 void task_VL53(void *pvParameters);
00161
00170 void task_Grove_LCD(void *pvParameters);
00171
00186 void task_Supervision(void *pvParameters);
00187
00190 void test_uart2(void *pvParameters);
00192 void test_vl53(void *pvParameters);
00194 void test_motor(void *pvParameters);
00214 int main(void);
00215
00216 /* USER CODE END EFP */
00217
00218 /* Private defines -----*/
00219 #define B1_Pin GPIO_PIN_13
00220 #define B1_GPIO_Port GPIOC
00221 #define USART_TX_Pin GPIO_PIN_2
00222 #define USART_TX_GPIO_Port GPIOA
00223 #define USART_RX_Pin GPIO_PIN_3
00224 #define USART_RX_GPIO_Port GPIOA
00225 #define LD2_Pin GPIO_PIN_5
00226 #define LD2_GPIO_Port GPIOA
00227 #define TMS_Pin GPIO_PIN_13
00228 #define TMS_GPIO_Port GPIOA
00229 #define TCK_Pin GPIO_PIN_14
00230 #define TCK_GPIO_Port GPIOA
00231 #define SWO_Pin GPIO_PIN_3
00232 #define SWO_GPIO_Port GPIOB
00233 /* USER CODE BEGIN Private defines */
00234
00235 /* USER CODE END Private defines */
00236
00237 #ifdef __cplusplus
00238 }
00239 #endif
00240
00241 #endif /* __MAIN_H */

```

5.10 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Inc/microROS.h File Reference

: Contain microROS topic and default custom creator for subscriber and publisher

```
#include "main.h"
```

Macros

- #define ARRAY_LEN 100
- #define CAPTEUR_DIR_TOPIC "capteur/dir"
- #define ETAT_MODE_TOPIC "etat/mode"
- #define ETAT_SPEED_TOPIC "etat/speed"
- #define CAMERA_X_TOPIC "camera/X"
- #define CAMERA_Y_TOPIC "camera/Y"
- #define TELECOMMANDE_DIR_TOPIC "direction"
- #define CONFIG_MODE_TOPIC "mode"
- #define CONFIG_SPEED_TOPIC "speed"

Functions

- void [createPublisher](#) (rcl_publisher_t *publisher, const rcl_node_t *node, const rosidl_message_type_support_t *type_support, const char *topic_name, std_msgs__msg__Int32 *msg)
- void [createSubscriber](#) (rcl_subscription_t *subscription, rcl_node_t *node, const rosidl_message_type_support_t *type_support, const char *topic_name, std_msgs__msg__Int32 *msg)

5.10.1 Detailed Description

: Contain microROS topic and default custom creator for subscriber and publisher

Definition in file [microROS.h](#).

5.10.2 Macro Definition Documentation

5.10.2.1 ARRAY_LEN

```
#define ARRAY_LEN 100
```

Length of string messages

Definition at line 10 of file [microROS.h](#).

5.10.2.2 CAMERA_X_TOPIC

```
#define CAMERA_X_TOPIC "camera/X"
```

Topic name of x camera subscriber

Definition at line 14 of file [microROS.h](#).

5.10.2.3 CAMERA_Y_TOPIC

```
#define CAMERA_Y_TOPIC "camera/Y"
```

Topic name of y camera subscriber

Definition at line 15 of file [microROS.h](#).

5.10.2.4 CAPTEUR_DIR_TOPIC

```
#define CAPTEUR_DIR_TOPIC "capteur/dir"
```

Topic name of direction publisher

Definition at line 11 of file [microROS.h](#).

5.10.2.5 CONFIG_MODE_TOPIC

```
#define CONFIG_MODE_TOPIC "mode"
```

Definition at line 17 of file [microROS.h](#).

5.10.2.6 CONFIG_SPEED_TOPIC

```
#define CONFIG_SPEED_TOPIC "speed"
```

Definition at line 18 of file [microROS.h](#).

5.10.2.7 ETAT_MODE_TOPIC

```
#define ETAT_MODE_TOPIC "etat/mode"
```

Topic name of mode publisher

Definition at line 12 of file [microROS.h](#).

5.10.2.8 ETAT_SPEED_TOPIC

```
#define ETAT_SPEED_TOPIC "etat/speed"
```

Topic name of speed publisher

Definition at line 13 of file [microROS.h](#).

5.10.2.9 TELECOMMANDE_DIR_TOPIC

```
#define TELECOMMANDE_DIR_TOPIC "direction"
```

Definition at line 16 of file [microROS.h](#).

5.10.3 Function Documentation

5.10.3.1 createPublisher()

```
void createPublisher (
    rcl_publisher_t * publisher,
    const rcl_node_t * node,
    const rosidl_message_type_support_t * type_support,
    const char * topic_name,
    std_msgs__msg__Int32 * msg )
```

Create a publisher with default options

Parameters

<i>publisher</i>	microRos structure that represent a publisher
<i>node</i>	microRos structure that represent a node
<i>type_support</i>	microRos structure that represent the type of message
<i>topic_name</i>	The name of the topic
<i>msg</i>	microRos structure that represent the message

Definition at line 10 of file [microROS.c](#).

5.10.3.2 createSubscriber()

```
void createSubscriber (
    rcl_subscription_t * subscription,
    rcl_node_t * node,
    const rosidl_message_type_support_t * type_support,
    const char * topic_name,
    std_msgs__msg__Int32 * msg )
```

Create a subscriber with default options

Parameters

<i>subscription</i>	microRos structure that represent a subscriber
<i>node</i>	microRos structure that represent a node
<i>type_support</i>	microRos structure that represent the type of message
<i>topic_name</i>	The name of the topic
<i>msg</i>	microRos structure that represent the message

Definition at line 29 of file [microROS.c](#).

5.11 microROS.h

[Go to the documentation of this file.](#)

```
00001
00006 #ifndef DEF_MICROROS
00007 #define DEF_MICROROS
00008
00009     #include "main.h"
00010     #define ARRAY_LEN 100
00011     #define CAPTEUR_DIR_TOPIC "capteur/dir"
00012     #define ETAT_MODE_TOPIC "etat/mode"
00013     #define ETAT_SPEED_TOPIC "etat/speed"
00014     #define CAMERA_X_TOPIC "camera/X"
00015     #define CAMERA_Y_TOPIC "camera/Y"
00016     #define TELECOMMANDE_DIR_TOPIC "direction" // "telecommande/dir"
00017     #define CONFIG_MODE_TOPIC "mode" // "config/mode"
00018     #define CONFIG_SPEED_TOPIC "speed" // "config/speed"
00019
00028     void createPublisher(rcl_publisher_t* publisher,
00029                         const rcl_node_t* node,
00030                         const rosidl_message_type_support_t* type_support,
00031                         const char* topic_name,
00032                         std_msgs__msg__Int32* msg);
00033
00042     void createSubscriber(rcl_subscription_t* subscription,
00043                         rcl_node_t* node,
```

```

00044         const rosidl_message_type_support_t* type_support,
00045         const char* topic_name,
00046         std_msgs__msg__Int32* msg);
00047
00048 #endif //DEF_MICROS

```

5.12 motorCommand.h

```

00001 /*
00002  * MotorCommand.h
00003  */
00004
00005 #ifndef INC_MOTORCOMMAND_H_
00006 #define INC_MOTORCOMMAND_H_
00007
00008 #include "main.h"
00009
00010
00011 void motorCommand_Init(void);
00012 void motorLeft_SetDuty(int);
00013 void motorRight_SetDuty(int);
00014
00015
00016
00017 #endif /* INC_MOTORCOMMAND_H_ */

```

5.13 quadEncoder.h

```

00001 /*
00002  * QuadEncoder.h
00003  */
00004
00005 #ifndef INC_QUADENCODER_H_
00006 #define INC_QUADENCODER_H_
00007
00008 #include "main.h"
00009
00010 void quadEncoder_Init(void);
00011 int16_t quadEncoder_GetPos16L(void);
00012 int16_t quadEncoder_GetPos16R(void);
00013 int32_t quadEncoder_GetPos32L(void);
00014 int32_t quadEncoder_GetPos32R(void);
00015 int16_t quadEncoder_GetSpeedL(void);
00016 int16_t quadEncoder_GetSpeedR(void);
00017 void quadEncoder_CallbackIndexL(void);
00018 void quadEncoder_CallbackIndexR(void);
00019 void quadEncoder_PosCalcL(int*);
00020 void quadEncoder_PosCalcR(int*);
00021
00022 #endif /* INC_QUADENCODER_H_ */

```

5.14 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_↔ Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Inc/retarget.h File Reference

: Contain function to add printf and scanf function use the UART2 All credit to Carmine Noviello for this code <https://github.com/cnoviello/mastering-stm32/blob/master/nucleo-f030↔R8/system/src/retarget/>

```

#include "stm32f4xx_hal.h"
#include <sys/stat.h>

```

Functions

- void [RetargetInit](#) (UART_HandleTypeDef *huart)
- int [_isatty](#) (int fd)
- int [_write](#) (int fd, char *ptr, int len)
- int [_close](#) (int fd)
- int [_lseek](#) (int fd, int ptr, int dir)
- int [_read](#) (int fd, char *ptr, int len)
- int [_fstat](#) (int fd, struct stat *st)
- int [_getpid](#) (void)
- int [_kill](#) (int pid, int sig)

5.14.1 Detailed Description

: Contain function to add printf and scanf function use the UART2 All credit to Carmine Noviello for this code <https://github.com/cnoviello/mastering-stm32/blob/master/nucleo-f030R8/system/src/retarget/>

Definition in file [retarget.h](#).

5.14.2 Macro Definition Documentation

5.14.2.1 `__RETARGET_H__`

```
#define __RETARGET_H__
```

Definition at line 12 of file [retarget.h](#).

5.14.3 Function Documentation

5.14.3.1 `_close()`

```
int _close (  
    int fd )
```

Definition at line 57 of file [retarget.c](#).

5.14.3.2 `_fstat()`

```
int _fstat (  
    int fd,  
    struct stat * st )
```

Definition at line 88 of file [retarget.c](#).

5.14.3.3 `_getpid()`

```
int _getpid (
    void )
```

Definition at line 98 of file [retarget.c](#).

5.14.3.4 `_isatty()`

```
int _isatty (
    int fd )
```

Definition at line 35 of file [retarget.c](#).

5.14.3.5 `_kill()`

```
int _kill (
    int pid,
    int sig )
```

Definition at line 103 of file [retarget.c](#).

5.14.3.6 `_lseek()`

```
int _lseek (
    int fd,
    int ptr,
    int dir )
```

Definition at line 65 of file [retarget.c](#).

5.14.3.7 `_read()`

```
int _read (
    int fd,
    char * ptr,
    int len )
```

Definition at line 74 of file [retarget.c](#).

5.14.3.8 `_write()`

```
int _write (
    int fd,
    char * ptr,
    int len )
```

Definition at line 43 of file [retarget.c](#).

5.14.3.9 `RetargetInit()`

```
void RetargetInit (
    UART_HandleTypeDef * huart )
```

Reconfigure stdin, stdout and stderr to use UART

Parameters

<i>huart</i>	Structure wich represent an UART
--------------	----------------------------------

Definition at line 27 of file [retarget.c](#).

5.15 retarget.h

[Go to the documentation of this file.](#)

```

00001
00008 #ifndef INC_RETARGET_H_
00009 #define INC_RETARGET_H_
00010
00011 #ifndef _RETARGET_H_
00012 #define _RETARGET_H_
00013
00014 #include "stm32f4xx_hal.h"
00015 #include <sys/stat.h>
00016
00021 void RetargetInit(UART_HandleTypeDef *huart);
00022 int _isatty(int fd);
00023 int _write(int fd, char* ptr, int len);
00024 int _close(int fd);
00025 int _lseek(int fd, int ptr, int dir);
00026 int _read(int fd, char* ptr, int len);
00027 int _fstat(int fd, struct stat* st);
00028 int _getpid(void);
00029 int _kill(int pid, int sig);
00030
00031 #endif //ifndef _RETARGET_H_
00032
00033 #endif /* INC_RETARGET_H_ */

```

5.16 stm32f4xx_hal_conf.h

```

00001 /* USER CODE BEGIN Header */
00021 /* USER CODE END Header */
00022
00023 /* Define to prevent recursive inclusion -----*/
00024 #ifndef __STM32F4xx_HAL_CONF_H
00025 #define __STM32F4xx_HAL_CONF_H
00026
00027 #ifdef __cplusplus
00028 extern "C" {
00029 #endif
00030
00031 /* Exported types -----*/
00032 /* Exported constants -----*/
00033
00034 /* ##### Module Selection ##### */
00038 #define HAL_MODULE_ENABLED
00039
00040 #define HAL_ADC_MODULE_ENABLED
00041 /* #define HAL_CRYP_MODULE_ENABLED */
00042 /* #define HAL_CAN_MODULE_ENABLED */
00043 /* #define HAL_CRC_MODULE_ENABLED */
00044 /* #define HAL_CAN_LEGACY_MODULE_ENABLED */
00045 /* #define HAL_CRYP_MODULE_ENABLED */
00046 /* #define HAL_DAC_MODULE_ENABLED */
00047 /* #define HAL_DCMI_MODULE_ENABLED */
00048 /* #define HAL_DMA2D_MODULE_ENABLED */
00049 /* #define HAL_ETH_MODULE_ENABLED */
00050 /* #define HAL_NAND_MODULE_ENABLED */
00051 /* #define HAL_NOR_MODULE_ENABLED */
00052 /* #define HAL_PCCARD_MODULE_ENABLED */
00053 /* #define HAL_SRAM_MODULE_ENABLED */
00054 /* #define HAL_SDRAM_MODULE_ENABLED */
00055 /* #define HAL_HASH_MODULE_ENABLED */
00056 #define HAL_I2C_MODULE_ENABLED
00057 /* #define HAL_I2S_MODULE_ENABLED */
00058 /* #define HAL_IWDG_MODULE_ENABLED */
00059 /* #define HAL_LTDC_MODULE_ENABLED */
00060 /* #define HAL_RNG_MODULE_ENABLED */

```

```

00061 /* #define HAL_RTC_MODULE_ENABLED */
00062 /* #define HAL_SAI_MODULE_ENABLED */
00063 /* #define HAL_SD_MODULE_ENABLED */
00064 /* #define HAL_MMC_MODULE_ENABLED */
00065 /* #define HAL_SPI_MODULE_ENABLED */
00066 #define HAL_TIM_MODULE_ENABLED
00067 #define HAL_UART_MODULE_ENABLED
00068 /* #define HAL_USART_MODULE_ENABLED */
00069 /* #define HAL_IRDA_MODULE_ENABLED */
00070 /* #define HAL_SMARTCARD_MODULE_ENABLED */
00071 /* #define HAL_SMBUS_MODULE_ENABLED */
00072 /* #define HAL_WWDG_MODULE_ENABLED */
00073 /* #define HAL_PCD_MODULE_ENABLED */
00074 /* #define HAL_HCD_MODULE_ENABLED */
00075 /* #define HAL_DSI_MODULE_ENABLED */
00076 /* #define HAL_QSPI_MODULE_ENABLED */
00077 /* #define HAL_QSPI_MODULE_ENABLED */
00078 /* #define HAL_CEC_MODULE_ENABLED */
00079 /* #define HAL_FMPI2C_MODULE_ENABLED */
00080 /* #define HAL_FMPMBUS_MODULE_ENABLED */
00081 /* #define HAL_SPDIFRX_MODULE_ENABLED */
00082 /* #define HAL_DFSDM_MODULE_ENABLED */
00083 /* #define HAL_LPTIM_MODULE_ENABLED */
00084 #define HAL_GPIO_MODULE_ENABLED
00085 #define HAL_EXTI_MODULE_ENABLED
00086 #define HAL_DMA_MODULE_ENABLED
00087 #define HAL_RCC_MODULE_ENABLED
00088 #define HAL_FLASH_MODULE_ENABLED
00089 #define HAL_PWR_MODULE_ENABLED
00090 #define HAL_CORTEX_MODULE_ENABLED
00091
00092 /* ##### HSE/HSI Values adaptation ##### */
00093 #if !defined (HSE_VALUE)
00094     #define HSE_VALUE      8000000U
00095 #endif /* HSE_VALUE */
00096
00097 #if !defined (HSE_STARTUP_TIMEOUT)
00098     #define HSE_STARTUP_TIMEOUT    100U
00099 #endif /* HSE_STARTUP_TIMEOUT */
00100
00101 #if !defined (HSI_VALUE)
00102     #define HSI_VALUE      ((uint32_t)16000000U)
00103 #endif /* HSI_VALUE */
00104
00105 #if !defined (LSI_VALUE)
00106     #define LSI_VALUE      32000U
00107 #endif /* LSI_VALUE */
00108
00109 #if !defined (LSE_VALUE)
00110     #define LSE_VALUE      32768U
00111 #endif /* LSE_VALUE */
00112
00113 #if !defined (LSE_STARTUP_TIMEOUT)
00114     #define LSE_STARTUP_TIMEOUT    5000U
00115 #endif /* LSE_STARTUP_TIMEOUT */
00116
00117 #if !defined (EXTERNAL_CLOCK_VALUE)
00118     #define EXTERNAL_CLOCK_VALUE    12288000U
00119 #endif /* EXTERNAL_CLOCK_VALUE */
00120
00121 /* Tip: To avoid modifying this file each time you need to use different HSE,
00122    === you can define the HSE value in your toolchain compiler preprocessor. */
00123
00124 /* ##### System Configuration ##### */
00125 #define VDD_VALUE      3300U
00126 #define TICK_INT_PRIORITY      15U
00127 #define USE_RTOS      0U
00128 #define PREFETCH_ENABLE      1U
00129 #define INSTRUCTION_CACHE_ENABLE      1U
00130 #define DATA_CACHE_ENABLE      1U
00131
00132 #define USE_HAL_ADC_REGISTER_CALLBACKS      0U /* ADC register callback disabled */
00133 #define USE_HAL_CAN_REGISTER_CALLBACKS      0U /* CAN register callback disabled */
00134 #define USE_HAL_CEC_REGISTER_CALLBACKS      0U /* CEC register callback disabled */
00135 #define USE_HAL_Cryp_REGISTER_CALLBACKS      0U /* CRYP register callback disabled */
00136 #define USE_HAL_DAC_REGISTER_CALLBACKS      0U /* DAC register callback disabled */
00137 #define USE_HAL_DCMI_REGISTER_CALLBACKS      0U /* DCMI register callback disabled */
00138 #define USE_HAL_DFSDM_REGISTER_CALLBACKS      0U /* DFSDM register callback disabled */
00139 #define USE_HAL_DMA2D_REGISTER_CALLBACKS      0U /* DMA2D register callback disabled */
00140 #define USE_HAL_DSI_REGISTER_CALLBACKS      0U /* DSI register callback disabled */
00141 #define USE_HAL_ETH_REGISTER_CALLBACKS      0U /* ETH register callback disabled */
00142 #define USE_HAL_HASH_REGISTER_CALLBACKS      0U /* HASH register callback disabled */
00143 #define USE_HAL_HCD_REGISTER_CALLBACKS      0U /* HCD register callback disabled */
00144 #define USE_HAL_I2C_REGISTER_CALLBACKS      0U /* I2C register callback disabled */
00145 #define USE_HAL_FMPI2C_REGISTER_CALLBACKS      0U /* FMPI2C register callback disabled */
00146 #define USE_HAL_FMPMBUS_REGISTER_CALLBACKS      0U /* FMPMBUS register callback disabled */
00147 #define USE_HAL_I2S_REGISTER_CALLBACKS      0U /* I2S register callback disabled */
00148 #define USE_HAL_IRDA_REGISTER_CALLBACKS      0U /* IRDA register callback disabled */

```

```

00174 #define USE_HAL_LPTIM_REGISTER_CALLBACKS 0U /* LPTIM register callback disabled */
00175 #define USE_HAL_LTDC_REGISTER_CALLBACKS 0U /* LTDC register callback disabled */
00176 #define USE_HAL_MMC_REGISTER_CALLBACKS 0U /* MMC register callback disabled */
00177 #define USE_HAL_NAND_REGISTER_CALLBACKS 0U /* NAND register callback disabled */
00178 #define USE_HAL_NOR_REGISTER_CALLBACKS 0U /* NOR register callback disabled */
00179 #define USE_HAL_PCCARD_REGISTER_CALLBACKS 0U /* PCCARD register callback disabled */
00180 #define USE_HAL_PCD_REGISTER_CALLBACKS 0U /* PCD register callback disabled */
00181 #define USE_HAL_QSPI_REGISTER_CALLBACKS 0U /* QSPI register callback disabled */
00182 #define USE_HAL_RNG_REGISTER_CALLBACKS 0U /* RNG register callback disabled */
00183 #define USE_HAL_RTC_REGISTER_CALLBACKS 0U /* RTC register callback disabled */
00184 #define USE_HAL_SAI_REGISTER_CALLBACKS 0U /* SAI register callback disabled */
00185 #define USE_HAL_SD_REGISTER_CALLBACKS 0U /* SD register callback disabled */
00186 #define USE_HAL_SMARTCARD_REGISTER_CALLBACKS 0U /* SMARTCARD register callback disabled */
00187 #define USE_HAL_SDRAM_REGISTER_CALLBACKS 0U /* SDRAM register callback disabled */
00188 #define USE_HAL_SRAM_REGISTER_CALLBACKS 0U /* SRAM register callback disabled */
00189 #define USE_HAL_SPDIFRX_REGISTER_CALLBACKS 0U /* SPDIFRX register callback disabled */
00190 #define USE_HAL_SMBUS_REGISTER_CALLBACKS 0U /* SMBUS register callback disabled */
00191 #define USE_HAL_SPI_REGISTER_CALLBACKS 0U /* SPI register callback disabled */
00192 #define USE_HAL_TIM_REGISTER_CALLBACKS 0U /* TIM register callback disabled */
00193 #define USE_HAL_UART_REGISTER_CALLBACKS 0U /* UART register callback disabled */
00194 #define USE_HAL_USART_REGISTER_CALLBACKS 0U /* USART register callback disabled */
00195 #define USE_HAL_WWDG_REGISTER_CALLBACKS 0U /* WWDG register callback disabled */
00196
00197 /* ##### Assert Selection ##### */
00202 /* #define USE_FULL_ASSERT 1U */
00203
00204 /* ##### Ethernet peripheral configuration ##### */
00205
00206 /* Section 1 : Ethernet peripheral configuration */
00207
00208 /* MAC ADDRESS: MAC_ADDR0:MAC_ADDR1:MAC_ADDR2:MAC_ADDR3:MAC_ADDR4:MAC_ADDR5 */
00209 #define MAC_ADDR0 2U
00210 #define MAC_ADDR1 0U
00211 #define MAC_ADDR2 0U
00212 #define MAC_ADDR3 0U
00213 #define MAC_ADDR4 0U
00214 #define MAC_ADDR5 0U
00215
00216 /* Definition of the Ethernet driver buffers size and count */
00217 #define ETH_RX_BUF_SIZE ETH_MAX_PACKET_SIZE /* buffer size for receive */
00218 #define ETH_TX_BUF_SIZE ETH_MAX_PACKET_SIZE /* buffer size for transmit */
00219 #define ETH_RXBUFNB 4U /* 4 Rx buffers of size ETH_RX_BUF_SIZE */
00220 #define ETH_TXBUFNB 4U /* 4 Tx buffers of size ETH_TX_BUF_SIZE */
00221
00222 /* Section 2: PHY configuration section */
00223
00224 /* DP83848_PHY_ADDRESS Address*/
00225 #define DP83848_PHY_ADDRESS 0x01U
00226 /* PHY Reset delay these values are based on a 1 ms Systick interrupt*/
00227 #define PHY_RESET_DELAY 0x000000FFU
00228 /* PHY Configuration delay */
00229 #define PHY_CONFIG_DELAY 0x000000FFU
00230
00231 #define PHY_READ_TO 0x0000FFFFU
00232 #define PHY_WRITE_TO 0x0000FFFFU
00233
00234 /* Section 3: Common PHY Registers */
00235
00236 #define PHY_BCR ((uint16_t)0x0000U)
00237 #define PHY_BSR ((uint16_t)0x0001U)
00239 #define PHY_RESET ((uint16_t)0x8000U)
00240 #define PHY_LOOPBACK ((uint16_t)0x4000U)
00241 #define PHY_FULLDUPLEX_100M ((uint16_t)0x2100U)
00242 #define PHY_HALFDUPLEX_100M ((uint16_t)0x2000U)
00243 #define PHY_FULLDUPLEX_10M ((uint16_t)0x0100U)
00244 #define PHY_HALFDUPLEX_10M ((uint16_t)0x0000U)
00245 #define PHY_AUTONEGOTIATION ((uint16_t)0x1000U)
00246 #define PHY_RESTART_AUTONEGOTIATION ((uint16_t)0x0200U)
00247 #define PHY_POWERDOWN ((uint16_t)0x0800U)
00248 #define PHY_ISOLATE ((uint16_t)0x0400U)
00250 #define PHY_AUTONEGO_COMPLETE ((uint16_t)0x0020U)
00251 #define PHY_LINKED_STATUS ((uint16_t)0x0004U)
00252 #define PHY_JABBER_DETECTION ((uint16_t)0x0002U)
00254 /* Section 4: Extended PHY Registers */
00255 #define PHY_SR ((uint16_t)0x10U)
00257 #define PHY_SPEED_STATUS ((uint16_t)0x0002U)
00258 #define PHY_DUPLEX_STATUS ((uint16_t)0x0004U)
00260 /* ##### SPI peripheral configuration ##### */
00261
00262 /* CRC FEATURE: Use to activate CRC feature inside HAL SPI Driver
00263 * Activated: CRC code is present inside driver
00264 * Deactivated: CRC code cleaned from driver
00265 */
00266
00267 #define USE_SPI_CRC 0U
00268
00269 /* Includes -----*/

```



```
00274 #ifndef HAL_RCC_MODULE_ENABLED
00275     #include "stm32f4xx_hal_rcc.h"
00276 #endif /* HAL_RCC_MODULE_ENABLED */
00277
00278 #ifndef HAL_GPIO_MODULE_ENABLED
00279     #include "stm32f4xx_hal_gpio.h"
00280 #endif /* HAL_GPIO_MODULE_ENABLED */
00281
00282 #ifndef HAL_EXTI_MODULE_ENABLED
00283     #include "stm32f4xx_hal_exti.h"
00284 #endif /* HAL_EXTI_MODULE_ENABLED */
00285
00286 #ifndef HAL_DMA_MODULE_ENABLED
00287     #include "stm32f4xx_hal_dma.h"
00288 #endif /* HAL_DMA_MODULE_ENABLED */
00289
00290 #ifndef HAL_CORTEX_MODULE_ENABLED
00291     #include "stm32f4xx_hal_cortex.h"
00292 #endif /* HAL_CORTEX_MODULE_ENABLED */
00293
00294 #ifndef HAL_ADC_MODULE_ENABLED
00295     #include "stm32f4xx_hal_adc.h"
00296 #endif /* HAL_ADC_MODULE_ENABLED */
00297
00298 #ifndef HAL_CAN_MODULE_ENABLED
00299     #include "stm32f4xx_hal_can.h"
00300 #endif /* HAL_CAN_MODULE_ENABLED */
00301
00302 #ifndef HAL_CAN_LEGACY_MODULE_ENABLED
00303     #include "stm32f4xx_hal_can_legacy.h"
00304 #endif /* HAL_CAN_LEGACY_MODULE_ENABLED */
00305
00306 #ifndef HAL_CRC_MODULE_ENABLED
00307     #include "stm32f4xx_hal_crc.h"
00308 #endif /* HAL_CRC_MODULE_ENABLED */
00309
00310 #ifndef HAL_Cryp_MODULE_ENABLED
00311     #include "stm32f4xx_hal_cryp.h"
00312 #endif /* HAL_Cryp_MODULE_ENABLED */
00313
00314 #ifndef HAL_DMA2D_MODULE_ENABLED
00315     #include "stm32f4xx_hal_dma2d.h"
00316 #endif /* HAL_DMA2D_MODULE_ENABLED */
00317
00318 #ifndef HAL_DAC_MODULE_ENABLED
00319     #include "stm32f4xx_hal_dac.h"
00320 #endif /* HAL_DAC_MODULE_ENABLED */
00321
00322 #ifndef HAL_DCMI_MODULE_ENABLED
00323     #include "stm32f4xx_hal_dcmi.h"
00324 #endif /* HAL_DCMI_MODULE_ENABLED */
00325
00326 #ifndef HAL_ETH_MODULE_ENABLED
00327     #include "stm32f4xx_hal_eth.h"
00328 #endif /* HAL_ETH_MODULE_ENABLED */
00329
00330 #ifndef HAL_FLASH_MODULE_ENABLED
00331     #include "stm32f4xx_hal_flash.h"
00332 #endif /* HAL_FLASH_MODULE_ENABLED */
00333
00334 #ifndef HAL_SRAM_MODULE_ENABLED
00335     #include "stm32f4xx_hal_sram.h"
00336 #endif /* HAL_SRAM_MODULE_ENABLED */
00337
00338 #ifndef HAL_NOR_MODULE_ENABLED
00339     #include "stm32f4xx_hal_nor.h"
00340 #endif /* HAL_NOR_MODULE_ENABLED */
00341
00342 #ifndef HAL_NAND_MODULE_ENABLED
00343     #include "stm32f4xx_hal_nand.h"
00344 #endif /* HAL_NAND_MODULE_ENABLED */
00345
00346 #ifndef HAL_PCCARD_MODULE_ENABLED
00347     #include "stm32f4xx_hal_pccard.h"
00348 #endif /* HAL_PCCARD_MODULE_ENABLED */
00349
00350 #ifndef HAL_SDRAM_MODULE_ENABLED
00351     #include "stm32f4xx_hal_sdram.h"
00352 #endif /* HAL_SDRAM_MODULE_ENABLED */
00353
00354 #ifndef HAL_HASH_MODULE_ENABLED
00355     #include "stm32f4xx_hal_hash.h"
00356 #endif /* HAL_HASH_MODULE_ENABLED */
00357
00358 #ifndef HAL_I2C_MODULE_ENABLED
00359     #include "stm32f4xx_hal_i2c.h"
00360 #endif /* HAL_I2C_MODULE_ENABLED */
```

```
00361
00362 #ifndef HAL_SMBUS_MODULE_ENABLED
00363 #include "stm32f4xx_hal_smbus.h"
00364 #endif /* HAL_SMBUS_MODULE_ENABLED */
00365
00366 #ifndef HAL_I2S_MODULE_ENABLED
00367 #include "stm32f4xx_hal_i2s.h"
00368 #endif /* HAL_I2S_MODULE_ENABLED */
00369
00370 #ifndef HAL_IWDG_MODULE_ENABLED
00371 #include "stm32f4xx_hal_iwdg.h"
00372 #endif /* HAL_IWDG_MODULE_ENABLED */
00373
00374 #ifndef HAL_LTDC_MODULE_ENABLED
00375 #include "stm32f4xx_hal_ltdc.h"
00376 #endif /* HAL_LTDC_MODULE_ENABLED */
00377
00378 #ifndef HAL_PWR_MODULE_ENABLED
00379 #include "stm32f4xx_hal_pwr.h"
00380 #endif /* HAL_PWR_MODULE_ENABLED */
00381
00382 #ifndef HAL_RNG_MODULE_ENABLED
00383 #include "stm32f4xx_hal_rng.h"
00384 #endif /* HAL_RNG_MODULE_ENABLED */
00385
00386 #ifndef HAL_RTC_MODULE_ENABLED
00387 #include "stm32f4xx_hal_rtc.h"
00388 #endif /* HAL_RTC_MODULE_ENABLED */
00389
00390 #ifndef HAL_SAI_MODULE_ENABLED
00391 #include "stm32f4xx_hal_sai.h"
00392 #endif /* HAL_SAI_MODULE_ENABLED */
00393
00394 #ifndef HAL_SD_MODULE_ENABLED
00395 #include "stm32f4xx_hal_sd.h"
00396 #endif /* HAL_SD_MODULE_ENABLED */
00397
00398 #ifndef HAL_SPI_MODULE_ENABLED
00399 #include "stm32f4xx_hal_spi.h"
00400 #endif /* HAL_SPI_MODULE_ENABLED */
00401
00402 #ifndef HAL_TIM_MODULE_ENABLED
00403 #include "stm32f4xx_hal_tim.h"
00404 #endif /* HAL_TIM_MODULE_ENABLED */
00405
00406 #ifndef HAL_UART_MODULE_ENABLED
00407 #include "stm32f4xx_hal_uart.h"
00408 #endif /* HAL_UART_MODULE_ENABLED */
00409
00410 #ifndef HAL_USART_MODULE_ENABLED
00411 #include "stm32f4xx_hal_usart.h"
00412 #endif /* HAL_USART_MODULE_ENABLED */
00413
00414 #ifndef HAL_IRDA_MODULE_ENABLED
00415 #include "stm32f4xx_hal_irda.h"
00416 #endif /* HAL_IRDA_MODULE_ENABLED */
00417
00418 #ifndef HAL_SMARTCARD_MODULE_ENABLED
00419 #include "stm32f4xx_hal_smartcard.h"
00420 #endif /* HAL_SMARTCARD_MODULE_ENABLED */
00421
00422 #ifndef HAL_WWDG_MODULE_ENABLED
00423 #include "stm32f4xx_hal_wwdg.h"
00424 #endif /* HAL_WWDG_MODULE_ENABLED */
00425
00426 #ifndef HAL_PCD_MODULE_ENABLED
00427 #include "stm32f4xx_hal_pcd.h"
00428 #endif /* HAL_PCD_MODULE_ENABLED */
00429
00430 #ifndef HAL_HCD_MODULE_ENABLED
00431 #include "stm32f4xx_hal_hcd.h"
00432 #endif /* HAL_HCD_MODULE_ENABLED */
00433
00434 #ifndef HAL_DSI_MODULE_ENABLED
00435 #include "stm32f4xx_hal_dsi.h"
00436 #endif /* HAL_DSI_MODULE_ENABLED */
00437
00438 #ifndef HAL_QSPI_MODULE_ENABLED
00439 #include "stm32f4xx_hal_qspi.h"
00440 #endif /* HAL_QSPI_MODULE_ENABLED */
00441
00442 #ifndef HAL_CEC_MODULE_ENABLED
00443 #include "stm32f4xx_hal_cec.h"
00444 #endif /* HAL_CEC_MODULE_ENABLED */
00445
00446 #ifndef HAL_FMPI2C_MODULE_ENABLED
00447 #include "stm32f4xx_hal_fmpi2c.h"
```

```

00448 #endif /* HAL_FMPI2C_MODULE_ENABLED */
00449
00450 #ifdef HAL_FMPMBUS_MODULE_ENABLED
00451 #include "stm32f4xx_hal_fmpmbus.h"
00452 #endif /* HAL_FMPMBUS_MODULE_ENABLED */
00453
00454 #ifdef HAL_SPDIFRX_MODULE_ENABLED
00455 #include "stm32f4xx_hal_spdifrx.h"
00456 #endif /* HAL_SPDIFRX_MODULE_ENABLED */
00457
00458 #ifdef HAL_DFSDM_MODULE_ENABLED
00459 #include "stm32f4xx_hal_dfldm.h"
00460 #endif /* HAL_DFSDM_MODULE_ENABLED */
00461
00462 #ifdef HAL_LPTIM_MODULE_ENABLED
00463 #include "stm32f4xx_hal_lptim.h"
00464 #endif /* HAL_LPTIM_MODULE_ENABLED */
00465
00466 #ifdef HAL_MMC_MODULE_ENABLED
00467 #include "stm32f4xx_hal_mmc.h"
00468 #endif /* HAL_MMC_MODULE_ENABLED */
00469
00470 /* Exported macro -----*/
00471 #ifdef USE_FULL_ASSERT
00480 #define assert_param(expr) ((expr) ? (void)0U : assert_failed((uint8_t *)__FILE__, __LINE__))
00481 /* Exported functions ----- */
00482 void assert_failed(uint8_t* file, uint32_t line);
00483 #else
00484 #define assert_param(expr) ((void)0U)
00485 #endif /* USE_FULL_ASSERT */
00486
00487 #ifdef __cplusplus
00488 }
00489 #endif
00490
00491 #endif /* __STM32F4xx_HAL_CONF_H */

```

5.17 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Inc/stm32f4xx_it.h File Reference

This file contains the headers of the interrupt handlers.

Functions

- void [NMI_Handler](#) (void)
- void [HardFault_Handler](#) (void)
- void [MemManage_Handler](#) (void)
- void [BusFault_Handler](#) (void)
- void [UsageFault_Handler](#) (void)

This function handles Undefined instruction or illegal state.

- void [DebugMon_Handler](#) (void)
- void [DMA1_Stream5_IRQHandler](#) (void)
- void [DMA1_Stream6_IRQHandler](#) (void)
- void [TIM1_UP_TIM10_IRQHandler](#) (void)
- void [USART1_IRQHandler](#) (void)
- void [USART2_IRQHandler](#) (void)
- void [DMA2_Stream2_IRQHandler](#) (void)
- void [DMA2_Stream7_IRQHandler](#) (void)

5.17.1 Detailed Description

This file contains the headers of the interrupt handlers.

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Definition in file [stm32f4xx_it.h](#).

5.17.2 Function Documentation

5.17.2.1 BusFault_Handler()

```
void BusFault_Handler (  
    void )
```

Definition at line 38 of file [stm32f4xx_it.c](#).

5.17.2.2 DebugMon_Handler()

```
void DebugMon_Handler (  
    void )
```

Definition at line 55 of file [stm32f4xx_it.c](#).

5.17.2.3 DMA1_Stream5_IRQHandler()

```
void DMA1_Stream5_IRQHandler (  
    void )
```

Definition at line 66 of file [stm32f4xx_it.c](#).

5.17.2.4 DMA1_Stream6_IRQHandler()

```
void DMA1_Stream6_IRQHandler (  
    void )
```

Definition at line 72 of file [stm32f4xx_it.c](#).

5.17.2.5 DMA2_Stream2_IRQHandler()

```
void DMA2_Stream2_IRQHandler (
    void )
```

Definition at line 97 of file [stm32f4xx_it.c](#).

5.17.2.6 DMA2_Stream7_IRQHandler()

```
void DMA2_Stream7_IRQHandler (
    void )
```

Definition at line 102 of file [stm32f4xx_it.c](#).

5.17.2.7 HardFault_Handler()

```
void HardFault_Handler (
    void )
```

Definition at line 22 of file [stm32f4xx_it.c](#).

5.17.2.8 MemManage_Handler()

```
void MemManage_Handler (
    void )
```

Definition at line 30 of file [stm32f4xx_it.c](#).

5.17.2.9 NMI_Handler()

```
void NMI_Handler (
    void )
```

Definition at line 15 of file [stm32f4xx_it.c](#).

5.17.2.10 UsageFault_Handler()

```
void UsageFault_Handler (
    void )
```

This function handles Undefined instruction or illegal state.

Definition at line 48 of file [stm32f4xx_it.c](#).

5.17.2.11 USART1_IRQHandler()

```
void USART1_IRQHandler (
    void )
```

Definition at line 87 of file [stm32f4xx_it.c](#).

5.17.2.12 USART2_IRQHandler()

```
void USART2_IRQHandler (
    void )
```

Definition at line 92 of file [stm32f4xx_it.c](#).

5.18 stm32f4xx_it.h

[Go to the documentation of this file.](#)

```
00001 /* USER CODE BEGIN Header */
00018 /* USER CODE END Header */
00019
00020 /* Define to prevent recursive inclusion -----*/
00021 #ifndef __STM32F4xx_IT_H
00022 #define __STM32F4xx_IT_H
00023
00024 #ifdef __cplusplus
00025     extern "C" {
00026 #endif
00027
00028 /* Private includes -----*/
00029 /* USER CODE BEGIN Includes */
00030
00031 /* USER CODE END Includes */
00032
00033 /* Exported types -----*/
00034 /* USER CODE BEGIN ET */
00035
00036 /* USER CODE END ET */
00037
00038 /* Exported constants -----*/
00039 /* USER CODE BEGIN EC */
00040
00041 /* USER CODE END EC */
00042
00043 /* Exported macro -----*/
00044 /* USER CODE BEGIN EM */
00045
00046 /* USER CODE END EM */
00047
00048 /* Exported functions prototypes -----*/
00049 void NMI_Handler(void);
00050 void HardFault_Handler(void);
00051 void MemManage_Handler(void);
00052 void BusFault_Handler(void);
00053 void UsageFault_Handler(void);
00054 void DebugMon_Handler(void);
00055 void DMA1_Stream5_IRQHandler(void);
00056 void DMA1_Stream6_IRQHandler(void);
00057 void TIM1_UP_TIM10_IRQHandler(void);
00058 void USART1_IRQHandler(void);
00059 void USART2_IRQHandler(void);
00060 void DMA2_Stream2_IRQHandler(void);
00061 void DMA2_Stream7_IRQHandler(void);
00062 /* USER CODE BEGIN EFP */
00063
00064 /* USER CODE END EFP */
00065
00066 #ifdef __cplusplus
00067 }
00068 #endif
00069
00070 #endif /* __STM32F4xx_IT_H */
```

5.19 systemclock.h

```

00001 /*
00002  * systemclock.h
00003  *
00004  * Created on: Mar 13, 2023
00005  * Author: kerhoas
00006  */
00007
00008 #ifndef INC_SYSTEMCLOCK_H_
00009 #define INC_SYSTEMCLOCK_H_
00010
00011 void SystemClock_Config(void);
00012
00013 #endif /* INC_SYSTEMCLOCK_H_ */

```

5.20 util.h

```

00001 /*
00002  * utils.h
00003  */
00004
00005 #ifndef INC_UTIL_H_
00006 #define INC_UTIL_H_
00007
00008 #include "main.h"
00009
00010 void num2str(char *s, unsigned int number, unsigned int base, unsigned int size, int sp);
00011 unsigned int str2num(char *s, unsigned base);
00012 void reverse(char *str, int len);
00013 int intToStr(int x, char str[], int d);
00014 void float2str(char *res, float n, int afterpoint);
00015 double myPow(double x, int n);
00016 void flush_ch(char* ch, int ch_size);
00017 int size_ch(char* ch, int ch_size_max);
00018
00019
00020 #endif /* INC_UTIL_H_ */

```

5.21 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_↔ Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Inc/VL53L0X.h File Reference

: VL53L0X API STSW-IMG005 portage Most of the functionality of this library is based on the VL53L0X API provided by ST (STSW-IMG005), and some of the explanatory comments are quoted or paraphrased from the API source code, API user manual (UM2039), and the VL53L0X datasheet.

Data Structures

- struct [statInfo_t](#)
- struct [SequenceStepEnables](#)
- struct [SequenceStepTimeouts](#)

Macros

- #define [ACTIVE_WHILE](#) 0
- #define [IO_2V8](#) 1
- #define [ADDRESS](#) 0x52
- #define [true](#) 1
- #define [false](#) 0
- #define [SYSRANGE_START](#) 0x00

- #define SYSTEM_THRESH_HIGH 0x0C
- #define SYSTEM_THRESH_LOW 0x0E
- #define SYSTEM_SEQUENCE_CONFIG 0x01
- #define SYSTEM_RANGE_CONFIG 0x09
- #define SYSTEM_INTERMEASUREMENT_PERIOD 0x04
- #define SYSTEM_INTERRUPT_GPIO_CONFIG 0x0A
- #define GPIO_HV_MUX_ACTIVE_HIGH 0x84
- #define SYSTEM_INTERRUPT_CLEAR 0x0B
- #define I2C_MODE 0x88
- #define RESULT_INTERRUPT_STATUS 0x13
- #define RESULT_RANGE_STATUS 0x14
- #define RESULT_CORE_AMBIENT_WINDOW_EVENTS_RTN 0xBC
- #define RESULT_CORE_RANGING_TOTAL_EVENTS_RTN 0xC0
- #define RESULT_CORE_AMBIENT_WINDOW_EVENTS_REF 0xD0
- #define RESULT_CORE_RANGING_TOTAL_EVENTS_REF 0xD4
- #define RESULT_PEAK_SIGNAL_RATE_REF 0xB6
- #define ALGO_PART_TO_PART_RANGE_OFFSET_MM 0x28
- #define MSRC_CONFIG_CONTROL 0x60
- #define PRE_RANGE_CONFIG_MIN_SNR 0x27
- #define PRE_RANGE_CONFIG_VALID_PHASE_LOW 0x56
- #define PRE_RANGE_CONFIG_VALID_PHASE_HIGH 0x57
- #define PRE_RANGE_MIN_COUNT_RATE_RTN_LIMIT 0x64
- #define FINAL_RANGE_CONFIG_MIN_SNR 0x67
- #define FINAL_RANGE_CONFIG_VALID_PHASE_LOW 0x47
- #define FINAL_RANGE_CONFIG_VALID_PHASE_HIGH 0x48
- #define FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT 0x44
- #define PRE_RANGE_CONFIG_SIGMA_THRESH_HI 0x61
- #define PRE_RANGE_CONFIG_SIGMA_THRESH_LO 0x62
- #define PRE_RANGE_CONFIG_VCSEL_PERIOD 0x50
- #define PRE_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x51
- #define PRE_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x52
- #define INTERNAL_TUNING_1 0x91
- #define INTERNAL_TUNING_2 0xFF
- #define SYSTEM_HISTOGRAM_BIN 0x81
- #define HISTOGRAM_CONFIG_INITIAL_PHASE_SELECT 0x33
- #define HISTOGRAM_CONFIG_READOUT_CTRL 0x55
- #define FINAL_RANGE_CONFIG_VCSEL_PERIOD 0x70
- #define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x71
- #define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x72
- #define CROSSTALK_COMPENSATION_PEAK_RATE_MCPS 0x20
- #define MSRC_CONFIG_TIMEOUT_MACROP 0x46
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF0 0xB0
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF1 0xB1
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF2 0xB2
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF3 0xB3
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF4 0xB4
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF5 0xB5
- #define GLOBAL_CONFIG_REF_EN_START_SELECT 0xB6
- #define DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD 0x4E
- #define DYNAMIC_SPAD_REF_EN_START_OFFSET 0x4F
- #define POWER_MANAGEMENT_GO1_POWER_FORCE 0x80
- #define VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV 0x89
- #define ALGO_PHASECAL_LIM 0x30
- #define ALGO_PHASECAL_CONFIG_TIMEOUT 0x30
- #define SYSTEM_THRESH_HIGH 0x0C

- #define SYSTEM_THRESH_LOW 0x0E
- #define SYSTEM_SEQUENCE_CONFIG 0x01
- #define SYSTEM_RANGE_CONFIG 0x09
- #define SYSTEM_INTERMEASUREMENT_PERIOD 0x04
- #define SYSTEM_INTERRUPT_CONFIG_GPIO 0x0A
- #define GPIO_HV_MUX_ACTIVE_HIGH 0x84
- #define SYSTEM_INTERRUPT_CLEAR 0x0B
- #define RESULT_INTERRUPT_STATUS 0x13
- #define RESULT_RANGE_STATUS 0x14
- #define RESULT_CORE_AMBIENT_WINDOW_EVENTS_RTN 0xBC
- #define RESULT_CORE_RANGING_TOTAL_EVENTS_RTN 0xC0
- #define RESULT_CORE_AMBIENT_WINDOW_EVENTS_REF 0xD0
- #define RESULT_CORE_RANGING_TOTAL_EVENTS_REF 0xD4
- #define RESULT_PEAK_SIGNAL_RATE_REF 0xB6
- #define ALGO_PART_TO_PART_RANGE_OFFSET_MM 0x28
- #define I2C_SLAVE_DEVICE_ADDRESS 0x8A
- #define MSRC_CONFIG_CONTROL 0x60
- #define PRE_RANGE_CONFIG_MIN_SNR 0x27
- #define PRE_RANGE_CONFIG_VALID_PHASE_LOW 0x56
- #define PRE_RANGE_CONFIG_VALID_PHASE_HIGH 0x57
- #define PRE_RANGE_MIN_COUNT_RATE_RTN_LIMIT 0x64
- #define FINAL_RANGE_CONFIG_MIN_SNR 0x67
- #define FINAL_RANGE_CONFIG_VALID_PHASE_LOW 0x47
- #define FINAL_RANGE_CONFIG_VALID_PHASE_HIGH 0x48
- #define FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT 0x44
- #define PRE_RANGE_CONFIG_SIGMA_THRESH_HI 0x61
- #define PRE_RANGE_CONFIG_SIGMA_THRESH_LO 0x62
- #define PRE_RANGE_CONFIG_VCSEL_PERIOD 0x50
- #define PRE_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x51
- #define PRE_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x52
- #define SYSTEM_HISTOGRAM_BIN 0x81
- #define HISTOGRAM_CONFIG_INITIAL_PHASE_SELECT 0x33
- #define HISTOGRAM_CONFIG_READOUT_CTRL 0x55
- #define FINAL_RANGE_CONFIG_VCSEL_PERIOD 0x70
- #define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x71
- #define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x72
- #define CROSSTALK_COMPENSATION_PEAK_RATE_MCPS 0x20
- #define MSRC_CONFIG_TIMEOUT_MACROP 0x46
- #define SOFT_RESET_GO2_SOFT_RESET_N 0xBF
- #define IDENTIFICATION_MODEL_ID 0xC0
- #define IDENTIFICATION_REVISION_ID 0xC2
- #define OSC_CALIBRATE_VAL 0xF8
- #define GLOBAL_CONFIG_VCSEL_WIDTH 0x32
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF_0 0xB0
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF_1 0xB1
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF_2 0xB2
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF_3 0xB3
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF_4 0xB4
- #define GLOBAL_CONFIG_SPAD_ENABLES_REF_5 0xB5
- #define GLOBAL_CONFIG_REF_EN_START_SELECT 0xB6
- #define DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD 0x4E
- #define DYNAMIC_SPAD_REF_EN_START_OFFSET 0x4F
- #define POWER_MANAGEMENT_GO1_POWER_FORCE 0x80
- #define VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV 0x89
- #define ALGO_PHASECAL_LIM 0x30

- `#define ALGO_PHASECAL_CONFIG_TIMEOUT 0x30`
- `#define ADDRESS_DEFAULT 0b01010010`
- `#define ADDRESS_DEFAULT2 0b00101001`
- `#define startTimeout() (g_timeoutStartMs = millis())`
- `#define checkTimeoutExpired() (g_ioTimeout > 0 && ((uint16_t)millis() - g_timeoutStartMs) > g_ioTimeout)`
- `#define decodeVcslPeriod(reg_val) (((reg_val) + 1) << 1)`
- `#define encodeVcslPeriod(period_pclks) (((period_pclks) >> 1) - 1)`
- `#define calcMacroPeriod(vcsl_period_pclks) (((uint32_t)2304 * (vcsl_period_pclks) * 1655) + 500) / 1000`

Enumerations

- `enum vcslPeriodType { VcslPeriodPreRange , VcslPeriodFinalRange }`

Functions

- `void setAddress (uint8_t new_addr)`
- `uint8_t getAddress (void)`
- `uint8_t initVL53L0X ()`
- `uint8_t setSignalRateLimit (float limit_Mcps)`
- `float getSignalRateLimit (void)`
- `uint8_t setMeasurementTimingBudget (uint32_t budget_us)`
- `uint32_t getMeasurementTimingBudget (void)`
- `uint8_t setVcslPulsePeriod (vcslPeriodType type, uint8_t period_pclks)`
- `uint8_t getVcslPulsePeriod (vcslPeriodType type)`
- `void startContinuous (uint32_t period_ms)`
- `void stopContinuous (void)`
- `uint16_t readRangeContinuousMillimeters ()`
- `uint16_t readRangeSingleMillimeters ()`
- `void setTimeout (uint16_t timeout)`
- `uint16_t getTimeout (void)`
- `bool timeoutOccurred (void)`
- `void writeReg (uint8_t reg, uint8_t value)`
- `void writeReg16Bit (uint8_t reg, uint16_t value)`
- `void writeReg32Bit (uint8_t reg, uint32_t value)`
- `uint8_t readReg (uint8_t reg)`
- `uint16_t readReg16Bit (uint8_t reg)`
- `uint32_t readReg32Bit (uint8_t reg)`
- `void writeMulti (uint8_t reg, uint8_t const *src, uint8_t count)`

5.21.1 Detailed Description

: VL53L0X API STSW-IMG005 portage Most of the functionality of this library is based on the VL53L0X API provided by ST (STSW-IMG005), and some of the explanatory comments are quoted or paraphrased from the API source code, API user manual (UM2039), and the VL53L0X datasheet.

Definition in file [VL53L0X.h](#).

5.21.2 Macro Definition Documentation

5.21.2.1 ACTIVE_WHILE

```
#define ACTIVE_WHILE 0
```

Definition at line 10 of file [VL53L0X.h](#).

5.21.2.2 ADDRESS

```
#define ADDRESS 0x52
```

Default address of VL53L0X sensor

Definition at line 12 of file [VL53L0X.h](#).

5.21.2.3 ADDRESS_DEFAULT

```
#define ADDRESS_DEFAULT 0b01010010
```

Definition at line 178 of file [VL53L0X.h](#).

5.21.2.4 ADDRESS_DEFAULT2

```
#define ADDRESS_DEFAULT2 0b00101001
```

Definition at line 179 of file [VL53L0X.h](#).

5.21.2.5 ALGO_PART_TO_PART_RANGE_OFFSET_MM [1/2]

```
#define ALGO_PART_TO_PART_RANGE_OFFSET_MM 0x28
```

Definition at line 43 of file [VL53L0X.h](#).

5.21.2.6 ALGO_PART_TO_PART_RANGE_OFFSET_MM [2/2]

```
#define ALGO_PART_TO_PART_RANGE_OFFSET_MM 0x28
```

Definition at line 43 of file [VL53L0X.h](#).

5.21.2.7 ALGO_PHASECAL_CONFIG_TIMEOUT [1/2]

```
#define ALGO_PHASECAL_CONFIG_TIMEOUT 0x30
```

Definition at line 89 of file [VL53L0X.h](#).

5.21.2.8 ALGO_PHASECAL_CONFIG_TIMEOUT [2/2]

```
#define ALGO_PHASECAL_CONFIG_TIMEOUT 0x30
```

Definition at line 89 of file [VL53L0X.h](#).

5.21.2.9 ALGO_PHASECAL_LIM [1/2]

```
#define ALGO_PHASECAL_LIM 0x30
```

Definition at line 88 of file [VL53L0X.h](#).

5.21.2.10 ALGO_PHASECAL_LIM [2/2]

```
#define ALGO_PHASECAL_LIM 0x30
```

Definition at line 88 of file [VL53L0X.h](#).

5.21.2.11 calcMacroPeriod

```
#define calcMacroPeriod(  
    vcsel_period_pclks ) (((uint32_t)2304 * (vcsel_period_pclks) * 1655) + 500) /  
1000)
```

Definition at line 198 of file [VL53L0X.h](#).

5.21.2.12 checkTimeoutExpired

```
#define checkTimeoutExpired( ) (g_ioTimeout > 0 && ((uint16_t)millis() - g_timeoutStartMs) >  
g_ioTimeout)
```

Definition at line 184 of file [VL53L0X.h](#).

5.21.2.13 CROSSTALK_COMPENSATION_PEAK_RATE_MCPS [1/2]

```
#define CROSSTALK_COMPENSATION_PEAK_RATE_MCPS 0x20
```

Definition at line 75 of file [VL53L0X.h](#).

5.21.2.14 CROSSTALK_COMPENSATION_PEAK_RATE_MCPS [2/2]

```
#define CROSSTALK_COMPENSATION_PEAK_RATE_MCPS 0x20
```

Definition at line 75 of file [VL53L0X.h](#).

5.21.2.15 decodeVcslPeriod

```
#define decodeVcslPeriod(  
    reg_val ) (((reg_val) + 1) << 1)
```

Definition at line 189 of file [VL53L0X.h](#).

5.21.2.16 DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD [1/2]

```
#define DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD 0x4E
```

Definition at line 84 of file [VL53L0X.h](#).

5.21.2.17 DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD [2/2]

```
#define DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD 0x4E
```

Definition at line 84 of file [VL53L0X.h](#).

5.21.2.18 DYNAMIC_SPAD_REF_EN_START_OFFSET [1/2]

```
#define DYNAMIC_SPAD_REF_EN_START_OFFSET 0x4F
```

Definition at line 85 of file [VL53L0X.h](#).

5.21.2.19 DYNAMIC_SPAD_REF_EN_START_OFFSET [2/2]

```
#define DYNAMIC_SPAD_REF_EN_START_OFFSET 0x4F
```

Definition at line 85 of file [VL53L0X.h](#).

5.21.2.20 encodeVcslPeriod

```
#define encodeVcslPeriod(  
    period_pclks ) (((period_pclks) >> 1) - 1)
```

Definition at line 193 of file [VL53L0X.h](#).

5.21.2.21 false

```
#define false 0
```

Definition at line 16 of file [VL53L0X.h](#).

5.21.2.22 FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT [1/2]

```
#define FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT 0x44
```

Definition at line 54 of file [VL53L0X.h](#).

5.21.2.23 FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT [2/2]

```
#define FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT 0x44
```

Definition at line 54 of file [VL53L0X.h](#).

5.21.2.24 FINAL_RANGE_CONFIG_MIN_SNR [1/2]

```
#define FINAL_RANGE_CONFIG_MIN_SNR 0x67
```

Definition at line 51 of file [VL53L0X.h](#).

5.21.2.25 FINAL_RANGE_CONFIG_MIN_SNR [2/2]

```
#define FINAL_RANGE_CONFIG_MIN_SNR 0x67
```

Definition at line 51 of file [VL53L0X.h](#).

5.21.2.26 FINAL_RANGE_CONFIG_TIMEOUT_MACROP_HI [1/2]

```
#define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x71
```

Definition at line 73 of file [VL53L0X.h](#).

5.21.2.27 FINAL_RANGE_CONFIG_TIMEOUT_MACROP_HI [2/2]

```
#define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x71
```

Definition at line 73 of file [VL53L0X.h](#).

5.21.2.28 FINAL_RANGE_CONFIG_TIMEOUT_MACROP_LO [1/2]

```
#define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x72
```

Definition at line 74 of file [VL53L0X.h](#).

5.21.2.29 FINAL_RANGE_CONFIG_TIMEOUT_MACROP_LO [2/2]

```
#define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x72
```

Definition at line 74 of file [VL53L0X.h](#).

5.21.2.30 FINAL_RANGE_CONFIG_VALID_PHASE_HIGH [1/2]

```
#define FINAL_RANGE_CONFIG_VALID_PHASE_HIGH 0x48
```

Definition at line 53 of file [VL53L0X.h](#).

5.21.2.31 FINAL_RANGE_CONFIG_VALID_PHASE_HIGH [2/2]

```
#define FINAL_RANGE_CONFIG_VALID_PHASE_HIGH 0x48
```

Definition at line 53 of file [VL53L0X.h](#).

5.21.2.32 FINAL_RANGE_CONFIG_VALID_PHASE_LOW [1/2]

```
#define FINAL_RANGE_CONFIG_VALID_PHASE_LOW 0x47
```

Definition at line 52 of file [VL53L0X.h](#).

5.21.2.33 FINAL_RANGE_CONFIG_VALID_PHASE_LOW [2/2]

```
#define FINAL_RANGE_CONFIG_VALID_PHASE_LOW 0x47
```

Definition at line 52 of file [VL53L0X.h](#).

5.21.2.34 FINAL_RANGE_CONFIG_VCSEL_PERIOD [1/2]

```
#define FINAL_RANGE_CONFIG_VCSEL_PERIOD 0x70
```

Definition at line 72 of file [VL53L0X.h](#).

5.21.2.35 FINAL_RANGE_CONFIG_VCSEL_PERIOD [2/2]

```
#define FINAL_RANGE_CONFIG_VCSEL_PERIOD 0x70
```

Definition at line 72 of file [VL53L0X.h](#).

5.21.2.36 GLOBAL_CONFIG_REF_EN_START_SELECT [1/2]

```
#define GLOBAL_CONFIG_REF_EN_START_SELECT 0xB6
```

Definition at line 83 of file [VL53L0X.h](#).

5.21.2.37 GLOBAL_CONFIG_REF_EN_START_SELECT [2/2]

```
#define GLOBAL_CONFIG_REF_EN_START_SELECT 0xB6
```

Definition at line 83 of file [VL53L0X.h](#).

5.21.2.38 GLOBAL_CONFIG_SPAD_ENABLES_REF0

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF0 0x0B0
```

Definition at line 77 of file [VL53L0X.h](#).

5.21.2.39 GLOBAL_CONFIG_SPAD_ENABLES_REF1

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF1 0x0B1
```

Definition at line 78 of file [VL53L0X.h](#).

5.21.2.40 GLOBAL_CONFIG_SPAD_ENABLES_REF2

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF2 0x0B2
```

Definition at line 79 of file [VL53L0X.h](#).

5.21.2.41 GLOBAL_CONFIG_SPAD_ENABLES_REF3

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF3 0x0B3
```

Definition at line 80 of file [VL53L0X.h](#).

5.21.2.42 GLOBAL_CONFIG_SPAD_ENABLES_REF4

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF4 0x0B4
```

Definition at line 81 of file [VL53L0X.h](#).

5.21.2.43 GLOBAL_CONFIG_SPAD_ENABLES_REF5

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF5 0x0B5
```

Definition at line 82 of file [VL53L0X.h](#).

5.21.2.44 GLOBAL_CONFIG_SPAD_ENABLES_REF_0

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF_0 0xB0
```

Definition at line 156 of file [VL53L0X.h](#).

5.21.2.45 GLOBAL_CONFIG_SPAD_ENABLES_REF_1

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF_1 0xB1
```

Definition at line 157 of file [VL53L0X.h](#).

5.21.2.46 GLOBAL_CONFIG_SPAD_ENABLES_REF_2

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF_2 0xB2
```

Definition at line 158 of file [VL53L0X.h](#).

5.21.2.47 GLOBAL_CONFIG_SPAD_ENABLES_REF_3

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF_3 0xB3
```

Definition at line 159 of file [VL53L0X.h](#).

5.21.2.48 GLOBAL_CONFIG_SPAD_ENABLES_REF_4

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF_4 0xB4
```

Definition at line 160 of file [VL53L0X.h](#).

5.21.2.49 GLOBAL_CONFIG_SPAD_ENABLES_REF_5

```
#define GLOBAL_CONFIG_SPAD_ENABLES_REF_5 0xB5
```

Definition at line 161 of file [VL53L0X.h](#).

5.21.2.50 GLOBAL_CONFIG_VCSEL_WIDTH

```
#define GLOBAL_CONFIG_VCSEL_WIDTH 0x32
```

Definition at line 155 of file [VL53L0X.h](#).

5.21.2.51 GPIO_HV_MUX_ACTIVE_HIGH [1/2]

```
#define GPIO_HV_MUX_ACTIVE_HIGH 0x84
```

Definition at line 29 of file [VL53L0X.h](#).

5.21.2.52 GPIO_HV_MUX_ACTIVE_HIGH [2/2]

```
#define GPIO_HV_MUX_ACTIVE_HIGH 0x84
```

Definition at line 29 of file [VL53L0X.h](#).

5.21.2.53 HISTOGRAM_CONFIG_INITIAL_PHASE_SELECT [1/2]

```
#define HISTOGRAM_CONFIG_INITIAL_PHASE_SELECT 0x33
```

Definition at line 70 of file [VL53L0X.h](#).

5.21.2.54 HISTOGRAM_CONFIG_INITIAL_PHASE_SELECT [2/2]

```
#define HISTOGRAM_CONFIG_INITIAL_PHASE_SELECT 0x33
```

Definition at line 70 of file [VL53L0X.h](#).

5.21.2.55 HISTOGRAM_CONFIG_READOUT_CTRL [1/2]

```
#define HISTOGRAM_CONFIG_READOUT_CTRL 0x55
```

Definition at line 71 of file [VL53L0X.h](#).

5.21.2.56 HISTOGRAM_CONFIG_READOUT_CTRL [2/2]

```
#define HISTOGRAM_CONFIG_READOUT_CTRL 0x55
```

Definition at line 71 of file [VL53L0X.h](#).

5.21.2.57 I2C_MODE

```
#define I2C_MODE 0x88
```

Definition at line 31 of file [VL53L0X.h](#).

5.21.2.58 I2C_SLAVE_DEVICE_ADDRESS

```
#define I2C_SLAVE_DEVICE_ADDRESS 0x8A
```

Definition at line 116 of file [VL53L0X.h](#).

5.21.2.59 IDENTIFICATION_MODEL_ID

```
#define IDENTIFICATION_MODEL_ID 0xC0
```

Definition at line 150 of file [VL53L0X.h](#).

5.21.2.60 IDENTIFICATION_REVISION_ID

```
#define IDENTIFICATION_REVISION_ID 0xC2
```

Definition at line 151 of file [VL53L0X.h](#).

5.21.2.61 INTERNAL_TUNING_1

```
#define INTERNAL_TUNING_1 0x91
```

Definition at line 64 of file [VL53L0X.h](#).

5.21.2.62 INTERNAL_TUNING_2

```
#define INTERNAL_TUNING_2 0xFF
```

Definition at line 65 of file [VL53L0X.h](#).

5.21.2.63 IO_2V8

```
#define IO_2V8 1
```

Definition at line 11 of file [VL53L0X.h](#).

5.21.2.64 MSRC_CONFIG_CONTROL [1/2]

```
#define MSRC_CONFIG_CONTROL 0x60
```

Definition at line 46 of file [VL53L0X.h](#).

5.21.2.65 MSRC_CONFIG_CONTROL [2/2]

```
#define MSRC_CONFIG_CONTROL 0x60
```

Definition at line 46 of file [VL53L0X.h](#).

5.21.2.66 MSRC_CONFIG_TIMEOUT_MACROP [1/2]

```
#define MSRC_CONFIG_TIMEOUT_MACROP 0x46
```

Definition at line 76 of file [VL53L0X.h](#).

5.21.2.67 MSRC_CONFIG_TIMEOUT_MACROP [2/2]

```
#define MSRC_CONFIG_TIMEOUT_MACROP 0x46
```

Definition at line 76 of file [VL53L0X.h](#).

5.21.2.68 OSC_CALIBRATE_VAL

```
#define OSC_CALIBRATE_VAL 0xF8
```

Definition at line 153 of file [VL53L0X.h](#).

5.21.2.69 POWER_MANAGEMENT_GO1_POWER_FORCE [1/2]

```
#define POWER_MANAGEMENT_GO1_POWER_FORCE 0x80
```

Definition at line 86 of file [VL53L0X.h](#).

5.21.2.70 POWER_MANAGEMENT_GO1_POWER_FORCE [2/2]

```
#define POWER_MANAGEMENT_GO1_POWER_FORCE 0x80
```

Definition at line 86 of file [VL53L0X.h](#).

5.21.2.71 PRE_RANGE_CONFIG_MIN_SNR [1/2]

```
#define PRE_RANGE_CONFIG_MIN_SNR 0x27
```

Definition at line 47 of file [VL53L0X.h](#).

5.21.2.72 PRE_RANGE_CONFIG_MIN_SNR [2/2]

```
#define PRE_RANGE_CONFIG_MIN_SNR 0x27
```

Definition at line 47 of file [VL53L0X.h](#).

5.21.2.73 PRE_RANGE_CONFIG_SIGMA_THRESH_HI [1/2]

```
#define PRE_RANGE_CONFIG_SIGMA_THRESH_HI 0x61
```

Definition at line 57 of file [VL53L0X.h](#).

5.21.2.74 PRE_RANGE_CONFIG_SIGMA_THRESH_HI [2/2]

```
#define PRE_RANGE_CONFIG_SIGMA_THRESH_HI 0x61
```

Definition at line 57 of file [VL53L0X.h](#).

5.21.2.75 PRE_RANGE_CONFIG_SIGMA_THRESH_LO [1/2]

```
#define PRE_RANGE_CONFIG_SIGMA_THRESH_LO 0x62
```

Definition at line 58 of file [VL53L0X.h](#).

5.21.2.76 PRE_RANGE_CONFIG_SIGMA_THRESH_LO [2/2]

```
#define PRE_RANGE_CONFIG_SIGMA_THRESH_LO 0x62
```

Definition at line 58 of file [VL53L0X.h](#).

5.21.2.77 PRE_RANGE_CONFIG_TIMEOUT_MACROP_HI [1/2]

```
#define PRE_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x51
```

Definition at line 60 of file [VL53L0X.h](#).

5.21.2.78 PRE_RANGE_CONFIG_TIMEOUT_MACROP_HI [2/2]

```
#define PRE_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x51
```

Definition at line 60 of file [VL53L0X.h](#).

5.21.2.79 PRE_RANGE_CONFIG_TIMEOUT_MACROP_LO [1/2]

```
#define PRE_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x52
```

Definition at line 61 of file [VL53L0X.h](#).

5.21.2.80 PRE_RANGE_CONFIG_TIMEOUT_MACROP_LO [2/2]

```
#define PRE_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x52
```

Definition at line 61 of file [VL53L0X.h](#).

5.21.2.81 PRE_RANGE_CONFIG_VALID_PHASE_HIGH [1/2]

```
#define PRE_RANGE_CONFIG_VALID_PHASE_HIGH 0x57
```

Definition at line 49 of file [VL53L0X.h](#).

5.21.2.82 PRE_RANGE_CONFIG_VALID_PHASE_HIGH [2/2]

```
#define PRE_RANGE_CONFIG_VALID_PHASE_HIGH 0x57
```

Definition at line 49 of file [VL53L0X.h](#).

5.21.2.83 PRE_RANGE_CONFIG_VALID_PHASE_LOW [1/2]

```
#define PRE_RANGE_CONFIG_VALID_PHASE_LOW 0x56
```

Definition at line 48 of file [VL53L0X.h](#).

5.21.2.84 PRE_RANGE_CONFIG_VALID_PHASE_LOW [2/2]

```
#define PRE_RANGE_CONFIG_VALID_PHASE_LOW 0x56
```

Definition at line 48 of file [VL53L0X.h](#).

5.21.2.85 PRE_RANGE_CONFIG_VCSEL_PERIOD [1/2]

```
#define PRE_RANGE_CONFIG_VCSEL_PERIOD 0x50
```

Definition at line 59 of file [VL53L0X.h](#).

5.21.2.86 PRE_RANGE_CONFIG_VCSEL_PERIOD [2/2]

```
#define PRE_RANGE_CONFIG_VCSEL_PERIOD 0x50
```

Definition at line 59 of file [VL53L0X.h](#).

5.21.2.87 PRE_RANGE_MIN_COUNT_RATE_RTN_LIMIT [1/2]

```
#define PRE_RANGE_MIN_COUNT_RATE_RTN_LIMIT 0x64
```

Definition at line 50 of file [VL53L0X.h](#).

5.21.2.88 PRE_RANGE_MIN_COUNT_RATE_RTN_LIMIT [2/2]

```
#define PRE_RANGE_MIN_COUNT_RATE_RTN_LIMIT 0x64
```

Definition at line 50 of file [VL53L0X.h](#).

5.21.2.89 RESULT_CORE_AMBIENT_WINDOW_EVENTS_REF [1/2]

```
#define RESULT_CORE_AMBIENT_WINDOW_EVENTS_REF 0xD0
```

Definition at line 38 of file [VL53L0X.h](#).

5.21.2.90 RESULT_CORE_AMBIENT_WINDOW_EVENTS_REF [2/2]

```
#define RESULT_CORE_AMBIENT_WINDOW_EVENTS_REF 0xD0
```

Definition at line 38 of file [VL53L0X.h](#).

5.21.2.91 RESULT_CORE_AMBIENT_WINDOW_EVENTS_RTN [1/2]

```
#define RESULT_CORE_AMBIENT_WINDOW_EVENTS_RTN 0xBC
```

Definition at line 36 of file [VL53L0X.h](#).

5.21.2.92 RESULT_CORE_AMBIENT_WINDOW_EVENTS_RTN [2/2]

```
#define RESULT_CORE_AMBIENT_WINDOW_EVENTS_RTN 0xBC
```

Definition at line 36 of file [VL53L0X.h](#).

5.21.2.93 RESULT_CORE_RANGING_TOTAL_EVENTS_REF [1/2]

```
#define RESULT_CORE_RANGING_TOTAL_EVENTS_REF 0xD4
```

Definition at line 39 of file [VL53L0X.h](#).

5.21.2.94 RESULT_CORE_RANGING_TOTAL_EVENTS_REF [2/2]

```
#define RESULT_CORE_RANGING_TOTAL_EVENTS_REF 0xD4
```

Definition at line 39 of file [VL53L0X.h](#).

5.21.2.95 RESULT_CORE_RANGING_TOTAL_EVENTS_RTN [1/2]

```
#define RESULT_CORE_RANGING_TOTAL_EVENTS_RTN 0xC0
```

Definition at line 37 of file [VL53L0X.h](#).

5.21.2.96 RESULT_CORE_RANGING_TOTAL_EVENTS_RTN [2/2]

```
#define RESULT_CORE_RANGING_TOTAL_EVENTS_RTN 0xC0
```

Definition at line 37 of file [VL53L0X.h](#).

5.21.2.97 RESULT_INTERRUPT_STATUS [1/2]

```
#define RESULT_INTERRUPT_STATUS 0x13
```

Definition at line 34 of file [VL53L0X.h](#).

5.21.2.98 RESULT_INTERRUPT_STATUS [2/2]

```
#define RESULT_INTERRUPT_STATUS 0x13
```

Definition at line 34 of file [VL53L0X.h](#).

5.21.2.99 RESULT_PEAK_SIGNAL_RATE_REF [1/2]

```
#define RESULT_PEAK_SIGNAL_RATE_REF 0xB6
```

Definition at line 40 of file [VL53L0X.h](#).

5.21.2.100 RESULT_PEAK_SIGNAL_RATE_REF [2/2]

```
#define RESULT_PEAK_SIGNAL_RATE_REF 0xB6
```

Definition at line 40 of file [VL53L0X.h](#).

5.21.2.101 RESULT_RANGE_STATUS [1/2]

```
#define RESULT_RANGE_STATUS 0x14
```

Definition at line 35 of file [VL53L0X.h](#).

5.21.2.102 RESULT_RANGE_STATUS [2/2]

```
#define RESULT_RANGE_STATUS 0x14
```

Definition at line 35 of file [VL53L0X.h](#).

5.21.2.103 SOFT_RESET_GO2_SOFT_RESET_N

```
#define SOFT_RESET_GO2_SOFT_RESET_N 0xBF
```

Definition at line 149 of file [VL53L0X.h](#).

5.21.2.104 startTimeout

```
#define startTimeout( ) (g_timeoutStartMs = millis())
```

Definition at line 181 of file [VL53L0X.h](#).

5.21.2.105 SYSRANGE_START

```
#define SYSRANGE_START 0x00
```

Definition at line 18 of file [VL53L0X.h](#).

5.21.2.106 SYSTEM_HISTOGRAM_BIN [1/2]

```
#define SYSTEM_HISTOGRAM_BIN 0x81
```

Definition at line 69 of file [VL53L0X.h](#).

5.21.2.107 SYSTEM_HISTOGRAM_BIN [2/2]

```
#define SYSTEM_HISTOGRAM_BIN 0x81
```

Definition at line 69 of file [VL53L0X.h](#).

5.21.2.108 SYSTEM_INTERMEASUREMENT_PERIOD [1/2]

```
#define SYSTEM_INTERMEASUREMENT_PERIOD 0x04
```

Definition at line 23 of file [VL53L0X.h](#).

5.21.2.109 SYSTEM_INTERMEASUREMENT_PERIOD [2/2]

```
#define SYSTEM_INTERMEASUREMENT_PERIOD 0x04
```

Definition at line 23 of file [VL53L0X.h](#).

5.21.2.110 SYSTEM_INTERRUPT_CLEAR [1/2]

```
#define SYSTEM_INTERRUPT_CLEAR 0x0B
```

Definition at line 30 of file [VL53L0X.h](#).

5.21.2.111 SYSTEM_INTERRUPT_CLEAR [2/2]

```
#define SYSTEM_INTERRUPT_CLEAR 0x0B
```

Definition at line 30 of file [VL53L0X.h](#).

5.21.2.112 SYSTEM_INTERRUPT_CONFIG_GPIO

```
#define SYSTEM_INTERRUPT_CONFIG_GPIO 0x0A
```

Definition at line 99 of file [VL53L0X.h](#).

5.21.2.113 SYSTEM_INTERRUPT_GPIO_CONFIG

```
#define SYSTEM_INTERRUPT_GPIO_CONFIG 0x0A
```

Definition at line 26 of file [VL53L0X.h](#).

5.21.2.114 SYSTEM_RANGE_CONFIG [1/2]

```
#define SYSTEM_RANGE_CONFIG 0x09
```

Definition at line 22 of file [VL53L0X.h](#).

5.21.2.115 SYSTEM_RANGE_CONFIG [2/2]

```
#define SYSTEM_RANGE_CONFIG 0x09
```

Definition at line 22 of file [VL53L0X.h](#).

5.21.2.116 SYSTEM_SEQUENCE_CONFIG [1/2]

```
#define SYSTEM_SEQUENCE_CONFIG 0x01
```

Definition at line 21 of file [VL53L0X.h](#).

5.21.2.117 SYSTEM_SEQUENCE_CONFIG [2/2]

```
#define SYSTEM_SEQUENCE_CONFIG 0x01
```

Definition at line 21 of file [VL53L0X.h](#).

5.21.2.118 SYSTEM_THRESH_HIGH [1/2]

```
#define SYSTEM_THRESH_HIGH 0x0C
```

Definition at line 19 of file [VL53L0X.h](#).

5.21.2.119 SYSTEM_THRESH_HIGH [2/2]

```
#define SYSTEM_THRESH_HIGH 0x0C
```

Definition at line 19 of file [VL53L0X.h](#).

5.21.2.120 SYSTEM_THRESH_LOW [1/2]

```
#define SYSTEM_THRESH_LOW 0x0E
```

Definition at line 20 of file [VL53L0X.h](#).

5.21.2.121 SYSTEM_THRESH_LOW [2/2]

```
#define SYSTEM_THRESH_LOW 0x0E
```

Definition at line 20 of file [VL53L0X.h](#).

5.21.2.122 true

```
#define true 1
```

Definition at line 15 of file [VL53L0X.h](#).

5.21.2.123 VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV [1/2]

```
#define VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV 0x89
```

Definition at line 87 of file [VL53L0X.h](#).

5.21.2.124 VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV [2/2]

```
#define VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV 0x89
```

Definition at line 87 of file [VL53L0X.h](#).

5.21.3 Enumeration Type Documentation

5.21.3.1 vcselPeriodType

```
enum vcselPeriodType
```

Definition at line 203 of file [VL53L0X.h](#).

5.21.4 Function Documentation

5.21.4.1 getAddress()

```
uint8_t getAddress (
    void )
```

Definition at line 99 of file [VL53L0X.c](#).

5.21.4.2 getSignalRateLimit()

```
float getSignalRateLimit (
    void )
```

Definition at line 325 of file [VL53L0X.c](#).

5.21.4.3 initVL53L0X()

```
uint8_t initVL53L0X ( )
```

Definition at line 111 of file [VL53L0X.c](#).

5.21.4.4 readRangeSingleMillimeters()

```
uint16_t readRangeSingleMillimeters ( )
```

Definition at line 338 of file [VL53L0X.c](#).

5.21.4.5 readReg()

```
uint8_t readReg (
    uint8_t reg )
```

Definition at line 58 of file [VL53L0X.c](#).

5.21.4.6 readReg16Bit()

```
uint16_t readReg16Bit (
    uint8_t reg )
```

Definition at line 66 of file [VL53L0X.c](#).

5.21.4.7 readReg32Bit()

```
uint32_t readReg32Bit (
    uint8_t reg )
```

Definition at line 75 of file [VL53L0X.c](#).

5.21.4.8 setAddress()

```
void setAddress (
    uint8_t new_addr )
```

Definition at line 94 of file [VL53L0X.c](#).

5.21.4.9 setSignalRateLimit()

```
uint8_t setSignalRateLimit (
    float limit_Mcps )
```

Definition at line 315 of file [VL53L0X.c](#).

5.21.4.10 writeMulti()

```
void writeMulti (
    uint8_t reg,
    uint8_t const * src,
    uint8_t count )
```

Definition at line 85 of file [VL53L0X.c](#).

5.21.4.11 writeReg()

```
void writeReg (
    uint8_t reg,
    uint8_t value )
```

Definition at line 35 of file [VL53L0X.c](#).

5.21.4.12 writeReg16Bit()

```
void writeReg16Bit (
    uint8_t reg,
    uint16_t value )
```

Definition at line 40 of file [VL53L0X.c](#).

5.21.4.13 writeReg32Bit()

```
void writeReg32Bit (
    uint8_t reg,
    uint32_t value )
```

Definition at line 48 of file [VL53L0X.c](#).

5.22 VL53L0X.h

[Go to the documentation of this file.](#)

```
00001
00010 #define ACTIVE_WHILE 0
00011 #define IO_2V8 1
00012 #define ADDRESS 0x52
00014 // #define bool uint8_t
00015 #define true 1
00016 #define false 0
00017
00018 #define SYSRANGE_START 0x00
00019 #define SYSTEM_THRESH_HIGH 0x0C
00020 #define SYSTEM_THRESH_LOW 0x0E
00021 #define SYSTEM_SEQUENCE_CONFIG 0x01
00022 #define SYSTEM_RANGE_CONFIG 0x09
00023 #define SYSTEM_INTERMEASUREMENT_PERIOD 0x04
00024
00025
00026 #define SYSTEM_INTERRUPT_GPIO_CONFIG 0x0A
00027
00028 //GPIO Config
00029 #define GPIO_HV_MUX_ACTIVE_HIGH 0x84
00030 #define SYSTEM_INTERRUPT_CLEAR 0x0B
00031 #define I2C_MODE 0x88
00032
00033 // Result registers
00034 #define RESULT_INTERRUPT_STATUS 0x13
00035 #define RESULT_RANGE_STATUS 0x14
00036 #define RESULT_CORE_AMBIENT_WINDOW_EVENTS_RTN 0xBC
00037 #define RESULT_CORE_RANGING_TOTAL_EVENTS_RTN 0xC0
00038 #define RESULT_CORE_AMBIENT_WINDOW_EVENTS_REF 0xD0
00039 #define RESULT_CORE_RANGING_TOTAL_EVENTS_REF 0xD4
00040 #define RESULT_PEAK_SIGNAL_RATE_REF 0xB6
00041
00042 //Algo Register
00043 #define ALGO_PART_TO_PART_RANGE_OFFSET_MM 0x28
00044
00045 //Check limit register
00046 #define MSRC_CONFIG_CONTROL 0x60
00047 #define PRE_RANGE_CONFIG_MIN_SNR 0x27
00048 #define PRE_RANGE_CONFIG_VALID_PHASE_LOW 0x56
00049 #define PRE_RANGE_CONFIG_VALID_PHASE_HIGH 0x57
00050 #define PRE_RANGE_MIN_COUNT_RATE_RTN_LIMIT 0x64
00051 #define FINAL_RANGE_CONFIG_MIN_SNR 0x67
00052 #define FINAL_RANGE_CONFIG_VALID_PHASE_LOW 0x47
00053 #define FINAL_RANGE_CONFIG_VALID_PHASE_HIGH 0x48
00054 #define FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT 0x44
00055
00056 // PRE RANGE registers
00057 #define PRE_RANGE_CONFIG_SIGMA_THRESH_HI 0x61
00058 #define PRE_RANGE_CONFIG_SIGMA_THRESH_LO 0x62
00059 #define PRE_RANGE_CONFIG_VCSEL_PERIOD 0x50
00060 #define PRE_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x51
00061 #define PRE_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x52
```

```

00062
00063 //Internal tuning registers
00064 #define INTERNAL_TUNING_1 0x91
00065 #define INTERNAL_TUNING_2 0xFF
00066
00067
00068 //Other registers
00069 #define SYSTEM_HISTOGRAM_BIN 0x81
00070 #define HISTOGRAM_CONFIG_INITIAL_PHASE_SELECT 0x33
00071 #define HISTOGRAM_CONFIG_READOUT_CTRL 0x55
00072 #define FINAL_RANGE_CONFIG_VCSEL_PERIOD 0x70
00073 #define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x71
00074 #define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x72
00075 #define CROSSTALK_COMPENSATION_PEAK_RATE_MCPS 0x20
00076 #define MSRC_CONFIG_TIMEOUT_MACROP 0x46
00077 #define GLOBAL_CONFIG_SPAD_ENABLES_REF0 0x0B0
00078 #define GLOBAL_CONFIG_SPAD_ENABLES_REF1 0x0B1
00079 #define GLOBAL_CONFIG_SPAD_ENABLES_REF2 0x0B2
00080 #define GLOBAL_CONFIG_SPAD_ENABLES_REF3 0x0B3
00081 #define GLOBAL_CONFIG_SPAD_ENABLES_REF4 0x0B4
00082 #define GLOBAL_CONFIG_SPAD_ENABLES_REF5 0x0B5
00083 #define GLOBAL_CONFIG_REF_EN_START_SELECT 0xB6
00084 #define DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD 0x4E
00085 #define DYNAMIC_SPAD_REF_EN_START_OFFSET 0x4F
00086 #define POWER_MANAGEMENT_G01_POWER_FORCE 0x80
00087 #define VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV 0x89
00088 #define ALGO_PHASECAL_LIM 0x30
00089 #define ALGO_PHASECAL_CONFIG_TIMEOUT 0x30
00090
00091
00092 #define SYSTEM_THRESH_HIGH 0x0C
00093 #define SYSTEM_THRESH_LOW 0x0E
00094
00095 #define SYSTEM_SEQUENCE_CONFIG 0x01
00096 #define SYSTEM_RANGE_CONFIG 0x09
00097 #define SYSTEM_INTERMEASUREMENT_PERIOD 0x04
00098
00099 #define SYSTEM_INTERRUPT_CONFIG_GPIO 0x0A
00100
00101 #define GPIO_HV_MUX_ACTIVE_HIGH 0x84
00102
00103 #define SYSTEM_INTERRUPT_CLEAR 0x0B
00104
00105 #define RESULT_INTERRUPT_STATUS 0x13
00106 #define RESULT_RANGE_STATUS 0x14
00107
00108 #define RESULT_CORE_AMBIENT_WINDOW_EVENTS_RTN 0xBC
00109 #define RESULT_CORE_RANGING_TOTAL_EVENTS_RTN 0xC0
00110 #define RESULT_CORE_AMBIENT_WINDOW_EVENTS_REF 0xD0
00111 #define RESULT_CORE_RANGING_TOTAL_EVENTS_REF 0xD4
00112 #define RESULT_PEAK_SIGNAL_RATE_REF 0xB6
00113
00114 #define ALGO_PART_TO_PART_RANGE_OFFSET_MM 0x28
00115
00116 #define I2C_SLAVE_DEVICE_ADDRESS 0x8A
00117 //#define I2C_SLAVE_DEVICE_ADDRESS 0x53
00118
00119 #define MSRC_CONFIG_CONTROL 0x60
00120
00121 #define PRE_RANGE_CONFIG_MIN_SNR 0x27
00122 #define PRE_RANGE_CONFIG_VALID_PHASE_LOW 0x56
00123 #define PRE_RANGE_CONFIG_VALID_PHASE_HIGH 0x57
00124 #define PRE_RANGE_MIN_COUNT_RATE_RTN_LIMIT 0x64
00125
00126 #define FINAL_RANGE_CONFIG_MIN_SNR 0x67
00127 #define FINAL_RANGE_CONFIG_VALID_PHASE_LOW 0x47
00128 #define FINAL_RANGE_CONFIG_VALID_PHASE_HIGH 0x48
00129 #define FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT 0x44
00130
00131 #define PRE_RANGE_CONFIG_SIGMA_THRESH_HI 0x61
00132 #define PRE_RANGE_CONFIG_SIGMA_THRESH_LO 0x62
00133
00134 #define PRE_RANGE_CONFIG_VCSEL_PERIOD 0x50
00135 #define PRE_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x51
00136 #define PRE_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x52
00137
00138 #define SYSTEM_HISTOGRAM_BIN 0x81
00139 #define HISTOGRAM_CONFIG_INITIAL_PHASE_SELECT 0x33
00140 #define HISTOGRAM_CONFIG_READOUT_CTRL 0x55
00141
00142 #define FINAL_RANGE_CONFIG_VCSEL_PERIOD 0x70
00143 #define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_HI 0x71
00144 #define FINAL_RANGE_CONFIG_TIMEOUT_MACROP_LO 0x72
00145 #define CROSSTALK_COMPENSATION_PEAK_RATE_MCPS 0x20
00146
00147 #define MSRC_CONFIG_TIMEOUT_MACROP 0x46
00148

```

```

00149 #define  SOFT_RESET_GO2_SOFT_RESET_N                0xBF
00150 #define  IDENTIFICATION_MODEL_ID                     0xC0
00151 #define  IDENTIFICATION_REVISION_ID                   0xC2
00152
00153 #define  OSC_CALIBRATE_VAL                             0xF8
00154
00155 #define  GLOBAL_CONFIG_VCSEL_WIDTH                     0x32
00156 #define  GLOBAL_CONFIG_SPAD_ENABLEREF_0               0xB0
00157 #define  GLOBAL_CONFIG_SPAD_ENABLEREF_1               0xB1
00158 #define  GLOBAL_CONFIG_SPAD_ENABLEREF_2               0xB2
00159 #define  GLOBAL_CONFIG_SPAD_ENABLEREF_3               0xB3
00160 #define  GLOBAL_CONFIG_SPAD_ENABLEREF_4               0xB4
00161 #define  GLOBAL_CONFIG_SPAD_ENABLEREF_5               0xB5
00162
00163 #define  GLOBAL_CONFIG_REF_EN_START_SELECT             0xB6
00164 #define  DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD          0x4E
00165 #define  DYNAMIC_SPAD_REF_EN_START_OFFSET             0x4F
00166 #define  POWER_MANAGEMENT_GO1_POWER_FORCE             0x80
00167
00168 #define  VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV             0x89
00169
00170 #define  ALGO_PHASECAL_LIM                             0x30
00171 #define  ALGO_PHASECAL_CONFIG_TIMEOUT                 0x30
00172
00173 //-----
00174 // Defines
00175 //-----
00176 // I use a 8-bit number for the address, LSB must be 0 so that I can
00177 // OR over the last bit correctly based on reads and writes
00178 #define  ADDRESS_DEFAULT 0b01010010
00179 #define  ADDRESS_DEFAULT2 0b00101001
00180 // Record the current time to check an upcoming timeout against
00181 #define  startTimeout() (g_timeoutStartMs = millis())
00182
00183 // Check if timeout is enabled (set to nonzero value) and has expired
00184 #define  checkTimeoutExpired() (g_ioTimeout > 0 && ((uint16_t)millis() - g_timeoutStartMs) >
    g_ioTimeout)
00185
00186 // Decode VCSEL (vertical cavity surface emitting laser) pulse period in PCLKs
00187 // from register value
00188 // based on VL53L0X_decode_vcsel_period()
00189 #define  decodeVcselPeriod(reg_val) (((reg_val) + 1) << 1)
00190
00191 // Encode VCSEL pulse period register value from period in PCLKs
00192 // based on VL53L0X_encode_vcsel_period()
00193 #define  encodeVcselPeriod(period_pclks) (((period_pclks) >> 1) - 1)
00194
00195 // Calculate macro period in *nanoseconds* from VCSEL period in PCLKs
00196 // based on VL53L0X_calc_macro_period_ps()
00197 // PLL_period_ps = 1655; macro_period_vclks = 2304
00198 #define  calcMacroPeriod(vcsel_period_pclks) (((uint32_t)2304 * (vcsel_period_pclks) * 1655) + 500) /
    1000)
00199
00200 // register addresses from API vl53l0x_device.h (ordered as listed there)
00201
00202
00203 typedef enum { VcselPeriodPreRange, VcselPeriodFinalRange }vcselPeriodType;
00204
00205 // Additional info for one measurement
00206 typedef struct{
00207     uint16_t rawDistance; //uncorrected distance [mm],    uint16_t
00208     uint16_t signalCnt;   //Signal Counting Rate [mcps], uint16_t, fixpoint9.7
00209     uint16_t ambientCnt;  //Ambient Counting Rate [mcps], uint16_t, fixpoint9.7
00210     uint16_t spadCnt;     //Effective SPAD return count,  uint16_t, fixpoint8.8
00211     uint8_t  rangeStatus; //Ranging status (0-15)
00212 } statInfo_t;
00213
00214
00215 //-----
00216 // API Functions
00217 //-----
00218 // configures chip i2c and lib for `new_addr` (8 bit, LSB=0)
00219 void setAddress(uint8_t new_addr);
00220 // Returns the current I2C address.
00221 uint8_t getAddress(void);
00222
00223 // Initializes and configures the sensor.
00224 // If the optional argument io_2v8 is 1, the sensor is configured for 2V8 mode (2.8 V I/O);
00225 // if 0, the sensor is left in 1V8 mode. Returns 1 if the initialization completed successfully.
00226 uint8_t initVL53L0X();
00227
00228 // Sets the return signal rate limit to the given value in units of MCPS (mega counts per second).
00229 // This is the minimum amplitude of the signal reflected from the target and received by the sensor
00230 // necessary for it to report a valid reading. Setting a lower limit increases the potential range
00231 // of the sensor but also increases the likelihood of getting an inaccurate reading because of
00232 // reflections from objects other than the intended target. This limit is initialized to 0.25 MCPS
00233 // by default. The return value is a boolean indicating whether the requested limit was valid.

```

```

00234 uint8_t setSignalRateLimit(float limit_Mcps);
00235
00236 // Returns the current return signal rate limit in MCPS.
00237 float getSignalRateLimit(void);
00238
00239 // Set the measurement timing budget in microseconds, which is the time allowed
00240 // for one measurement; the ST API and this library take care of splitting the
00241 // timing budget among the sub-steps in the ranging sequence. A longer timing
00242 // budget allows for more accurate measurements. Increasing the budget by a
00243 // factor of N decreases the range measurement standard deviation by a factor of
00244 // sqrt(N). Defaults to about 33 milliseconds; the minimum is 20 ms.
00245 // based on VL53L0X_set_measurement_timing_budget_micro_seconds()
00246 uint8_t setMeasurementTimingBudget(uint32_t budget_us);
00247
00248 // Returns the current measurement timing budget in microseconds.
00249 uint32_t getMeasurementTimingBudget(void);
00250
00251 // Sets the VCSEL (vertical cavity surface emitting laser) pulse period for the given period type
00252 // (VcselPeriodPreRange or VcselPeriodFinalRange) to the given value (in PCLKs).
00253 // Longer periods increase the potential range of the sensor. Valid values are (even numbers only):
00254 // Pre: 12 to 18 (initialized to 14 by default)
00255 // Final: 8 to 14 (initialized to 10 by default)
00256 // The return value is a boolean indicating whether the requested period was valid.
00257 uint8_t setVcselPulsePeriod(vcselPeriodType type, uint8_t period_pclks);
00258
00259 // Returns the current VCSEL pulse period for the given period type.
00260 uint8_t getVcselPulsePeriod(vcselPeriodType type);
00261
00262 // Starts continuous ranging measurements. If the argument period_ms is 0,
00263 // continuous back-to-back mode is used (the sensor takes measurements as often as possible);
00264 // if it is nonzero, continuous timed mode is used, with the specified inter-measurement period
00265 // in milliseconds determining how often the sensor takes a measurement.
00266 void startContinuous(uint32_t period_ms);
00267
00268 // Stops continuous mode.
00269 void stopContinuous(void);
00270
00271 // Returns a range reading in millimeters when continuous mode is active.
00272 // Additional measurement data will be copied into 'extraStats' if it is non-zero.
00273 uint16_t readRangeContinuousMillimeters(/* statInfo_t *extraStats */);
00274
00275 // Performs a single-shot ranging measurement and returns the reading in millimeters.
00276 // Additional measurement data will be copied into 'extraStats' if it is non-zero.
00277 uint16_t readRangeSingleMillimeters( /*statInfo_t *extraStats */);
00278
00279 // Sets a timeout period in milliseconds after which read operations will abort
00280 // if the sensor is not ready. A value of 0 disables the timeout.
00281 void setTimeout(uint16_t timeout);
00282
00283 // Returns the current timeout period setting.
00284 uint16_t getTimeout(void);
00285
00286 // Indicates whether a read timeout has occurred since the last call to timeoutOccurred().
00287 bool timeoutOccurred(void);
00288
00289 //-----
00290 // I2C communication Functions
00291 //-----
00292 void writeReg(uint8_t reg, uint8_t value); // Write an 8-bit register
00293 void writeReg16Bit(uint8_t reg, uint16_t value); // Write a 16-bit register
00294 void writeReg32Bit(uint8_t reg, uint32_t value); // Write a 32-bit register
00295 uint8_t readReg(uint8_t reg); // Read an 8-bit register
00296 uint16_t readReg16Bit(uint8_t reg); // Read a 16-bit register
00297 uint32_t readReg32Bit(uint8_t reg); // Read a 32-bit register
00298 // Write 'count' number of bytes from 'src' to the sensor, starting at 'reg'
00299 void writeMulti(uint8_t reg, uint8_t const *src, uint8_t count);
00300
00301 // TCC: Target CentreCheck
00302 // MSRC: Minimum Signal Rate Check
00303 // DSS: Dynamic Spad Selection
00304 typedef struct {
00305     uint8_t tcc, msrc, dss, pre_range, final_range;
00306 }SequenceStepEnables;
00307
00308 typedef struct {
00309     uint16_t pre_range_vcsel_period_pclks, final_range_vcsel_period_pclks;
00310
00311     uint16_t msrc_dss_tcc_mclks, pre_range_mclks, final_range_mclks;
00312     uint32_t msrc_dss_tcc_us, pre_range_us, final_range_us;
00313 }SequenceStepTimeouts;
00314

```


5.23 captDistIR.c

```

00001 /*
00002  * IRMeasure.c
00003  */
00004
00005
00006 #include "captDistIR.h"
00007
00008 ADC_HandleTypeDef  adcHandle;
00009 ADC_HandleTypeDef  adcHandle_12;
00010 ADC_HandleTypeDef  adcHandle_13;
00011 ADC_ChannelConfTypeDef  sConfig;
00012
00013 //=====
00014 //          ADC INIT FOR IR SENSOR SHARP GP2D12
00015 //=====
00016
00017 void  captDistIR_Init(void)
00018 {
00019     adcHandle.Instance      = ADC1;
00020
00021     adcHandle.Init.ClockPrescaler = ADC_CLOCKPRESCALER_PCLK_DIV2;
00022     adcHandle.Init.DataAlign = ADC_DATAALIGN_RIGHT;
00023     adcHandle.Init.Resolution = ADC_RESOLUTION12b;
00024     // Don't do continuous conversions - do them on demand
00025     adcHandle.Init.ContinuousConvMode    = DISABLE; // Continuous mode disabled to have only 1
conversion at each conversion trig
00026     // Disable the scan conversion so we do one at a time */
00027     adcHandle.Init.ScanConvMode = DISABLE;
00028     //Say how many channels would be used by the sequencer
00029     adcHandle.Init.NbrOfConversion = 2;
00030     adcHandle.Init.DiscontinuousConvMode = DISABLE; // Parameter discarded because sequencer is
disabled
00031     adcHandle.Init.NbrOfDiscConversion = 2;
00032     adcHandle.Init.ExternalTrigConvEdge = ADC_EXTERNALTRIGCONVEDGE_NONE ;
00033     //Start conversion by software, not an external trigger
00034     adcHandle.Init.ExternalTrigConv = 0;
00035     adcHandle.Init.DMAContinuousRequests = DISABLE;
00036     adcHandle.Init.EOCSelection = DISABLE;
00037
00038     HAL_ADC_Init(&adcHandle);
00039 }
00040
00041 //=====
00042 //          IR GET (POLL METHOD)
00043 //=====
00044
00045 int  captDistIR_Get(int* tab)
00046 {
00047     sConfig.Channel      = ADC_CHANNEL_4;
00048     sConfig.Rank          = 1;
00049     sConfig.SamplingTime = ADC_SAMPLETIME_56CYCLES;
00050     HAL_ADC_ConfigChannel(&adcHandle, &sConfig);
00051
00052     HAL_ADC_Start(&adcHandle); //Start the conversion
00053     HAL_ADC_PollForConversion(&adcHandle,10); //Processing the conversion
00054     tab[0]=HAL_ADC_GetValue(&adcHandle); //Return the converted data
00055
00056     sConfig.Channel      = ADC_CHANNEL_8;
00057     sConfig.Rank          = 1;
00058     sConfig.SamplingTime = ADC_SAMPLETIME_56CYCLES;
00059     HAL_ADC_ConfigChannel(&adcHandle, &sConfig);
00060
00061     HAL_ADC_Start(&adcHandle); //Start the conversion
00062     HAL_ADC_PollForConversion(&adcHandle,10); //Processing the conversion
00063     tab[1]=HAL_ADC_GetValue(&adcHandle); //Return the converted data
00064
00065     return 0;
00066 }
00067 //=====

```

5.24 dma_transport.c

```

00001 #include <uxr/client/transport.h>
00002
00003 #include <rmw_microrxcds_c/config.h>
00004
00005 #include "main.h"
00006 #include "cmsis_os.h"
00007
00008 #include <unistd.h>
00009 #include <stdio.h>

```

```

00010 #include <string.h>
00011 #include <stdbool.h>
00012
00013 #ifdef RMW_UXRCE_TRANSPORT_CUSTOM
00014
00015 // --- micro-ROS Transports ---
00016 #define UART_DMA_BUFFER_SIZE 2048
00017
00018 static uint8_t dma_buffer[UART_DMA_BUFFER_SIZE];
00019 static size_t dma_head = 0, dma_tail = 0;
00020
00021 bool cubemx_transport_open(struct uxrCustomTransport * transport){
00022     UART_HandleTypeDef * uart = (UART_HandleTypeDef*) transport->args;
00023     HAL_UART_Receive_DMA(uart, dma_buffer, UART_DMA_BUFFER_SIZE);
00024     return true;
00025 }
00026
00027 bool cubemx_transport_close(struct uxrCustomTransport * transport){
00028     UART_HandleTypeDef * uart = (UART_HandleTypeDef*) transport->args;
00029     HAL_UART_DMAStop(uart);
00030     return true;
00031 }
00032
00033 size_t cubemx_transport_write(struct uxrCustomTransport* transport, uint8_t * buf, size_t len, uint8_t
* err){
00034     UART_HandleTypeDef * uart = (UART_HandleTypeDef*) transport->args;
00035
00036     HAL_StatusTypeDef ret;
00037     if (uart->gState == HAL_UART_STATE_READY){
00038         ret = HAL_UART_Transmit_DMA(uart, buf, len);
00039         while (ret == HAL_OK && uart->gState != HAL_UART_STATE_READY){
00040             osDelay(1);
00041         }
00042
00043         return (ret == HAL_OK) ? len : 0;
00044     }else{
00045         return 0;
00046     }
00047 }
00048
00049 size_t cubemx_transport_read(struct uxrCustomTransport* transport, uint8_t* buf, size_t len, int
timeout, uint8_t* err){
00050     UART_HandleTypeDef * uart = (UART_HandleTypeDef*) transport->args;
00051
00052     int ms_used = 0;
00053     do
00054     {
00055         __disable_irq();
00056         dma_tail = UART_DMA_BUFFER_SIZE - __HAL_DMA_GET_COUNTER(uart->hdmarx);
00057         __enable_irq();
00058         ms_used++;
00059         osDelay(portTICK_RATE_MS);
00060     } while (dma_head == dma_tail && ms_used < timeout);
00061
00062     size_t wrote = 0;
00063     while ((dma_head != dma_tail) && (wrote < len)){
00064         buf[wrote] = dma_buffer[dma_head];
00065         dma_head = (dma_head + 1) % UART_DMA_BUFFER_SIZE;
00066         wrote++;
00067     }
00068
00069     return wrote;
00070 }
00071
00072 #endif //RMW_UXRCE_TRANSPORT_CUSTOM

```

5.25 drv_gpio.c

```

00001 #include "main.h"
00002 #include "drv_gpio.h"
00003
00004 void MX_GPIO_Init(void)
00005 {
00006     GPIO_InitTypeDef GPIO_InitStruct = {0};
00007
00008     /* GPIO Ports Clock Enable */
00009     __HAL_RCC_GPIOC_CLK_ENABLE();
00010     __HAL_RCC_GPIOH_CLK_ENABLE();
00011     __HAL_RCC_GPIOA_CLK_ENABLE();
00012     __HAL_RCC_GPIOB_CLK_ENABLE();
00013
00014     /*Configure GPIO pin Output Level */
00015     HAL_GPIO_WritePin(LD2_GPIO_Port, LD2_Pin, GPIO_PIN_RESET);

```

```

00016
00017  /*Configure GPIO pin : B1_Pin */
00018  GPIO_InitStruct.Pin = B1_Pin;
00019  GPIO_InitStruct.Mode = GPIO_MODE_IT_FALLING;
00020  GPIO_InitStruct.Pull = GPIO_NOPULL;
00021  HAL_GPIO_Init(B1_GPIO_Port, &GPIO_InitStruct);
00022
00023  /*Configure GPIO pin : LD2_Pin */
00024  GPIO_InitStruct.Pin = LD2_Pin;
00025  GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
00026  GPIO_InitStruct.Pull = GPIO_NOPULL;
00027  GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_LOW;
00028  HAL_GPIO_Init(LD2_GPIO_Port, &GPIO_InitStruct);
00029
00030 }
00031
00032 extern void quadEncoder_CallbackIndexL(void);
00033 extern void quadEncoder_CallbackIndexR(void);
00034
00035 void HAL_GPIO_EXTI_Callback(uint16_t GPIO_Pin)
00036 {
00037     switch(GPIO_Pin)
00038     {
00039         case GPIO_PIN_0 :
00040             quadEncoder_CallbackIndexR();
00041             break;
00042
00043         case GPIO_PIN_1 :
00044
00045             break;
00046
00047         case GPIO_PIN_3:
00048             break;
00049
00050         case GPIO_PIN_10:
00051             quadEncoder_CallbackIndexL();
00052             break;
00053
00054         case GPIO_PIN_13 :    // USER BUTTON
00055             break;
00056
00057         default :
00058             break;
00059     }
00060 }
00061 }

```

5.26 drv_i2c.c

```

00001 #include "main.h"
00002 #include <string.h>
00003 #include "drv_i2c.h"
00004
00005
00006 I2C_HandleTypeDef hi2c1;
00007
00008 void MX_I2C1_Init(void)
00009 {
00010
00011     hi2c1.Instance = I2C1;
00012     hi2c1.Init.ClockSpeed = 100000;
00013     hi2c1.Init.DutyCycle = I2C_DUTYCYCLE_2;
00014     hi2c1.Init.OwnAddress1 = 0;
00015     hi2c1.Init.AddressingMode = I2C_ADDRESSINGMODE_7BIT;
00016     hi2c1.Init.DualAddressMode = I2C_DUALADDRESS_DISABLE;
00017     hi2c1.Init.OwnAddress2 = 0;
00018     hi2c1.Init.GeneralCallMode = I2C_GENERALCALL_DISABLE;
00019     hi2c1.Init.NoStretchMode = I2C_NOSTRETCH_DISABLE;
00020     if (HAL_I2C_Init(&hi2c1) != HAL_OK)
00021     {
00022         Error_Handler();
00023     }
00024
00025 }
00026
00027
00028
00029
00030
00031 //=====
00032 // Transmit n_data bytes to i2c slave
00033 //=====
00034 int i2c1_WriteBuffer(uint16_t addrSlave, uint8_t *data, int n_data)

```

```

00035 {
00036     int status;
00037     status = HAL_I2C_Master_Transmit(&hi2c1, addrSlave, data, n_data , 100);
00038     return status;
00039 }
00040 //=====
00041 // Receive n_data bytes from i2c slave
00042 //=====
00043 int i2c1_ReadBuffer(uint16_t addrSlave, uint8_t *data, int n_data)
00044 {
00045     int status;
00046     status = HAL_I2C_Master_Receive(&hi2c1, addrSlave, data, n_data , 100);
00047     return status;
00048 }
00049 //=====
00050 // Receive n_data bytes - located at regAddr - from i2c slave
00051 //=====
00052 int i2c1_ReadRegBuffer(uint16_t addrSlave, uint8_t regAddr, uint8_t *data, int n_data)
00053 {
00054     int status;
00055     uint8_t RegAddr;
00056     RegAddr=regAddr;
00057     do{
00058         status=HAL_I2C_Master_Transmit(&hi2c1, addrSlave, &RegAddr, 1, 100);
00059         if( status )
00060             break;
00061         status =HAL_I2C_Master_Receive(&hi2c1, addrSlave, data, n_data, n_data*100);
00062     }while(0);
00063     return status;
00064 }
00065 //=====
00066 // Write n_data bytes - have to be written at regAddr - to i2c slave
00067 //=====
00068 //=====
00069 int i2c1_WriteRegBuffer(uint16_t addrSlave, uint8_t regAddr, uint8_t *data, int n_data)
00070 {
00071     int status;
00072     uint8_t RegAddr[0x10];
00073     RegAddr[0]=regAddr;
00074     memcpy(RegAddr+1, data, n_data);
00075     status=HAL_I2C_Master_Transmit(&hi2c1, addrSlave, RegAddr, n_data+1, 100);
00076     return status;
00077 }
00078 //=====
00079 // Write 1 byte at regAddr Slave - Interrupt Method
00080 //=====
00081 void i2c1_WriteRegByte_IT(uint16_t addrSlave, uint8_t regAddr, uint8_t data)
00082 {
00083     uint8_t datas_to_send[2];
00084     datas_to_send[0]=regAddr;
00085     datas_to_send[1]=data;
00086     while(HAL_I2C_Master_Transmit_IT(&hi2c1, addrSlave, datas_to_send, 2)!= HAL_OK){}
00087     while( HAL_I2C_GetState(&hi2c1) != HAL_I2C_STATE_READY){}
00088 }
00089 //=====
00090 // Read 1 byte from regAddr Slave - Interrupt Method
00091 //=====
00092 void i2c1_ReadRegBuffer_IT(uint16_t addrSlave, uint8_t regAddr, uint8_t* datas, int len)
00093 {
00094     while(HAL_I2C_Master_Transmit_IT(&hi2c1, addrSlave, &regAddr, 1)!= HAL_OK){}
00095     while( HAL_I2C_GetState(&hi2c1) != HAL_I2C_STATE_READY){}
00096     while(HAL_I2C_Master_Receive_IT(&hi2c1, addrSlave, datas, len)!= HAL_OK){}
00097     while( HAL_I2C_GetState(&hi2c1) != HAL_I2C_STATE_READY ){}
00098 }
00099 //=====
00100 // Write 1 byte to regAddr (16 bits) Slave
00101 //=====
00102 int i2c1_WriteReg16Byte(uint16_t addrSlave, uint16_t regAddr, uint8_t data)
00103 {
00104     int status;
00105     uint8_t buffer[3];
00106     buffer[0]=regAddr>>8;
00107     buffer[1]=regAddr&0xFF;
00108     buffer[2]=data;
00109     status = HAL_I2C_Master_Transmit(&hi2c1, addrSlave, buffer, 3 , 100);
00110     return status;
00111 }
00112 //=====
00113 // Write 16 bits word to regAddr (16 bits) Slave

```

```

00122 //=====
00123 int i2c1_WriteReg16Word16(uint16_t addrSlave, uint16_t regAddr, uint16_t data)
00124 {
00125     int status;
00126     uint8_t buffer[4];
00127     buffer[0]=regAddr>>8;
00128     buffer[1]=regAddr&0xFF;
00129     buffer[2]=data>>8;
00130     buffer[3]=data&0xFF;
00131
00132     status = HAL_I2C_Master_Transmit(&hi2c1, addrSlave, buffer, 4 , 100);
00133     return status;
00134 }
00135 //=====
00136 // Write 32 bits word to regAddr (16 bits) Slave
00137 //=====
00138 int i2c1_WriteReg16Word32(uint16_t addrSlave, uint16_t regAddr, uint32_t data)
00139 {
00140     int status;
00141     uint8_t buffer[4];
00142     buffer[0]=regAddr>>8;
00143     buffer[1]=regAddr&0xFF;
00144     buffer[2]=data>>24;
00145     buffer[3]=(data>>16)&0xFF;
00146     buffer[4]=(data>>8)&0xFF;;
00147     buffer[5]=data&0xFF;
00148
00149     status = HAL_I2C_Master_Transmit(&hi2c1, addrSlave, buffer, 6 , 100);
00150     return status;
00151 }
00152 //=====
00153 // Read 1 byte from regAddr (16 bits) Slave
00154 //=====
00155 int i2c1_ReadReg16Byte(uint16_t addrSlave, uint16_t regAddr, uint8_t *data)
00156 {
00157     int status;
00158     uint8_t buffer[2];
00159
00160     buffer[0]=regAddr>>8;
00161     buffer[1]=regAddr&0xFF;
00162
00163     status=HAL_I2C_Master_Transmit(&hi2c1, addrSlave, buffer, 2, 100);
00164     if(!status ) {
00165         status =HAL_I2C_Master_Receive(&hi2c1, addrSlave, buffer, 1, 100);
00166         if( !status ){
00167             *data=buffer[0];
00168         }
00169     }
00170
00171     return status;
00172 }
00173 //=====
00174 // Read 16 bits word from regAddr (16 bits) Slave
00175 //=====
00176 int i2c1_ReadReg16Word16(uint16_t addrSlave, uint16_t regAddr, uint16_t *data)
00177 {
00178     int status;
00179     uint8_t buffer[2];
00180
00181     buffer[0]=regAddr>>8;
00182     buffer[1]=regAddr&0xFF;
00183
00184     status=HAL_I2C_Master_Transmit(&hi2c1, addrSlave, buffer, 2, 100);
00185     if(!status ) {
00186         status =HAL_I2C_Master_Receive(&hi2c1, addrSlave, buffer, 2, 100);
00187         if( !status ){
00188             //VL6180x register are Big endian if cpu is be direct read direct into *data is possible
00189             *data=((uint16_t)buffer[0]<<8)|(uint16_t)buffer[1];
00190         }
00191     }
00192
00193     return status;
00194 }
00195 //=====
00196 // Read 32 bits word from regAddr (16 bits) Slave
00197 //=====
00198 int i2c1_ReadReg16Word32(uint16_t addrSlave, uint16_t regAddr, uint32_t *data)
00199 {
00200     int status;
00201     uint8_t buffer[4];
00202
00203     buffer[0]=regAddr>>8;
00204     buffer[1]=regAddr&0xFF;
00205
00206     status=HAL_I2C_Master_Transmit(&hi2c1, addrSlave, buffer, 2, 100);
00207     if(!status ) {
00208         status =HAL_I2C_Master_Receive(&hi2c1, addrSlave, buffer, 4, 100);

```

```

00209         if( !status ){
00210             //VL6180x register are Big endian if cpu is be direct read direct into *data is possible
00211             *data=((uint32_t)buffer[0]«24)|((uint32_t)buffer[1]«16)|((uint32_t)buffer[2]«8)|((uint32_t)buffer[3]);
00212         }
00213     }
00214 }
00215     return status;
00216 }
00217
00218 //=====
00219 // Read n_data bytes from regAddr (16 bits) Slave
00220 //=====
00221 int i2c1_ReadReg16Buffer(uint16_t addrSlave, uint16_t regAddr, uint8_t *data, int n_data)
00222 {
00223     int status;
00224     uint8_t buffer[2];
00225
00226     buffer[0]=regAddr»8;
00227     buffer[1]=regAddr&0xFF;
00228
00229     status=HAL_I2C_Master_Transmit(&hi2c1, addrSlave, buffer, 2, 100);
00230     if( !status ){
00231         status=HAL_I2C_Master_Receive(&hi2c1, addrSlave, data, n_data, n_data*100);
00232     }
00233
00234
00235
00236     return status;
00237 }
00238
00239
00240
00241
00242

```

5.27 drv_uart.c

```

00001 #include "main.h"
00002 #include "drv_uart.h"
00003
00004 UART_HandleTypeDef huart1;
00005 UART_HandleTypeDef huart2;
00006 DMA_HandleTypeDef hdma_usart1_rx;
00007 DMA_HandleTypeDef hdma_usart1_tx;
00008 DMA_HandleTypeDef hdma_usart2_rx;
00009 DMA_HandleTypeDef hdma_usart2_tx;
00010
00011
00012 void MX_USART1_UART_Init(void)
00013 {
00014     huart1.Instance = USART1;
00015     huart1.Init.BaudRate = 115200;
00016     huart1.Init.WordLength = UART_WORDLENGTH_8B;
00017     huart1.Init.StopBits = UART_STOPBITS_1;
00018     huart1.Init.Parity = UART_PARITY_NONE;
00019     huart1.Init.Mode = UART_MODE_TX_RX;
00020     huart1.Init.HwFlowCtl = UART_HWCONTROL_NONE;
00021     huart1.Init.OverSampling = UART_OVERSAMPLING_16;
00022     if (HAL_UART_Init(&huart1) != HAL_OK)
00023     {
00024         Error_Handler();
00025     }
00026 }
00027
00028
00029 void MX_USART2_UART_Init(void)
00030 {
00031     huart2.Instance = USART2;
00032     huart2.Init.BaudRate = 115200;
00033     huart2.Init.WordLength = UART_WORDLENGTH_8B;
00034     huart2.Init.StopBits = UART_STOPBITS_1;
00035     huart2.Init.Parity = UART_PARITY_NONE;
00036     huart2.Init.Mode = UART_MODE_TX_RX;
00037     huart2.Init.HwFlowCtl = UART_HWCONTROL_NONE;
00038     huart2.Init.OverSampling = UART_OVERSAMPLING_16;
00039     if (HAL_UART_Init(&huart2) != HAL_OK)
00040     {
00041         Error_Handler();
00042     }
00043 }
00044
00048 void MX_DMA_Init(void)

```

```

00049 {
00050
00051     /* DMA controller clock enable */
00052     __HAL_RCC_DMA2_CLK_ENABLE();
00053     __HAL_RCC_DMA1_CLK_ENABLE();
00054
00055     /* DMA interrupt init */
00056     /* DMA1_Stream5_IRQn interrupt configuration */
00057     HAL_NVIC_SetPriority(DMA1_Stream5_IRQn, 5, 0);
00058     HAL_NVIC_EnableIRQ(DMA1_Stream5_IRQn);
00059     /* DMA1_Stream6_IRQn interrupt configuration */
00060     HAL_NVIC_SetPriority(DMA1_Stream6_IRQn, 5, 0);
00061     HAL_NVIC_EnableIRQ(DMA1_Stream6_IRQn);
00062     /* DMA2_Stream2_IRQn interrupt configuration */
00063     HAL_NVIC_SetPriority(DMA2_Stream2_IRQn, 5, 0);
00064     HAL_NVIC_EnableIRQ(DMA2_Stream2_IRQn);
00065     /* DMA2_Stream7_IRQn interrupt configuration */
00066     HAL_NVIC_SetPriority(DMA2_Stream7_IRQn, 5, 0);
00067     HAL_NVIC_EnableIRQ(DMA2_Stream7_IRQn);
00068
00069 }

```

5.28 freertos.c

```

00001 /* USER CODE BEGIN Header */
00018 /* USER CODE END Header */
00019
00020 /* Includes -----*/
00021 #include "FreeRTOS.h"
00022 #include "task.h"
00023 #include "main.h"
00024
00025 /* Private includes -----*/
00026 /* USER CODE BEGIN Includes */
00027
00028 /* USER CODE END Includes */
00029
00030 /* Private typedef -----*/
00031 /* USER CODE BEGIN PTD */
00032
00033 /* USER CODE END PTD */
00034
00035 /* Private define -----*/
00036 /* USER CODE BEGIN PD */
00037
00038 /* USER CODE END PD */
00039
00040 /* Private macro -----*/
00041 /* USER CODE BEGIN PM */
00042
00043 /* USER CODE END PM */
00044
00045 /* Private variables -----*/
00046 /* USER CODE BEGIN Variables */
00047
00048 /* USER CODE END Variables */
00049
00050 /* Private function prototypes -----*/
00051 /* USER CODE BEGIN FunctionPrototypes */
00052
00053 /* USER CODE END FunctionPrototypes */
00054
00055 /* Private application code -----*/
00056 /* USER CODE BEGIN Application */
00057
00058 /* USER CODE END Application */
00059

```

5.29 groveLCD.c

```

00001 /*
00002  * groveLCD.c
00003  *
00004  * Created on: Jan 8, 2020
00005  * Author: kerhoas
00006  */
00007
00008 #include "groveLCD.h"
00009 #include <math.h>

```

```

00010 #include "util.h"
00011
00012 uint8_t _displayfunction;
00013 uint8_t _displaycontrol;
00014 uint8_t _displaymode;
00015 uint8_t _initialized;
00016 uint8_t _numlines,_currline;
00017
00018 //=====
00019 void groveLCD_test()
00020 {
00021     uint8_t tab[2];
00022     tab[1] = 100;
00023     i2c1_WriteRegBuffer(RGB_ADDRESS, REG_RED, tab, 1);
00024 }
00025 //=====
00026 void i2c_send_byte(unsigned char dta)
00027 {
00028     i2c1_WriteBuffer(LCD_ADDRESS, &dta, 1);
00029 }
00030 //=====
00031 void i2c_send_byteS(unsigned char *dta, unsigned char len)
00032 {
00033     i2c1_WriteBuffer(LCD_ADDRESS, dta, len);
00034 }
00035 //=====
00036 void groveLCD_begin(uint8_t cols, uint8_t lines, uint8_t dotsize)
00037 {
00038     if (lines > 1) {
00039         _displayfunction |= LCD_2LINE;
00040     }
00041     _numlines = lines;
00042     _currline = 0;
00043
00044     // for some 1 line displays you can select a 10 pixel high font
00045     if ((dotsize != 0) && (lines == 1)) {
00046         _displayfunction |= LCD_5x10DOTS;
00047     }
00048
00049     // SEE PAGE 45/46 FOR INITIALIZATION SPECIFICATION!
00050     // according to datasheet, we need at least 40ms after power rises above 2.7V
00051     // before sending commands. Arduino can turn on way befer 4.5V so we'll wait 50
00052     HAL_Delay(50);
00053
00054     // this is according to the hitachi HD44780 datasheet
00055     // page 45 figure 23
00056
00057     // Send function set command sequence
00058     groveLCD_command(LCD_FUNCTIONSET | _displayfunction);
00059     HAL_Delay(5); // wait more than 4.1ms
00060
00061     // second try
00062     groveLCD_command(LCD_FUNCTIONSET | _displayfunction);
00063     HAL_Delay(5);
00064
00065     // third go
00066     groveLCD_command(LCD_FUNCTIONSET | _displayfunction);
00067
00068     // finally, set # lines, font size, etc.
00069     groveLCD_command(LCD_FUNCTIONSET | _displayfunction);
00070
00071     _displaycontrol = LCD_DISPLAYON | LCD_CURSOROFF | LCD_BLINKOFF;
00072     groveLCD_display();
00073
00074     // clear it off
00075     groveLCD_clear();
00076
00077     // Initialize to default text direction (for romance languages)
00078     _displaymode = LCD_ENTRYLEFT | LCD_ENTRYSHIFTDECREMENT;
00079     // set the entry mode
00080     groveLCD_command(LCD_ENTRYMODESET | _displaymode);
00081
00082     // backlight init
00083     groveLCD_setReg(REG_MODE1, 0);
00084     // set LEDs controllable by both PWM and GRPPWM registers
00085     groveLCD_setReg(REG_OUTPUT, 0xFF);
00086     // set MODE2 values
00087     // 0010 0000 -> 0x20 (DMBLNK to 1, ie blinky mode)
00088     groveLCD_setReg(REG_MODE2, 0x20);
00089
00090     groveLCD_setColorWhite();
00091
00092

```



```

00097 }
00098 //=====
00099 void groveLCD_setColorAll(){groveLCD_setRGB(0, 0, 0);}
00100 void groveLCD_setColorWhite(){groveLCD_setRGB(255, 255, 255);}
00101 //=====
00102
00103 /******* high level commands, for the user! */
00104 void groveLCD_clear()
00105 {
00106     groveLCD_command(LCD_CLEARDISPLAY);          // clear display, set cursor position to zero
00107     HAL_Delay(2000);                             // this command takes a long time!
00108 }
00109 //=====
00110 void groveLCD_home()
00111 {
00112     groveLCD_command(LCD_RETURNHOME);            // set cursor position to zero
00113     HAL_Delay(2000);                             // this command takes a long time!
00114 }
00115 //=====
00116 void groveLCD_setCursor(uint8_t col, uint8_t row)
00117 {
00118     col = (row == 0 ? col|0x80 : col|0xc0);
00119     unsigned char dta[2] = {0x80, col};
00120     i2c_send_bytes(dta, 2);
00121 }
00122 //=====
00123 // Turn the display on/off (quickly)
00124 void groveLCD_noDisplay()
00125 {
00126     _displaycontrol &= ~LCD_DISPLAYON;
00127     groveLCD_command(LCD_DISPLAYCONTROL | _displaycontrol);
00128 }
00129 //=====
00130 void groveLCD_display() {
00131     _displaycontrol |= LCD_DISPLAYON;
00132     groveLCD_command(LCD_DISPLAYCONTROL | _displaycontrol);
00133 }
00134 //=====
00135 // Turns the underline cursor on/off
00136 void groveLCD_noCursor()
00137 {
00138     _displaycontrol &= ~LCD_CURSORON;
00139     groveLCD_command(LCD_DISPLAYCONTROL | _displaycontrol);
00140 }
00141 //=====
00142 void groveLCD_cursor() {
00143     _displaycontrol |= LCD_CURSORON;
00144     groveLCD_command(LCD_DISPLAYCONTROL | _displaycontrol);
00145 }
00146 //=====
00147 // Turn on and off the blinking cursor
00148 void groveLCD_noBlink()
00149 {
00150     _displaycontrol &= ~LCD_BLINKON;
00151     groveLCD_command(LCD_DISPLAYCONTROL | _displaycontrol);
00152 }
00153 //=====
00154 void groveLCD_blink()
00155 {
00156     _displaycontrol |= LCD_BLINKON;
00157     groveLCD_command(LCD_DISPLAYCONTROL | _displaycontrol);
00158 }
00159 //=====
00160 // These commands scroll the display without changing the RAM
00161 void groveLCD_scrollDisplayLeft(void)
00162 {
00163     groveLCD_command(LCD_CURSORSHIFT | LCD_DISPLAYMOVE | LCD_MOVELEFT);
00164 }
00165 //=====
00166 void groveLCD_scrollDisplayRight(void)
00167 {
00168     groveLCD_command(LCD_CURSORSHIFT | LCD_DISPLAYMOVE | LCD_MOVERIGHT);
00169 }
00170 //=====
00171 // This is for text that flows Left to Right
00172 void groveLCD_leftToRight(void)
00173 {
00174     _displaymode |= LCD_ENTRYLEFT;
00175     groveLCD_command(LCD_ENTRYMODESET | _displaymode);
00176 }
00177 //=====
00178 // This is for text that flows Right to Left
00179 void groveLCD_rightToLeft(void)
00180 {
00181     _displaymode &= ~LCD_ENTRYLEFT;
00182     groveLCD_command(LCD_ENTRYMODESET | _displaymode);
00183 }

```

```

00184 //=====
00185 // This will 'right justify' text from the cursor
00186 void groveLCD_autoscroll(void)
00187 {
00188     _displaymode |= LCD_ENTRYSHIFTINCREMENT;
00189     groveLCD_command(LCD_ENTRYMODESET | _displaymode);
00190 }
00191 //=====
00192 // This will 'left justify' text from the cursor
00193 void groveLCD_noAutoscroll(void)
00194 {
00195     _displaymode &= ~LCD_ENTRYSHIFTINCREMENT;
00196     groveLCD_command(LCD_ENTRYMODESET | _displaymode);
00197 }
00198 //=====
00199 // Allows us to fill the first 8 CGRAM locations
00200 // with custom characters
00201 void groveLCD_createChar(uint8_t location, uint8_t charmap[])
00202 {
00203     location &= 0x7; // we only have 8 locations 0-7
00204     groveLCD_command(LCD_SETCGRAMADDR | (location << 3));
00205
00206     unsigned char dta[9];
00207     dta[0] = 0x40;
00208     for(int i=0; i<8; i++)
00209     {
00210         dta[i+1] = charmap[i];
00211     }
00212     i2c_send_byteS(dta, 9);
00213 }
00214 //=====
00215 // Control the backlight LED blinking
00216 void groveLCD_blinkLED(void)
00217 {
00218     // blink period in seconds = (<reg 7> + 1) / 24
00219     // on/off ratio = <reg 6> / 256
00220     groveLCD_setReg(0x07, 0x17); // blink every second
00221     groveLCD_setReg(0x06, 0x7f); // half on, half off
00222 }
00223 //=====
00224 void groveLCD_noBlinkLED(void)
00225 {
00226     groveLCD_setReg(0x07, 0x00);
00227     groveLCD_setReg(0x06, 0xff);
00228 }
00229 //=====
00230 /******* mid level commands, for sending data/cmds */
00231
00232 // send command
00233 void groveLCD_command(uint8_t value)
00234 {
00235     unsigned char dta[2] = {0x80, value};
00236     i2c_send_byteS(dta, 2);
00237 }
00238 //=====
00239 // send data
00240 int groveLCD_write(uint8_t value)
00241 {
00242     unsigned char dta[2] = {0x40, value};
00243     i2c_send_byteS(dta, 2);
00244     return 1; // assume success
00245 }
00246 //=====
00247 void groveLCD_putString(char* s)
00248 {
00249     while(*s != '\0')
00250     {
00251         groveLCD_write(*s);
00252         s++;
00253     }
00254 }
00255 //=====
00256 void groveLCD_setReg(unsigned char addr, unsigned char dta)
00257 {
00258     i2c1_WriteRegBuffer(RGB_ADDRESS, addr, &dta, 1);
00259 }
00260 //=====
00261 void groveLCD_setRGB(unsigned char r, unsigned char g, unsigned char b)
00262 {
00263     groveLCD_setReg(REG_RED, r);
00264     groveLCD_setReg(REG_GREEN, g);
00265     groveLCD_setReg(REG_BLUE, b);
00266 }
00267 //=====
00268 const unsigned char color_define[4][3] =
00269 {
00270     {255, 255, 255}, // white

```

```

00271     {255, 0, 0},           // red
00272     {0, 255, 0},          // green
00273     {0, 0, 255},         // blue
00274 };
00275 //=====
00276 void groveLCD_setColor(unsigned char color)
00277 {
00278     if(color > 3) return ;
00279     groveLCD_setRGB(color_define[color][0], color_define[color][1], color_define[color][2]);
00280 }
00281 //=====
00282 void groveLCD_term_printf(const char* fmt, ...)
00283 {
00284     __gnuc_va_list ap;
00285     char *p;
00286     char ch;
00287     unsigned long ul;
00288     unsigned long long ull;
00289     unsigned long size;
00290     unsigned int sp;
00291     char s[60];
00292     int first=0;
00293
00294     va_start(ap, fmt);
00295
00296     while (*fmt != '\0') {
00297         if (*fmt == '%') {
00298             size=0; sp=1;
00299             if (++fmt=='0') {fmt++; sp=0;} // parse %04d --> sp=0
00300             ch=*fmt;
00301             if ((ch>'0') && (ch<='9')) { // parse %4d --> size=4
00302                 char tmp[10];
00303                 int i=0;
00304                 while ((ch>='0') && (ch<='9')) {
00305                     tmp[i++]=ch;
00306                     ch=++fmt;
00307                 }
00308                 tmp[i]='\0';
00309                 size=str2num(tmp,10);
00310             }
00311             switch (ch) {
00312                 case '%':
00313                     groveLCD_write('%');
00314                     break;
00315                 case 'c':
00316                     ch = va_arg(ap, int);
00317                     groveLCD_write(ch);
00318                     break;
00319                 case 's':
00320                     p = va_arg(ap, char *);
00321                     groveLCD_putString(p);
00322                     break;
00323                 case 'd':
00324                     ul = va_arg(ap, long);
00325                     if ((long)ul < 0) {
00326                         groveLCD_write('-');
00327                         ul = -(long)ul;
00328                         //size--;
00329                     }
00330                     num2str(s, ul, 10, size, sp);
00331                     groveLCD_putString(s);
00332                     break;
00333                 case 'u':
00334                     ul = va_arg(ap, unsigned int);
00335                     num2str(s, ul, 10, size, sp);
00336                     groveLCD_putString(s);
00337                     break;
00338                 case 'o':
00339                     ul = va_arg(ap, unsigned int);
00340                     num2str(s, ul, 8, size, sp);
00341                     groveLCD_putString(s);
00342                     break;
00343                 case 'p':
00344                     groveLCD_write('0');
00345                     groveLCD_write('x');
00346                     ul = va_arg(ap, unsigned int);
00347                     num2str(s, ul, 16, size, sp);
00348                     groveLCD_putString(s);
00349                     break;
00350                 case 'x':
00351                     ul = va_arg(ap, unsigned int);
00352                     num2str(s, ul, 16, size, sp);
00353                     groveLCD_putString(s);
00354                     break;
00355                 case 'f':
00356                     if(first==0){ ull = va_arg(ap, long long unsigned int); first = 1;}
00357                     ull = va_arg(ap, long long unsigned int);

```

```

00358             int sign = ( ull & 0x80000000 ) >> 31;
00359             int m = (ull & 0x000FFFFF) ; // should be 0x007FFFFF
00360             float mf = (float)m ;
00361             mf = mf / pow(2.0,20.0);
00362             mf = mf + 1.0;
00363             int e = ( ull & 0x78000000 ) >> 23 ; // should be int e = ( ul & 0x7F800000 ) >> 23;
00364             e = e | (( ull & 0x000F0000 ) >> 20);
00365             e = e - 127;
00366             float f = mf*myPow(2.0,e);
00367             if(sign==1){ groveLCD_write('-'); }
00368             float2str((char*)s, f, 5);
00369             groveLCD_putString((char*)s);
00370             break;
00371
00372             default:
00373                 groveLCD_write(*fmt);
00374             }
00375         } else groveLCD_write(*fmt);
00376         fmt++;
00377     }
00378     va_end(ap);
00379 }
00380 //=====
00381
00382
00383
00384

```

5.30 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_↔ Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Src/main.c File Reference

file that contain the main code

```

#include "main.h"
#include "motorCommand.h"
#include "quadEncoder.h"
#include "captDistIR.h"
#include "VL53L0X.h"
#include "groveLCD.h"

```

Data Structures

- struct [AMessage](#)
- struct [MicroRosPubMsg](#)
- struct [MicroRosSubMsg](#)

Macros

- #define [SAMPLING_PERIOD_ms](#) 5

config exo

- #define [EXSTARTUP](#) 0
- #define [EXTEST_UART2](#) 1
- #define [EXCORRECTOR](#) 2
- #define [EXTESTCORRECTOR](#) 3
- #define [EXTEST_VL53](#) 4
- #define [EXTEST_MICROROS](#) 5
- #define [EXFINAL](#) 6

- #define SYNCHRO_EX EXFINAL

config robot

- #define SEUIL_DIST_SENSOR 800
- #define ROS_DOMAIN_ID 0
- #define LCD 1
- #define VL53 1
- #define MICROROS 1
- #define DEBUG_PRINTF 0
- #define DEBUG_MOTOR 0

config correcteur

- #define Te SAMPLING_PERIOD_ms
- #define LKp 0.001
- #define LKi (5.0/(0.1*40.0))
- #define RKp 0.001
- #define RKi (5.0/(0.1*40.0))

config default speed for each mode

- #define CMD 1000
- #define VITESSE_KART CMD/2
- #define VITESSE_OBS CMD
- #define VITESSE_CAM CMD/3

config camera settings

- #define CAMERA_X_MIN 0
- #define CAMERA_X_MAX 640
- #define CAMERA_Y_MIN 0
- #define CAMERA_Y_MAX 480

config default behaviour

- #define DEFAULT_MODE MODE_ZIG
- #define DEFAULT_SPEED LOW
- #define DEFAULT_DIR STOP

config test value

- #define NB 200
- #define TEST_CORRECTOR_DUTY 150
- #define TEST_CORRECTOR_SPEEDL -100
- #define TEST_CORRECTOR_SPEEDR -100
- #define TEST_LEFT_MOTOR 1

Enumerations

- enum { MODE_OBS , MODE_ZIG , MODE_CAM , LAST_MODE }
- enum {
STOP_VIT , LOW , FAST , SONIC ,
LAST_SPEED =100 }
- enum {
AVANT , GAUCHE , RECULE , DROITE ,
STOP , AVANT_GAUCHE , AVANT_DROITE , RECULE_GAUCHE ,
RECULE_DROITE , LAST_DIR }

Functions

- void [SystemClock_Config](#) (void)
- bool **cubemx_transport_open** (struct uxrCustomTransport *transport)
- bool **cubemx_transport_close** (struct uxrCustomTransport *transport)
- size_t **cubemx_transport_write** (struct uxrCustomTransport *transport, const uint8_t *buf, size_t len, uint8_t *err)
- size_t **cubemx_transport_read** (struct uxrCustomTransport *transport, uint8_t *buf, size_t len, int timeout, uint8_t *err)
- void * [microros_allocate](#) (size_t size, void *state)
- void [microros_deallocate](#) (void *pointer, void *state)
- void * [microros_reallocate](#) (void *pointer, size_t size, void *state)
- void * [microros_zero_allocate](#) (size_t number_of_elements, size_t size_of_element, void *state)
- void [CHECKMRRET](#) (rcl_ret_t ret, char *msg)
- void [SubscriberCallbackFunction](#) (const void *msgin)
- void [microros_task](#) (void *argument)
- void [task_Motor_Left](#) (void *pvParameters)
- void [task_Motor_Right](#) (void *pvParameters)
- void [task_VL53](#) (void *pvParameters)
- void [task_Grove_LCD](#) (void *pvParameters)
- void [task_Supervision](#) (void *pvParameters)
- int [main](#) (void)
- void [test_uart2](#) (void *pvParameters)
- void [test_vl53](#) (void *pvParameters)
- void [test_motor](#) (void *pvParameters)
- void [HAL_TIM_PeriodElapsedCallback](#) (TIM_HandleTypeDef *htim)
- void [Error_Handler](#) (void)

Variables

- UART_HandleTypeDef [huart1](#)
- UART_HandleTypeDef [huart2](#)
- DMA_HandleTypeDef [hdma_usart1_rx](#)
- DMA_HandleTypeDef [hdma_usart1_tx](#)
- DMA_HandleTypeDef [hdma_usart2_rx](#)
- DMA_HandleTypeDef [hdma_usart2_tx](#)
- I2C_HandleTypeDef [hi2c1](#)
- osThreadId_t [defaultTaskHandle](#)
- const osThreadAttr_t [defaultTask_attributes](#)
- int16_t [tab_speed](#) [NB]

semaphore

- xSemaphoreHandle [xSem_Supervision](#) = NULL

queueHandle

- xQueueHandle [q_mot_L](#) = NULL
- xQueueHandle [q_mot_R](#) = NULL
- xQueueHandle [qhMR_sub](#) = NULL
- xQueueHandle [qhMR_pub](#) = NULL
- xQueueHandle [qhLCD](#) = NULL
- xQueueHandle [qhVI53](#) = NULL

5.30.1 Detailed Description

file that contain the main code

Definition in file [main.c](#).

5.30.2 Macro Definition Documentation

5.30.2.1 CAMERA_X_MAX

```
#define CAMERA_X_MAX 640
```

Define maximal x position return by camera

Definition at line 73 of file [main.c](#).

5.30.2.2 CAMERA_X_MIN

```
#define CAMERA_X_MIN 0
```

Define minimal x position return by camera

Definition at line 72 of file [main.c](#).

5.30.2.3 CAMERA_Y_MAX

```
#define CAMERA_Y_MAX 480
```

Define maximal y position return by camera

Definition at line 75 of file [main.c](#).

5.30.2.4 CAMERA_Y_MIN

```
#define CAMERA_Y_MIN 0
```

Define minimal y position return by camera

Definition at line 74 of file [main.c](#).

5.30.2.5 CMD

```
#define CMD 1000
```

Can be use as default speed

Definition at line 66 of file [main.c](#).

5.30.2.6 DEBUG_MOTOR

```
#define DEBUG_MOTOR 0
```

Activate motor debug print

Definition at line 56 of file [main.c](#).

5.30.2.7 DEBUG_PRINTF

```
#define DEBUG_PRINTF 0
```

Activate debug print

Definition at line 55 of file [main.c](#).

5.30.2.8 DEFAULT_DIR

```
#define DEFAULT_DIR STOP
```

Default direction at startup

Definition at line 82 of file [main.c](#).

5.30.2.9 DEFAULT_MODE

```
#define DEFAULT_MODE MODE_ZIG
```

Default mode at startup

Definition at line 80 of file [main.c](#).

5.30.2.10 DEFAULT_SPEED

```
#define DEFAULT_SPEED LOW
```

Default speed at startup

Definition at line 81 of file [main.c](#).

5.30.2.11 EXCORRECTOR

```
#define EXCORRECTOR 2
```

Code to calibrate your correcteur

Definition at line 41 of file [main.c](#).

5.30.2.12 EXFINAL

```
#define EXFINAL 6
```

Final code

Definition at line 45 of file [main.c](#).

5.30.2.13 EXSTARTUP

```
#define EXSTARTUP 0
```

startup code

Definition at line 39 of file [main.c](#).

5.30.2.14 EXTEST_MICROROS

```
#define EXTEST_MICROROS 5
```

Test Micro ROS subscriber and publisher

Definition at line 44 of file [main.c](#).

5.30.2.15 EXTEST_UART2

```
#define EXTEST_UART2 1
```

Test printf and scanf function

Definition at line 40 of file [main.c](#).

5.30.2.16 EXTEST_VL53

```
#define EXTEST_VL53 4
```

Test VL530X sensor

Definition at line 43 of file [main.c](#).

5.30.2.17 EXTESTCORRECTOR

```
#define EXTESTCORRECTOR 3
```

Code to test your correcteur

Definition at line 42 of file [main.c](#).

5.30.2.18 LCD

```
#define LCD 1
```

Activate LCD task

Definition at line 52 of file [main.c](#).

5.30.2.19 LKi

```
#define LKi (5.0/(0.1*40.0))
```

Ki factor for the left motor

Definition at line 61 of file [main.c](#).

5.30.2.20 LKp

```
#define LKp 0.001
```

Kp factor for the left motor

Definition at line 60 of file [main.c](#).

5.30.2.21 MICROROS

```
#define MICROROS 1
```

Activate MicroROS task

Definition at line 54 of file [main.c](#).

5.30.2.22 NB

```
#define NB 200
```

Number of samples in correcteur calibration task

Definition at line 85 of file [main.c](#).

5.30.2.23 RKi

```
#define RKi (5.0/(0.1*40.0))
```

Kp factor for the right motor

Definition at line 63 of file [main.c](#).

5.30.2.24 RKp

```
#define RKp 0.001
```

Kp factor for the right motor

Definition at line 62 of file [main.c](#).

5.30.2.25 ROS_DOMAIN_ID

```
#define ROS_DOMAIN_ID 0
```

Define ROS domain id

Definition at line 51 of file [main.c](#).

5.30.2.26 SAMPLING_PERIOD_ms

```
#define SAMPLING_PERIOD_ms 5
```

Define the delay beetween two execution of the same task

Definition at line 37 of file [main.c](#).

5.30.2.27 SEUIL_DIST_SENSOR

```
#define SEUIL_DIST_SENSOR 800
```

Define the trigger for forward sensors4

Definition at line 50 of file [main.c](#).

5.30.2.28 SYNCHRO_EX

```
#define SYNCHRO_EX EXFINAL
```

Define wich config are executed

Definition at line 47 of file [main.c](#).

5.30.2.29 Te

```
#define Te SAMPLING_PERIOD_ms
```

Definition at line 59 of file [main.c](#).

5.30.2.30 TEST_CORRECTOR_DUTY

```
#define TEST_CORRECTOR_DUTY 150
```

Duty cycle to apply to calibrate the correcteur

Definition at line 86 of file [main.c](#).

5.30.2.31 TEST_CORRECTOR_SPEEDL

```
#define TEST_CORRECTOR_SPEEDL -100
```

Speed to test the left correcteur

Definition at line 87 of file [main.c](#).

5.30.2.32 TEST_CORRECTOR_SPEEDR

```
#define TEST_CORRECTOR_SPEEDR -100
```

Speed to test the right correcteur

Definition at line 88 of file [main.c](#).

5.30.2.33 TEST_LEFT_MOTOR

```
#define TEST_LEFT_MOTOR 1
```

Calibrate left motor correcteur or not

Definition at line 89 of file [main.c](#).

5.30.2.34 VITESSE_CAM

```
#define VITESSE_CAM CMD/3
```

Default speed for camera mode

Definition at line 69 of file [main.c](#).

5.30.2.35 VITESSE_KART

```
#define VITESSE_KART CMD/2
```

Default speed for manual mode

Definition at line 67 of file [main.c](#).

5.30.2.36 VITESSE_OBS

```
#define VITESSE_OBS CMD
```

Default speed for obstacle mode

Definition at line 68 of file [main.c](#).

5.30.2.37 VL53

```
#define VL53 1
```

Activate VL530X task

Definition at line 53 of file [main.c](#).

5.30.3 Enumeration Type Documentation

5.30.3.1 anonymous enum

```
anonymous enum
```

enumerate mode of robot

Definition at line 31 of file [main.c](#).

5.30.3.2 anonymous enum

```
anonymous enum
```

enumerate speed

Definition at line 33 of file [main.c](#).

5.30.3.3 anonymous enum

```
anonymous enum
```

enumerate direction

Definition at line 35 of file [main.c](#).

5.30.4 Function Documentation

5.30.4.1 CHECKMRRET()

```
void CHECKMRRET (  
    rcl_ret_t ret,  
    char * msg )
```

check if microRos function success else print msg in console

Parameters

<i>ret</i>	return value of microRos function
<i>msg</i>	message to print if fail

Definition at line 154 of file [main.c](#).

5.30.4.2 Error_Handler()

```
void Error_Handler (
    void )
```

Definition at line 914 of file [main.c](#).

5.30.4.3 HAL_TIM_PeriodElapsedCallback()

```
void HAL_TIM_PeriodElapsedCallback (
    TIM_HandleTypeDef * htim )
```

Definition at line 906 of file [main.c](#).

5.30.4.4 main()

```
int main (
    void )
```

Init all GPIO and drivers, start the task, init semaphore and queue and launch the kernel

- Config EXSTARTUP
 - Launch microRos, supervision, left motor, right motor and lcd task
- Config EXTEST_UART2
 - Launch test_uart2 task
- Config EXCORRECTOR
 - Launch test_motor task
- Config EXTESTCORRECTOR
 - Launch supervision, left motor and right motor task
- Config EXTEST_VL53
 - Launch test_vl53 task
- Config EXTEST_MICROROS
 - Launch microRos task
- Config EXFINAL
 - Launch microRos, supervision, left motor, right motor, vl53 and lcd task

Definition at line 752 of file [main.c](#).

5.30.4.5 microros_allocate()

```
void * microros_allocate (
    size_t size,
    void * state )
```

Definition at line 14 of file [microros_allocators.c](#).

5.30.4.6 microros_deallocate()

```
void microros_deallocate (
    void * pointer,
    void * state )
```

Definition at line 22 of file [microros_allocators.c](#).

5.30.4.7 microros_reallocate()

```
void * microros_reallocate (
    void * pointer,
    size_t size,
    void * state )
```

Definition at line 31 of file [microros_allocators.c](#).

5.30.4.8 microros_task()

```
void microros_task (
    void * argument )
```

- All config
 - Create the node *STM32_node*
 - Set the Domain id of microRos
- Config EXSTARTUP :
 - Create a publisher and send a message on it
- Config EXTEST_MICROROS :
 - Create a publisher, a subscriber and an executor
 - Init the executor and add the subscriber to it
 - Run the executor and send the receive message on the publisher
- Config EXFINAL :
 - Create 3 publishers, 5 subscriber and an executor
 - Init the executor and add the 5 subscribers to it
 - run the executor and if they are no elements waiting to be read by the task decision put the receive information in the queue If decison task send data then publish data to microRos

Parameters

<i>argument</i>	
-----------------	--

Definition at line 168 of file [main.c](#).

5.30.4.9 microros_zero_allocate()

```
void * microros_zero_allocate (
    size_t number_of_elements,
    size_t size_of_element,
    void * state )
```

Definition at line 44 of file [microros_allocators.c](#).

5.30.4.10 SubscriberCallbackFunction()

```
void SubscriberCallbackFunction (
    const void * msgin )
```

callback call by microros when a message is receive here use as debug and just print the receive msg

Parameters

<i>message</i>	receive
----------------	---------

Definition at line 156 of file [main.c](#).

5.30.4.11 SystemClock_Config()

```
void SystemClock_Config (
    void )
```

Configure the main internal regulator output voltage

Initializes the RCC Oscillators according to the specified parameters in the RCC_OscInitTypeDef structure.

Initializes the CPU, AHB and APB buses clocks

Definition at line 11 of file [systemclock.c](#).

5.30.4.12 task_Grove_LCD()

```
void task_Grove_LCD (
    void * pvParameters )
```

Task use to write information on LCD depending of the data in the LCD queue

- Config EXSTARTUP :
 - Print 'TEST' LCD on screen
- Config EXFINAL :
 - Print different messages depending of the actual mode

Parameters

<i>argument</i>	
-----------------	--

Definition at line 463 of file [main.c](#).

5.30.4.13 task_Motor_Left()

```
void task_Motor_Left (
    void * pvParameters )
```

Task use to control the left motor of the robot

Parameters

<i>argument</i>	
-----------------	--

Definition at line 385 of file [main.c](#).

5.30.4.14 task_Motor_Right()

```
void task_Motor_Right (
    void * pvParameters )
```

Task use to control the right motor of the robot

Parameters

<i>argument</i>	
-----------------	--

Definition at line 411 of file [main.c](#).

5.30.4.15 task_Supervision()

```
void task_Supervision (
    void * pvParameters )
```

Brain of the robot. get information for MicroRos and VL53 task, then send speed to left and right motor, lcd and microRos task

- Config EXSTARTUP :
 - Make the robot drive forward until an obstacle are found
- Config EXTESTCORRECTOR :
 - Make the robot drive forward at speed set by config
- Config EXFINAL :

- Make robot switch between 3 behaviour depending of the mode
- Obstacle : drive and avoid obstacles
- Manual : drive in direction set in ihm
- Camera : follow an object

Parameters

<i>argument</i>	
-----------------	--

Definition at line 498 of file [main.c](#).

5.30.4.16 task_VL53()

```
void task_VL53 (
    void * pvParameters )
```

task that get the value of the VL53 sensor and put it on the VL53 queue

Parameters

<i>argument</i>	
-----------------	--

Definition at line 438 of file [main.c](#).

5.30.4.17 test_motor()

```
void test_motor (
    void * pvParameters )
```

Use to set the duty cycle and register the motor speed at each Te

Definition at line 868 of file [main.c](#).

5.30.4.18 test_uart2()

```
void test_uart2 (
    void * pvParameters )
```

Use to test printf and scanf function

Definition at line 845 of file [main.c](#).

5.30.4.19 test_vl53()

```
void test_vl53 (
    void * pvParameters )
```

Use to test the VL53 sensor

Definition at line 857 of file [main.c](#).

5.30.5 Variable Documentation

5.30.5.1 defaultTask_attributes

```
const osThreadAttr_t defaultTask_attributes
```

Initial value:

```
= {  
    .name = "defaultTask",  
    .stack_size = 3000 * 4,  
    .priority = (osPriority_t) osPriorityNormal,  
}
```

Definition at line 24 of file [main.c](#).

5.30.5.2 defaultTaskHandle

```
osThreadId_t defaultTaskHandle
```

Definition at line 23 of file [main.c](#).

5.30.5.3 hdma_usart1_rx

```
DMA_HandleTypeDef hdma_usart1_rx [extern]
```

Definition at line 6 of file [drv_uart.c](#).

5.30.5.4 hdma_usart1_tx

```
DMA_HandleTypeDef hdma_usart1_tx [extern]
```

Definition at line 7 of file [drv_uart.c](#).

5.30.5.5 hdma_usart2_rx

```
DMA_HandleTypeDef hdma_usart2_rx [extern]
```

Definition at line 8 of file [drv_uart.c](#).

5.30.5.6 hdma_usart2_tx

```
DMA_HandleTypeDef hdma_usart2_tx [extern]
```

Definition at line 9 of file [drv_uart.c](#).

5.30.5.7 hi2c1

```
I2C_HandleTypeDef hi2c1 [extern]
```

Definition at line 6 of file [drv_i2c.c](#).

5.30.5.8 huart1

```
UART_HandleTypeDef huart1 [extern]
```

Definition at line 4 of file [drv_uart.c](#).

5.30.5.9 huart2

```
UART_HandleTypeDef huart2 [extern]
```

Definition at line 5 of file [drv_uart.c](#).

5.30.5.10 q_mot_L

```
xQueueHandle q_mot_L = NULL
```

Queue to communicate with left motor task

Definition at line 97 of file [main.c](#).

5.30.5.11 q_mot_R

```
xQueueHandle q_mot_R = NULL
```

Queue to communicate with right motor task

Definition at line 98 of file [main.c](#).

5.30.5.12 qhLCD

```
xQueueHandle qhLCD = NULL
```

Queue to communicate with LCD task

Definition at line 101 of file [main.c](#).

5.30.5.13 qhMR_pub

```
xQueueHandle qhMR_pub = NULL
```

Queue to communicate with microRos task

Definition at line 100 of file [main.c](#).

5.30.5.14 qhMR_sub

```
xQueueHandle qhMR_sub = NULL
```

Queue to get information from microRos task

Definition at line 99 of file [main.c](#).

5.30.5.15 qhVL53

```
xQueueHandle qhVL53 = NULL
```

Queue to communicate with VL53 task

Definition at line 102 of file [main.c](#).

5.30.5.16 tab_speed

```
int16_t tab_speed[NB]
```

use to store speed of motor during calibration of the correcteur

Definition at line 105 of file [main.c](#).

5.30.5.17 xSem_Supervision

```
xSemaphoreHandle xSem_Supervision = NULL
```

Semaphore use in decision task

Definition at line 94 of file [main.c](#).

5.31 main.c

[Go to the documentation of this file.](#)

```
00001
00005 #include "main.h"
00006
00007 #include "motorCommand.h"
00008 #include "quadEncoder.h"
00009 #include "captDistIR.h"
00010 #include "VL53L0X.h"
00011 #include "groveLCD.h"
00012
00013 extern UART_HandleTypeDef huart1;
00014 extern UART_HandleTypeDef huart2;
00015 extern DMA_HandleTypeDef hdma_usart1_rx;
00016 extern DMA_HandleTypeDef hdma_usart1_tx;
00017 extern DMA_HandleTypeDef hdma_usart2_rx;
00018 extern DMA_HandleTypeDef hdma_usart2_tx;
00019
00020 extern I2C_HandleTypeDef hi2c1;
00021
00022 /* Definitions for defaultTask */
00023 osThreadId_t defaultTaskHandle;
00024 const osThreadAttr_t defaultTask_attributes = {
00025     .name = "defaultTask",
00026     .stack_size = 3000 * 4,
```

```

00027     .priority = (osPriority_t) osPriorityNormal,
00028 };
00029
00031 enum {MODE_OBS, MODE_ZIG, MODE_CAM, LAST_MODE};
00033 enum {STOP_VIT, LOW, FAST, SONIC, LAST_SPEED=100};
00035 enum {AVANT, GAUCHE, RECULE, DROITE, STOP, AVANT_GAUCHE, AVANT_DROITE, RECULE_GAUCHE, RECULE_DROITE,
LAST_DIR};
00036
00037 #define SAMPLING_PERIOD_ms 5
00039 #define EXSTARTUP 0
00040 #define EXTEST_UART2 1
00041 #define EXCORRECTOR 2
00042 #define EXTESTCORRECTOR 3
00043 #define EXTEST_VL53 4
00044 #define EXTEST_MICROROS 5
00045 #define EXFINAL 6
00047 #define SYNCHRO_EX EXFINAL
00050 #define SEUIL_DIST_SENSOR 800
00051 #define ROS_DOMAIN_ID 0
00052 #define LCD 1
00053 #define VL53 1
00054 #define MICROROS 1
00055 #define DEBUG_PRINTF 0
00056 #define DEBUG_MOTOR 0
00059 #define Te SAMPLING_PERIOD_ms
00060 #define LKp 0.001
00061 #define LKi (5.0/(0.1*40.0))
00062 #define RKp 0.001
00063 #define RKi (5.0/(0.1*40.0))
00066 #define CMD 1000
00067 #define VITESSE_KART CMD/2
00068 #define VITESSE_OBS CMD
00069 #define VITESSE_CAM CMD/3
00072 #define CAMERA_X_MIN 0
00073 #define CAMERA_X_MAX 640
00074 #define CAMERA_Y_MIN 0
00075 #define CAMERA_Y_MAX 480
00076 // #define CAMERA_X_TIER (CAMERA_X_MAX-CAMERA_X_MIN)/3 /**< */
00077 // #define CAMERA_Y_TIER (CAMERA_Y_MAX-CAMERA_Y_MIN)/3 /**< */
00080 #define DEFAULT_MODE MODE_ZIG
00081 #define DEFAULT_SPEED LOW
00082 #define DEFAULT_DIR STOP
00085 #define NB 200
00086 #define TEST_CORRECTOR_DUTY 150
00087 #define TEST_CORRECTOR_SPEEDL -100
00088 #define TEST_CORRECTOR_SPEEDR -100
00089 #define TEST_LEFT_MOTOR 1
00092 // Déclaration des objets synchronisants !! Ne pas oublier de les créer
00094 xSemaphoreHandle xSemSupervision = NULL;
00097 xQueueHandle q_mot_L = NULL;
00098 xQueueHandle q_mot_R = NULL;
00099 xQueueHandle qhMR_sub = NULL;
00100 xQueueHandle qhMR_pub = NULL;
00101 xQueueHandle qhLCD = NULL;
00102 xQueueHandle qhVL53 = NULL;
00105 int16_t tab_speed[NB];
00111 typedef struct
00112 {
00113     char command;
00114     int data;
00115 } AMessage;
00116
00120 typedef struct
00121 {
00122     char dir;
00123     int mode;
00124     int speed;
00125 } MicroRosPubMsg;
00126
00130 typedef struct
00131 {
00132     int dir;
00133     int x;
00134     int y;
00135     int mode;
00136     int speed;
00137 } MicroRosSubMsg;
00140 //Robot function
00141 void SystemClock_Config(void);
00142
00143 //Micro-Ros function
00144 bool cubemx_transport_open(struct uxrCustomTransport * transport);
00145 bool cubemx_transport_close(struct uxrCustomTransport * transport);
00146 size_t cubemx_transport_write(struct uxrCustomTransport* transport, const uint8_t * buf, size_t len,
uint8_t * err);
00147 size_t cubemx_transport_read(struct uxrCustomTransport* transport, uint8_t* buf, size_t len, int
timeout, uint8_t* err);

```

```

00148
00149 void * microros_allocate(size_t size, void * state);
00150 void microros_deallocate(void * pointer, void * state);
00151 void * microros_reallocate(void * pointer, size_t size, void * state);
00152 void * microros_zero_allocate(size_t number_of_elements, size_t size_of_element, void * state);
00153
00154 void CHECKMRRET(rcl_ret_t ret, char* msg){if (ret != RCL_RET_OK){ if (DEBUG_PRINTF){printf("Error :
%d\r\nMsg : %s\r\n", (int)ret, msg); }}}
00155
00156 void SubscriberCallbackFunction(const void *msgin){
00157 #if SYNCHRO_EX == EXTEST_MICROROS
00158     std_msgs__msg__String * msg = (std_msgs__msg__String *) msgin;
00159     printf("\r\nMessage recue : %s\r\n", msg->data->data);
00160 #elif SYNCHRO_EX == EXFINAL
00161     std_msgs__msg__Int32 * msg = (std_msgs__msg__Int32 *) msgin;
00162     if (DEBUG_PRINTF)
00163         printf("\r\nMessage recue : %ld\r\n", msg->data);
00164 #endif //SYNCHRO_EX
00165 }
00166
00167 // https://github.com/lFatality/stm32_micro_ros_setup
00168 void microros_task(void *argument)
00169 {
00170     // micro-ROS app variable
00171     rclc_support_t support; //Contain information about how config microros
00172     rcl_allocator_t allocator; //Contain information about how microRos can allocate memory
00173     rcl_node_t node; //microRos structure wich represent a node ROS
00174     rcl_node_options_t node_opt; //microRos structure wich represent option of a node ROS
00175     rclc_executor_t executor; //microRos structure wich represent an executor wich can be use to
receive message
00176
00177     // micro-ROS configuration with freertos
00178     rmw_uos_set_custom_transport(
00179         true,
00180         (void *) &uart1,
00181         cubemx_transport_open,
00182         cubemx_transport_close,
00183         cubemx_transport_write,
00184         cubemx_transport_read);
00185
00186     rcl_allocator_t freeRTOS_allocator = rcutils_get_zero_initialized_allocator();
00187     freeRTOS_allocator.allocate = microros_allocate;
00188     freeRTOS_allocator.deallocate = microros_deallocate;
00189     freeRTOS_allocator.reallocate = microros_reallocate;
00190     freeRTOS_allocator.zero_allocate = microros_zero_allocate;
00191
00192     if (!rcutils_set_default_allocator(&freeRTOS_allocator)) {
00193         printf("Error on default allocators (line %d)\r\n", __LINE__);
00194     }
00195
00196     allocator = rcl_get_default_allocator();
00197
00198     //create init_options
00199     CHECKMRRET(rclc_support_init(&support, 0, NULL, &allocator), "error on init support");
00200     // create node
00201     node_opt = rcl_node_get_default_options(); //Get default node options
00202     node_opt.domain_id = ROS_DOMAIN_ID; //Set the ROS_DOMAIN_ID
00203     CHECKMRRET(rclc_node_init_with_options(&node, "STM32_node", "", &support, &node_opt), "error on
init node");
00204
00205
00206 #if SYNCHRO_EX == EXSTARTUP
00207     static int counter = 0;
00208     rcl_ret_t ret; //Use to store the return of microRos function
00209     rcl_publisher_t publisher; //microRos structure wich represent a publisher
00210     std_msgs__msg__String msg; //microRos structure wich represent a String ROS message
00211
00212     CHECKMRRET(rclc_publisher_init_default(&publisher, &node, ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs,
msg, String), "cubemx_publisher"),
00213         "Error when create publisher"); //Create a default publisher wich publish on topic named
"cubemx_publisher"
00214
00215     //Allocate memory for string message
00216     msg.data.data = (char *) malloc(100 * sizeof(char));
00217     msg.data.size = 0;
00218     msg.data.capacity = 100; //Capacity need to be less than or equal to the allocation memory space
00219
00220     for (;;)
00221     {
00222         sprintf(msg.data.data, "Hello from micro-ROS #%d", counter++); //Write string in message
00223         msg.data.size = strlen(msg.data.data); //Set the size of the message
00224         ret = rcl_publish(&publisher, &msg, NULL); //Publish the message
00225         if (ret != RCL_RET_OK)
00226             printf("Error publishing (line %d)\r\n", __LINE__); //If the message are not publish print
an error
00227         vTaskDelay(SAMPLING_PERIOD_ms);
00228     }

```

```

00229 #elif SYNCHRO_EX == EXTEST_MICROROS
00230     //micro-ros topic variable
00231     rcl_ret_t ret; //Use to store the return of microRos function
00232     rcl_publisher_t publisher; //microRos structure wich represent a publisher
00233     rcl_subscription_t subscriber; //microRos structure wich represent a subscriber
00234     std_msgs__msg__String msg; //microRos structure wich represent a String ROS message
00235
00236     //create default publisher wich publish on topic named "cubemx_publisher"
00237     CHECKMRRET(rclc_publisher_init_default(&publisher, &node, ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs,
msg, String), "cubemx_publisher"),
00238         "Error when create publisher");
00239
00240     //create default subscriber wich listen to the topic named "cubemx_subscriber"
00241     subscriber = rcl_get_zero_initialized_subscription();
00242     CHECKMRRET(rclc_subscription_init_default(&subscriber, &node,
ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, String), "cubemx_subscriber"),
00243         "Error when create subscriber");
00244
00245     //Init string msg
00246     msg.data.data = (char *) malloc(ARRAY_LEN * sizeof(char));
00247     msg.data.size = 0;
00248     msg.data.capacity = ARRAY_LEN;
00249
00250     // Init executor by indicate how many subscriber we will put in it
00251     CHECKMRRET(rclc_executor_init(
00252         &executor, //executor structure
00253         &support.context,
00254         1, //number of subscriber that will be add
00255         &allocator), "Error on init executor");
00256     //Add subscriber to the executor
00257     CHECKMRRET(rclc_executor_add_subscription(&executor, //executor structure
00258         &subscriber, //subscriber structure
00259         &msg, //msg structure
00260         &SubscriberCallbackFunction, ON_NEW_DATA), "error add subscriber");
00261
00262     for (;;)
00263     {
00264         //Execute the executor to receive message
00265         ret = rclc_executor_spin_some(&executor, 100*1000*1000);
00266         vTaskDelay(SAMPLING_PERIOD_ms);
00267     }
00268 #elif SYNCHRO_EX == EXFINAL
00269     //Init the queue message
00270     MicroRosPubMsg MsgToPub = {'N', 0, 0};
00271     MicroRosSubMsg SubToMsg = {DEFAULT_DIR, 0, 0, DEFAULT_MODE, DEFAULT_SPEED};
00272     /* PUBLISHER */
00273     //Use to publish the direction of robot in sensor mode
00274     rcl_publisher_t capteur_dir_pub;
00275     char* capteur_dir_topic = CAPTEUR_DIR_TOPIC;
00276     std_msgs__msg__Int32 capteur_dir_msg;
00277     //Use to publish the actual mode of the robot
00278     rcl_publisher_t etat_mode_pub;
00279     char* etat_mode_topic = ETAT_MODE_TOPIC;
00280     std_msgs__msg__Int32 etat_mode_msg;
00281     //Use to publish the actual speed of the robot
00282     rcl_publisher_t etat_speed_pub;
00283     char* etat_speed_topic = ETAT_SPEED_TOPIC;
00284     std_msgs__msg__Int32 etat_speed_msg;
00285     /* SUBSCRIBER */
00286     //Use to receive the x position of object see by the camera
00287     rcl_subscription_t camera_x_sub;
00288     char* camera_x_topic = CAMERA_X_TOPIC;
00289     std_msgs__msg__Int32 camera_x_msg;
00290     //Use to receive the y position of object see by the camera
00291     rcl_subscription_t camera_y_sub;
00292     char* camera_y_topic = CAMERA_Y_TOPIC;
00293     std_msgs__msg__Int32 camera_y_msg;
00294     //Use to receive the remote control in remote mode
00295     rcl_subscription_t telecommande_dir_sub;
00296     char* telecommande_dir_topic = TELECOMMANDE_DIR_TOPIC;
00297     std_msgs__msg__Int32 telecommande_dir_msg;
00298     //Use to receive the mode config
00299     rcl_subscription_t config_mode_sub;
00300     char* config_mode_topic = CONFIG_MODE_TOPIC;
00301     std_msgs__msg__Int32 config_mode_msg;
00302     //Use to receive the speed config
00303     rcl_subscription_t config_speed_sub;
00304     char* config_speed_topic = CONFIG_SPEED_TOPIC;
00305     std_msgs__msg__Int32 config_speed_msg;
00306
00307     // create publisher
00308     createPublisher(&capteur_dir_pub, &node,
00309         ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, Int32),
00310         capteur_dir_topic, &capteur_dir_msg);
00311
00312     createPublisher(&etat_mode_pub, &node,
00313         ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, Int32),

```



```

00314     etat_mode_topic, &etat_mode_msg);
00315
00316     createPublisher(&etat_speed_pub, &node,
00317         ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, Int32),
00318         etat_speed_topic, &etat_speed_msg);
00319
00320     //create subscriber
00321     createSubscriber(&camera_x_sub, &node,
00322         ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, Int32),
00323         camera_x_topic, &camera_x_msg);
00324
00325     createSubscriber(&camera_y_sub, &node,
00326         ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, Int32),
00327         camera_y_topic, &camera_y_msg);
00328
00329     createSubscriber(&telecommande_dir_sub, &node,
00330         ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, Int32),
00331         telecommande_dir_topic, &telecommande_dir_msg);
00332
00333     createSubscriber(&config_mode_sub, &node,
00334         ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, Int32),
00335         config_mode_topic, &config_mode_msg);
00336
00337     createSubscriber(&config_speed_sub, &node,
00338         ROSIDL_GET_MSG_TYPE_SUPPORT(std_msgs, msg, Int32),
00339         config_speed_topic, &config_speed_msg);
00340
00341     //Init the executor
00342     CHECKMRRET(rclc_executor_init(&executor, &support.context, 5, &allocator), "Error on init
executor");
00343     /*Add subscriber to executor to let it check if message is receive on this
00344     topic and store the data on the message structure after call the callback*/
00345     CHECKMRRET(rclc_executor_add_subscription(&executor, &camera_x_sub, &camera_x_msg,
&SubscriberCallbackFunction, ON_NEW_DATA), "error add camera_x_sub");
00346     CHECKMRRET(rclc_executor_add_subscription(&executor, &camera_y_sub, &camera_y_msg,
&SubscriberCallbackFunction, ON_NEW_DATA), "error add camera_y_sub");
00347     CHECKMRRET(rclc_executor_add_subscription(&executor, &telecommande_dir_sub, &telecommande_dir_msg,
&SubscriberCallbackFunction, ON_NEW_DATA), "error add telecommande_dir_sub");
00348     CHECKMRRET(rclc_executor_add_subscription(&executor, &config_mode_sub, &config_mode_msg,
&SubscriberCallbackFunction, ON_NEW_DATA), "error add config_mode_sub");
00349     CHECKMRRET(rclc_executor_add_subscription(&executor, &config_speed_sub, &config_speed_msg,
&SubscriberCallbackFunction, ON_NEW_DATA), "error add config_speed_sub");
00350
00351     for(;;)
00352     {
00353         if (!uxQueueMessagesWaiting(qhMR_sub)) //If no message in 'output' queue
00354             xQueueSend(qhMR_sub, (void *) &SubToMsg, portMAX_DELAY); //Send queue message
00355         rclc_executor_spin_some(&executor, 1*1000*1000); //Execute executor
00356
00357         //Put the receive data into the queue message structure
00358         SubToMsg.dir = telecommande_dir_msg.data;
00359         SubToMsg.x = camera_x_msg.data;
00360         SubToMsg.y = camera_y_msg.data;
00361         SubToMsg.mode = config_mode_msg.data;
00362         SubToMsg.speed = config_speed_msg.data;
00363
00364         if (uxQueueMessagesWaiting(qhMR_pub)) //If no message in 'input' queue
00365         {
00366             xQueueReceive(qhMR_pub, &MsgToPub, portMAX_DELAY); //Receive data
00367             capteur_dir_msg.data = (int)MsgToPub.dir;
00368             etat_mode_msg.data = MsgToPub.mode;
00369             etat_speed_msg.data = MsgToPub.speed;
00370
00371             //Publish data
00372             CHECKMRRET(rcl_publish(&capteur_dir_pub, &capteur_dir_msg, NULL), "erreur publish
capteur_dir_pub");
00373             CHECKMRRET(rcl_publish(&etat_mode_pub, &etat_mode_msg, NULL), "erreur publish
etat_mode_pub");
00374             CHECKMRRET(rcl_publish(&etat_speed_pub, &etat_speed_msg, NULL), "erreur publish
etat_speed_pub");
00375
00376             #if DEBUG_PRINTF
00377             printf("\r\nReceive from decision : \r\nDirection : %d\r\nMode : %d\r\nSpeed : %d\r\n",
capteur_dir_msg.data, etat_mode_msg.data, etat_speed_msg.data);
00378             #endif //DEBUG_PRINTF
00379         }
00380         vTaskDelay(SAMPLING_PERIOD_ms);
00381     }
00382 #endif //SYNCHRO_EX
00383 }
00384
00385 void task_Motor_Left(void *pvParameters)
00386 {
00387     int16_t consigne = 0; //Store the desirate speed
00388
00389     float ui = 0.0; //Integral term of the correcteur
00390     float up = 0.0; //Proportionnal term of the correcteur

```

```

00391     int err = 0; //Error term of the correcteur
00392     int speed = 0; //Actual speed of motor
00393
00394     for (;;)
00395     {
00396         xQueueReceive(q_mot_L, &consigne, portMAX_DELAY); //receive wanted speed
00397
00398         speed = quadEncoder_GetSpeedL(); //Get actual speed
00399         //Calculate term of correcteur
00400         err=consigne-speed;
00401         up=LKp*(float)err;
00402         ui=ui+LKp*LKi*(float)err;
00403
00404         motorLeft_SetDuty(100+(int)(up+ui)); //Set duty cycle of the motor
00405
00406         xSemaphoreGive(xSem_Supervision); //Give semaphore to liberate the decision task
00407         vTaskDelay(SAMPLING_PERIOD_ms);
00408     }
00409 }
00410
00411 void task_Motor_Right(void *pvParameters)
00412 {
00413     int16_t consigne = 0; //Store the desirate speed
00414
00415     float ui = 0.0; //Integral term of the correcteur
00416     float up = 0.0; //Proportionnal term of the correcteur
00417     int err = 0; //Error term of the correcteur
00418     int speed = 0; //Actual speed of motor
00419
00420     for (;;)
00421     {
00422         xQueueReceive(q_mot_R, &consigne, portMAX_DELAY); //receive wanted speed
00423
00424         speed = quadEncoder_GetSpeedR(); //Get actual speed
00425         //Calculate term of correcteur
00426         err=consigne-speed;
00427         up=RKp*(float)err;
00428         ui=ui+RKp*RKi*(float)err;
00429
00430         motorRight_SetDuty(100+(int)(up+ui)); //Set duty cycle of the motor
00431
00432         xSemaphoreGive(xSem_Supervision); //Give semaphore to liberate the decision task
00433         vTaskDelay(SAMPLING_PERIOD_ms);
00434     }
00435 }
00436
00437 #if VL53
00438 void task_VL53(void *pvParameters)
00439 {
00440     static uint16_t dist;
00441     static const int SEUIL = 20; //Trigger
00442     int obs = 0; //Bool to indicate if we detect an obstacle or not
00443
00444     for(;;)
00445     {
00446         dist = readRangeSingleMillimeters()/10; //Get the distance from the sensor
00447
00448         if (dist < SEUIL && dist != 0) //If distance is less than the trigger
00449             obs = 1; //We detect an obstacle
00450         else
00451             obs = 0; //We do not detect an obstacle
00452
00453         if (!uxQueueMessagesWaiting(qhVL53)) //If no data in queue
00454             xQueueSend(qhVL53, (void *)&obs, portMAX_DELAY); //Send data
00455
00456         vTaskDelay(SAMPLING_PERIOD_ms);
00457     }
00458 }
00459 #endif //VL53
00460
00461 #if LCD
00462 void task_Grove_LCD(void *pvParameters)
00463 {
00464     #if SYNCHRO_EX == EXSTARTUP
00465     for (;;)
00466     {
00467         groveLCD_setCursor(0,0); //Set cursor position to 0,0
00468         groveLCD_term_printf("TEST LCD"); //Write TEST LCD on the screen
00469         vTaskDelay(100);
00470     }
00471     #elif SYNCHRO_EX == EXFINAL
00472     AMessage pRxedMessage;
00473
00474     for(;;)
00475     {
00476         if (uxQueueMessagesWaiting(qhLCD)) //If data in the queue

```

```

00478     {
00479         xQueueReceive(qhLCD, &pxRxedMessage, portMAX_DELAY); //Receive data
00480         int mode = pxRxedMessage.data;
00481         char direction=pxRxedMessage.command;
00482         groveLCD_setCursor(0,0);
00483         //Write on screen information about mode
00484         if (mode == MODE_OBS)
00485             groveLCD_term_printf("M:Obstacle D:%c", direction);
00486         else if (mode == MODE_ZIG)
00487             groveLCD_term_printf("M:Manuel      ");
00488         else if (mode == MODE_CAM)
00489             groveLCD_term_printf("M:Camera      ");
00490     }
00491
00492     vTaskDelay(SAMPLING_PERIOD_ms);
00493 }
00494 #endif //SYNCHRO_EX
00495 }
00496 #endif //LCD
00497
00498 void task_Supervision(void *pvParameters)
00499 {
00500     #if SYNCHRO_EX == EXSTARTUP
00501         int16_t consigne_G=0; //Motor left speed
00502         int16_t consigne_D=0; //Motor righth speed
00503
00504         int tab_mes_ir[2]; //VL53L0X sensors values
00505         uint16_t mes_vl53=0; //VL530X sensor value
00506
00507         vTaskDelay(100);
00508         for (;;)
00509         {
00510             //Get sensor value
00511             captDistIR_Get(tab_mes_ir);
00512             //mes_vl53 = readRangeSingleMillimeters()/10;
00513
00514             if ((tab_mes_ir[0]>2000) || (tab_mes_ir[1]>2000))
00515             { // !! obstacle
00516                 consigne_G=0;
00517                 consigne_D=0;
00518             }
00519             else
00520             {
00521                 consigne_G=1000;
00522                 consigne_D=1000;
00523             }
00524
00525             xQueueSend( q_mot_L, ( void * ) &consigne_G, portMAX_DELAY );
00526             xSemaphoreTake( xSem_Supervision, portMAX_DELAY );
00527
00528             xQueueSend( q_mot_R, ( void * ) &consigne_D, portMAX_DELAY );
00529             xSemaphoreTake( xSem_Supervision, portMAX_DELAY );
00530
00531             vTaskDelay(SAMPLING_PERIOD_ms);
00532         }
00533     #elif SYNCHRO_EX == EXTESTCORRECTOR
00534         int16_t speedLeft = TEST_CORRECTOR_SPEEDL;
00535         int16_t speedRight = TEST_CORRECTOR_SPEEDR;
00536
00537         for (;;)
00538         {
00539             xQueueSend(q_mot_L, (void *)&speedLeft, portMAX_DELAY);
00540             xSemaphoreTake(xSem_Supervision, portMAX_DELAY);
00541
00542             xQueueSend(q_mot_R, (void *)&speedRight, portMAX_DELAY);
00543             xSemaphoreTake(xSem_Supervision, portMAX_DELAY);
00544
00545             vTaskDelay(SAMPLING_PERIOD_ms);
00546         }
00547     #elif SYNCHRO_EX == EXFINAL
00548         int16_t speedLeft; //Motor left speed
00549         int16_t speedRight; //Motor righth speed
00550
00551         int table[2]; //VL53L0X sensors values
00552         #if VL53
00553         int vl53 = 0; //VL530X detect an obstacle or not
00554         #endif //VL53
00555
00556         static int obs = 0; //store the number of different obstacle detected without break
00557         static char dir = 'f'; //represent the direction of the robot in obstacle mode
00558         static int direction = DEFAULT_DIR; //default direction of the robot
00559         static int speed = DEFAULT_SPEED; //default speed of the robot
00560         static int mode = DEFAULT_MODE; //default mode of the robot
00561         static int x = 0; //position x of the object detect by the camera
00562         static int y = 0; //position y of the object detect by the camera
00563
00564     #if LCD

```

```

00565     AMessage pxMessage; //LCD queue message
00566 #endif
00567
00568 #if MICROROS
00569     MicroRosSubMsg SubToMsg; //ROS subscriber queue message
00570     MicroRosPubMsg MsgToPub; //ROS publisher queue message
00571 #endif //MICROROS
00572
00573     for (;;)
00574     {
00575         #if MICROROS
00576         if (uxQueueMessagesWaiting(qhMR_sub)) //If data are in the the queue
00577         {
00578             xQueueReceive(qhMR_sub, &SubToMsg, portMAX_DELAY); //Receive data
00579             //Set mode, speed and direction if the data is correct
00580             if (SubToMsg.mode >= 0 && SubToMsg.mode < LAST_MODE)
00581                 mode = SubToMsg.mode;
00582             if (SubToMsg.dir >= 0 && SubToMsg.dir < LAST_DIR)
00583                 direction = SubToMsg.dir;
00584             if (SubToMsg.speed > 0 && SubToMsg.speed < LAST_SPEED)
00585                 speed = SubToMsg.speed;
00586             //Set x and y position
00587             x = SubToMsg.x;
00588             y = SubToMsg.y;
00589             #if DEBUG_PRINTF
00590             printf("%cc%c[2J%c[0;0HVariable to make decision : \n\rDirection : %d\r\nMode: %d\r\nSpeed
: %d\r\nX: %d\r\nY : %d\r\n", 0x1b, 0x1b, 0x1b, direction, mode, speed, x, y);
00591             #endif //DEBUG_PRINTF
00592         }
00593         #endif //MICROROS
00594
00595         if (mode == MODE_ZIG) //Mode manual
00596         {
00597             dir = 'N'; //No direction information
00598             obs = 0; //No obstacle
00599             switch(direction) //Set the motor speed depending of the direction variable
00600             {
00601                 case STOP:
00602                     speedLeft = 0;
00603                     speedRight = 0;
00604                     break;
00605                 case AVANT:
00606                     speedLeft = VITESSE_KART+(8*(speed-50));
00607                     speedRight = VITESSE_KART+(8*(speed-50));
00608                     break;
00609                 case RECULE:
00610                     speedLeft = -(VITESSE_KART+(8*(speed-50)));
00611                     speedRight = -(VITESSE_KART+(8*(speed-50)));
00612                     break;
00613                 case DROITE:
00614                     speedLeft = VITESSE_KART+(8*(speed-50));
00615                     speedRight = -(VITESSE_KART+(8*(speed-50)));
00616                     break;
00617                 case GAUCHE:
00618                     speedLeft = -(VITESSE_KART+(8*(speed-50)));
00619                     speedRight = VITESSE_KART+(8*(speed-50));
00620                     break;
00621                 case AVANT_GAUCHE:
00622                     speedLeft = (VITESSE_KART/2)+(8*(speed-50));
00623                     speedRight = VITESSE_KART+(8*(speed-50));
00624                     break;
00625                 case AVANT_DROITE:
00626                     speedLeft = VITESSE_KART+(8*(speed-50));
00627                     speedRight = (VITESSE_KART/2)+(8*(speed-50));
00628                     break;
00629                 case RECULE_GAUCHE:
00630                     speedLeft = -(VITESSE_KART+(8*(speed-50)));
00631                     speedRight = -(VITESSE_KART/2)+(8*(speed-50));
00632                     break;
00633                 case RECULE_DROITE:
00634                     speedLeft = -(VITESSE_KART/2)+(8*(speed-50));
00635                     speedRight = -(VITESSE_KART+(8*(speed-50)));
00636                     break;
00637                 default:
00638                     speedLeft = 0;
00639                     speedRight = 0;
00640                     break;
00641             }
00642         }
00643         else if (mode == MODE_OBS) //Mode obstacle
00644         {
00645             //Get sensors informations
00646             captDistIR_Get(table);
00647             #if VL53
00648             if (uxQueueMessagesWaiting(qhV153))
00649                 xQueueReceive(qhV153, &v153, portMAX_DELAY);
00650             else

```

```

00651         v153 = 0;
00652
00653         if (v153 == 1) //if an obstacle is detected on the back we stop
00654         {
00655             if (dir != 'S')
00656                 printf("Detection d'un obstacle à l'arrière");
00657             speedLeft = 0;
00658             speedRight = 0;
00659             dir = 'S';
00660             obs = 1;
00661         }
00662         else
00663             #endif //VL53
00664         if (table[0] > SEUIL_DIST_SENSOR || table[1] > SEUIL_DIST_SENSOR) //We have an obstacle in
front of the robot
00665         {
00666             if (obs > 10) //If we detect more than 10 different obstacle we turn on the left until
they are no more obstacle
00667             {
00668                 speedLeft = VITESSE_OBS/2;
00669                 speedRight = -VITESSE_OBS/2;
00670                 dir = 'G';
00671             }
00672             else
00673             {
00674                 speedLeft = 0;
00675                 speedRight = 0;
00676
00677                 if (table[0] > table[1] && table[0] > SEUIL_DIST_SENSOR) //We have an obstacle on
our right
00678                 {
00679                     dir = 'G';
00680                     speedLeft = -VITESSE_OBS/2;
00681                     speedRight = VITESSE_OBS/2;
00682                     if (obs%2 == 0)
00683                         obs++;
00684                 }
00685                 else if (table[0] < table[1] && table[1] > SEUIL_DIST_SENSOR) //We have an
obstacle on left right
00686                 {
00687                     dir = 'D';
00688                     speedLeft = VITESSE_OBS/2;
00689                     speedRight = -VITESSE_OBS/2;
00690                     if (obs%2 == 1)
00691                         obs++;
00692                 }
00693             }
00694         }
00695         else //No obstacle
00696         {
00697             speedLeft = VITESSE_OBS;
00698             speedRight = VITESSE_OBS;
00699             dir = 'F';
00700             obs = 0;
00701         }
00702     }
00703     else if (mode == MODE_CAM) //Mode camera
00704     {
00705         dir = 'N';
00706         obs = 0;
00707
00708         if(x < 0 || y < 0) //No object
00709         {
00710             speedLeft = 0;
00711             speedRight = 0;
00712         }
00713         else //Try to keep the object on the center
00714         {
00715             speedLeft = VITESSE_CAM - ((CAMERA_X_MAX/2 - x))/3; // (int) (((float)
((x-CAMERA_X_MAX/2)/CAMERA_X_MAX))*500);
00716             speedRight = VITESSE_CAM + ((CAMERA_X_MAX/2 - x))/3; // (int) (((float)
(x/CAMERA_X_MAX))*500);
00717         }
00718     }
00719
00720     #if DEBUG_MOTOR
00721     printf("Motor L : %d || R : %d\r\n", speedLeft, speedRight);
00722     #endif
00723
00724     xQueueSend( q_mot_L, ( void * ) &speedLeft, portMAX_DELAY ); //Send motor left speed
00725     xSemaphoreTake( xSem_Supervision, portMAX_DELAY );
00726
00727     xQueueSend( q_mot_R, ( void * ) &speedRight, portMAX_DELAY ); //Send motor right speed
00728     xSemaphoreTake( xSem_Supervision, portMAX_DELAY );
00729
00730     #if MICROROS
00731     MsgToPub.dir = dir;

```

```

00732     MsgToPub.mode = mode;
00733     MsgToPub.speed = speed;
00734     if (!uxQueueMessagesWaiting(qhMR_pub)) //If no data in queue
00735         xQueueSend(qhMR_pub, ( void * ) &MsgToPub, portMAX_DELAY); //Send data
00736 #endif //MICROROS
00737
00738 #if LCD
00739     if (!uxQueueMessagesWaiting(qhLCD)) //If no data in queue
00740     {
00741         pxMessage.data=mode;
00742         pxMessage.command=dir;
00743         xQueueSend( qhLCD, ( void * ) &pxMessage, portMAX_DELAY); //Send data
00744     }
00745 #endif //LCD
00746
00747     vTaskDelay(SAMPLING_PERIOD_ms);
00748 }
00749 #endif //SYNCHRO_EX
00750 }
00751
00752 int main(void)
00753 {
00754     HAL_Init();
00755     SystemClock_Config();
00756     MX_GPIO_Init();
00757     MX_DMA_Init();
00758     MX_USART2_UART_Init();
00759     MX_I2C1_Init();
00760     MX_USART1_UART_Init();
00761
00762     RetargetInit(&uart2); //make printf and scanf work with uart2
00763     printf("%c%c[2J%c[0;0HTitouan//Jeremy//Louanne//Donald\r\n", 0x1b, 0x1b, 0x1b);
00764
00765     motorCommand_Init();
00766     quadEncoder_Init();
00767     captDistIR_Init();
00768
00769     HAL_Delay(500);
00770
00771 #if VL53
00772     initVL53L0X();
00773     HAL_Delay(500);
00774 #endif //VL53
00775
00776     // Test Ecran LCD
00777 #if LCD
00778     groveLCD_begin(16,2,0); // !! cette fonction prend du temps
00779     HAL_Delay(100);
00780     groveLCD_setCursor(0,0);
00781     groveLCD_setColor(1);
00782     groveLCD_term_printf("Titouan//Jeremy//Louanne");
00783     HAL_Delay(1000);
00784 #endif //LCD
00785
00786     osKernelInitialize();
00787     //defaultTaskHandle = osThreadNew(microros_task, NULL, &defaultTask_attributes);
00788
00789     //Create the diffrent task depending of the config
00790 #if SYNCHRO_EX == EXSTARTUP
00791     #if MICROROS
00792     xTaskCreate( microros_task, ( const portCHAR * ) "microros_task", 3000 /* stack size */, NULL, 24,
00793     NULL);
00794     #endif //MICROROS
00795     xTaskCreate( task_Supervision, ( const portCHAR * ) "task Supervision", 128 /* stack size */,
00796     NULL, 27, NULL);
00797     xTaskCreate( task_Motor_Left, ( const portCHAR * ) "task Mot L", 128 /* stack size */, NULL, 25,
00798     NULL);
00799     xTaskCreate( task_Motor_Right, ( const portCHAR * ) "task Mot R", 128 /* stack size */, NULL, 26,
00800     NULL);
00801     #if LCD
00802     xTaskCreate( task_Grove_LCD, ( const portCHAR * ) "task Mot R", 128 /* stack size */, NULL, 23,
00803     NULL);
00804     #endif
00805 #elif SYNCHRO_EX == EXTEST_UART2
00806     xTaskCreate(test_uart2, ( const portCHAR * ) "task print uart 2", 128 /* stack size */, NULL,
00807     tskIDLE_PRIORITY, NULL);
00808 #elif SYNCHRO_EX == EXCORRECTOR
00809     xTaskCreate(test_motor, ( const portCHAR * ) "task test motor", 128 /* stack size */, NULL,
00810     tskIDLE_PRIORITY, NULL);
00811 #elif SYNCHRO_EX == EXTESTCORRECTOR
00812     xTaskCreate(task_Supervision, ( const portCHAR * ) "task Supervision", 128 /* stack size */, NULL,
00813     27, NULL);
00814     xTaskCreate(task_Motor_Left, ( const portCHAR * ) "task Motor Left", 128 /* stack size */, NULL,
00815     25, NULL);
00816     xTaskCreate(task_Motor_Right, ( const portCHAR * ) "task Motor Right", 128 /* stack size */, NULL,
00817     26, NULL);
00818 #elif SYNCHRO_EX == EXTEST_VL53

```

```

00809     xTaskCreate(test_vl53, ( const portCHAR * ) "test_vl53", 128 /* stack size */, NULL,
    tskIDLE_PRIORITY, NULL);
00810 #elif SYNCHRO_EX == EXTEST_MICROROS
00811     xTaskCreate(microros_task, ( const portCHAR * ) "microros_task", 3000 /* stack size */, NULL,
    tskIDLE_PRIORITY, NULL);
00812 #elif SYNCHRO_EX == EXFINAL
00813     #if MICROROS
00814     xTaskCreate(microros_task, ( const portCHAR * ) "microros_task", 3000 /* stack size */, NULL, 24,
    NULL);
00815     #endif //MICROROS
00816     xTaskCreate(task_Supervision, ( const portCHAR * ) "task Supervision", 128 /* stack size */, NULL,
    27, NULL);
00817     xTaskCreate(task_Motor_Left, ( const portCHAR * ) "task Motor Left", 128 /* stack size */, NULL,
    25, NULL);
00818     xTaskCreate(task_Motor_Right, ( const portCHAR * ) "task Motor Right", 128 /* stack size */, NULL,
    26, NULL);
00819
00820     #if VL53
00821     xTaskCreate(task_VL53, ( const portCHAR * ) "task VL53", 128 /* stack size */, NULL, 23, NULL);
00822     #endif //VL53
00823
00824     #if LCD
00825     xTaskCreate(task_Grove_LCD, ( const portCHAR * ) "task LCD", 128 /* stack size */, NULL, 23,
    NULL);
00826     #endif //LCD
00827 #endif //SYNCHRO_EX
00828
00829     //Create the semaphore
00830     vSemaphoreCreateBinary(xSem_Supervision);
00831
00832     //Init all the queue
00833     q_mot_L = xQueueCreate(1, sizeof(int16_t));
00834     q_mot_R = xQueueCreate(1, sizeof(int16_t));
00835     qhVL53 = xQueueCreate(1, sizeof(int));
00836
00837     qhMR_sub = xQueueCreate(1, sizeof(MicroRosSubMsg));
00838     qhMR_pub = xQueueCreate(1, sizeof(MicroRosPubMsg));
00839     qhLCD = xQueueCreate(1, sizeof(AMessage));
00840
00841     osKernelStart();
00842     while(1){}
00843 }
00844
00845 void test_uart2(void *pvParameters)
00846 {
00847     char buf[100] = "";
00848     for(;;)
00849     {
00850         printf("Veuillez saisir votre nom :\r\n");
00851         scanf("%s", buf);
00852         printf("bonjour et bienvenue %s\r\n", buf);
00853         vTaskDelay(SAMPLING_PERIOD_ms);
00854     }
00855 }
00856
00857 void test_vl53(void *pvParameters)
00858 {
00859     uint16_t val;
00860
00861     for(;;)
00862     {
00863         val = readRangeSingleMillimeters()/10;
00864         printf("Distance capteur : %d\r\n", val);
00865     }
00866 }
00867
00868 void test_motor(void *pvParameters)
00869 {
00870     int16_t consigne = TEST_CORRECTOR_DUTY;
00871     if (consigne < 0 || consigne > 200)
00872         consigne = 150;
00873     int speed = 0;
00874     int i = 0;
00875
00876     for (;;)
00877     {
00878         #if TEST_LEFT_MOTOR
00879         motorLeft_SetDuty(consigne);
00880         speed = quadEncoder_GetSpeedL();
00881         #else
00882         motorRight_SetDuty(consigne);
00883         speed = quadEncoder_GetSpeedR();
00884         #endif
00885
00886         if(i<NB)
00887         {
00888             tab_speed[i]=speed;

```

```

00889         i++;
00890     }
00891     else
00892         printf("sampling end");
00893     vTaskDelay(SAMPLING_PERIOD_ms);
00894 }
00895 }
00896
00897 //=====
00898 /*
00899  * @brief Period elapsed callback in non blocking mode
00900  * @note This function is called when TIM1 interrupt took place, inside
00901  * HAL_TIM_IRQHandler(). It makes a direct call to HAL_IncTick() to increment
00902  * a global variable "uwTick" used as application time base.
00903  * @param htim : TIM handle
00904  * @retval None
00905  */
00906 void HAL_TIM_PeriodElapsedCallback(TIM_HandleTypeDef *htim)
00907 {
00908     if (htim->Instance == TIM4)
00909     {
00910         HAL_IncTick();
00911     }
00912 }
00913 //=====
00914 void Error_Handler(void)
00915 {
00916     __disable_irq();
00917     while (1)
00918     {}
00919 }
00920 //=====
00921 #ifndef USE_FULL_ASSERT
00922 /*
00923  * @brief Reports the name of the source file and the source line number
00924  * where the assert_param error has occurred.
00925  * @param file: pointer to the source file name
00926  * @param line: assert_param error line source number
00927  * @retval None
00928  */
00929 void assert_failed(uint8_t *file, uint32_t line)
00930 {
00931     /* USER CODE BEGIN 6 */
00932     /* User can add his own implementation to report the file name and line number,
00933        ex: printf("Wrong parameters value: file %s on line %d\r\n", file, line) */
00934     /* USER CODE END 6 */
00935 }
00936 #endif /* USE_FULL_ASSERT */

```

5.32 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_↵ Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Src/microROS.c File Reference

: Contain microROS default custom creator for subscriber and publisher

```
#include "main.h"
```

Macros

- #define [STRING](#) 0

Functions

- void [createPublisher](#) (rcl_publisher_t *publisher, const rcl_node_t *node, const rosidl_message_type_↵
support_t *type_support, const char *topic_name, std_msgs__msg__Int32 *msg)
- void [createSubscriber](#) (rcl_subscription_t *subscription, rcl_node_t *node, const rosidl_message_type_↵
support_t *type_support, const char *topic_name, std_msgs__msg__Int32 *msg)

5.32.1 Detailed Description

: Contain microROS default custom creator for subscriber and publisher

Definition in file [microROS.c](#).

5.32.2 Macro Definition Documentation

5.32.2.1 STRING

```
#define STRING 0
```

Definition at line 8 of file [microROS.c](#).

5.32.3 Function Documentation

5.32.3.1 createPublisher()

```
void createPublisher (
    rcl_publisher_t * publisher,
    const rcl_node_t * node,
    const rosidl_message_type_support_t * type_support,
    const char * topic_name,
    std_msgs__msg__Int32 * msg )
```

Create a publisher with default options

Parameters

<i>publisher</i>	microRos structure that represent a publisher
<i>node</i>	microRos structure that represent a node
<i>type_support</i>	microRos structure that represent the type of message
<i>topic_name</i>	The name of the topic
<i>msg</i>	microRos structure that represent the message

Definition at line 10 of file [microROS.c](#).

5.32.3.2 createSubscriber()

```
void createSubscriber (
    rcl_subscription_t * subscription,
    rcl_node_t * node,
    const rosidl_message_type_support_t * type_support,
    const char * topic_name,
    std_msgs__msg__Int32 * msg )
```

Create a subscriber with default options

Parameters

<i>subscription</i>	microRos structure that represent a subscriber
<i>node</i>	microRos structure that represent a node
<i>type_support</i>	microRos structure that represent the type of message
<i>topic_name</i>	The name of the topic
<i>msg</i>	microRos structure that represent the message

Definition at line 29 of file [microROS.c](#).

5.33 microROS.c

[Go to the documentation of this file.](#)

```

00001
00006 #include "main.h"
00007
00008 #define STRING 0
00009
00010 void createPublisher(rcl_publisher_t* publisher,
00011     const rcl_node_t* node,
00012     const rosidl_message_type_support_t* type_support,
00013     const char* topic_name,
00014     std_msgs__msg__Int32* msg)
00015 {
00016     rcl_ret_t ret = rclc_publisher_init_default(publisher, node, type_support, topic_name);
00017     printf("Publisher %s is created with result %d\r\n", topic_name, (int)ret);
00018
00019     #if STRING == 1
00020         (*msg).data.data = (char * ) malloc(ARRAY_LEN * sizeof(char));
00021         (*msg).data.size = 0;
00022         (*msg).data.capacity = ARRAY_LEN;
00023     #else
00024         (*msg).data = 0;
00025     #endif
00026 }
00027
00028
00029 void createSubscriber(rcl_subscription_t* subscription,
00030     rcl_node_t* node,
00031     const rosidl_message_type_support_t* type_support,
00032     const char* topic_name,
00033     std_msgs__msg__Int32* msg)
00034 {
00035     *subscription = rcl_get_zero_initialized_subscription();
00036
00037     rcl_ret_t ret = rclc_subscription_init_default(subscription, node,
00038         type_support, topic_name);
00039     printf("Subscription %s is created with result %d\r\n", topic_name, (int)ret);
00040
00041     #if STRING == 1
00042         (*msg).data.data = (char * ) malloc(ARRAY_LEN * sizeof(char));
00043         (*msg).data.size = 0;
00044         (*msg).data.capacity = ARRAY_LEN;
00045     #else
00046         (*msg).data = 0;
00047     #endif
00048 }

```

5.34 microros_allocators.c

```

00001
00002 #include <unistd.h>
00003 #include "cmsis_os.h"
00004
00005 int absoluteUsedMemory = 0;
00006 int usedMemory = 0;
00007
00008 void *pvPortMallocMicroROS( size_t xWantedSize );
00009 void vPortFreeMicroROS( void *pv );
00010 void *pvPortReallocMicroROS( void *pv, size_t xWantedSize );

```

```

00011 size_t getBlockSize( void *pv );
00012 void *pvPortCallocMicroROS( size_t num, size_t xWantedSize );
00013
00014 void * microros_allocate(size_t size, void * state){
00015     (void) state;
00016     // printf("-- Alloc %d (prev: %d B)\n",size, xPortGetFreeHeapSize());
00017     absoluteUsedMemory += size;
00018     usedMemory += size;
00019     return pvPortMallocMicroROS(size);
00020 }
00021
00022 void microros_deallocate(void * pointer, void * state){
00023     (void) state;
00024     // printf("-- Free %d (prev: %d B)\n",getBlockSize(pointer), xPortGetFreeHeapSize());
00025     if (NULL != pointer){
00026         usedMemory -= getBlockSize(pointer);
00027         vPortFreeMicroROS(pointer);
00028     }
00029 }
00030
00031 void * microros_reallocate(void * pointer, size_t size, void * state){
00032     (void) state;
00033     // printf("-- Realloc %d -> %d (prev: %d B)\n",getBlockSize(pointer),size, xPortGetFreeHeapSize());
00034     absoluteUsedMemory += size;
00035     usedMemory += size;
00036     if (NULL == pointer){
00037         return pvPortMallocMicroROS(size);
00038     } else {
00039         usedMemory -= getBlockSize(pointer);
00040         return pvPortReallocMicroROS(pointer,size);
00041     }
00042 }
00043
00044 void * microros_zero_allocate(size_t number_of_elements, size_t size_of_element, void * state){
00045     (void) state;
00046     // printf("-- Calloc %d x %d = %d -> (prev: %d B)\n",number_of_elements,size_of_element,
00047     number_of_elements*size_of_element, xPortGetFreeHeapSize());
00048     absoluteUsedMemory += number_of_elements*size_of_element;
00049     usedMemory += number_of_elements*size_of_element;
00050     return pvPortCallocMicroROS(number_of_elements,size_of_element);
00051 }

```

5.35 microros_time.c

```

00001 #include <unistd.h>
00002 #include <time.h>
00003 #include "cmsis_os.h"
00004
00005 #define MICROSECONDS_PER_SECOND    ( 1000000LL )
00006 #define NANOSECONDS_PER_SECOND    ( 1000000000LL )
00007 #define NANOSECONDS_PER_TICK      ( NANOSECONDS_PER_SECOND / configTICK_RATE_HZ )
00008 void UTILS_NanosecondsToTimespec( int64_t llSource,
00009     struct timespec * const pxDestination )
00010 {
00011     long lCarrySec = 0;
00012
00013     /* Convert to timespec. */
00014     pxDestination->tv_sec = ( time_t ) ( llSource / NANOSECONDS_PER_SECOND );
00015     pxDestination->tv_nsec = ( long ) ( llSource % NANOSECONDS_PER_SECOND );
00016
00017     /* Subtract from tv_nsec if tv_nsec < 0. */
00018     if( pxDestination->tv_nsec < 0L )
00019     {
00020         /* Compute the number of seconds to carry. */
00021         lCarrySec = ( pxDestination->tv_nsec / ( long ) NANOSECONDS_PER_SECOND ) + 1L;
00022
00023         pxDestination->tv_sec -= ( time_t ) ( lCarrySec );
00024         pxDestination->tv_nsec += lCarrySec * ( long ) NANOSECONDS_PER_SECOND;
00025     }
00026 }
00027
00028 int clock_gettime( int clock_id,
00029     struct timespec * tp )
00030 {
00031     TimeOut_t xCurrentTime = { 0 };
00032
00033     /* Intermediate variable used to convert TimeOut_t to struct timespec.
00034      * Also used to detect overflow issues. It must be unsigned because the
00035      * behavior of signed integer overflow is undefined. */
00036     uint64_t ullTickCount = 0ULL;
00037
00038     /* Silence warnings about unused parameters. */
00039     ( void ) clock_id;
00040 }

```

```

00041
00042 /* Get the current tick count and overflow count. vTaskSetTimeOutState()
00043  * is used to get these values because they are both static in tasks.c. */
00044 vTaskSetTimeOutState( &xCurrentTime );
00045
00046 /* Adjust the tick count for the number of times a TickType_t has overflowed.
00047  * portMAX_DELAY should be the maximum value of a TickType_t. */
00048 ullTickCount = ( uint64_t ) ( xCurrentTime.xOverflowCount ) « ( sizeof( TickType_t ) * 8 );
00049
00050 /* Add the current tick count. */
00051 ullTickCount += xCurrentTime.xTimeOnEntering;
00052
00053 /* Convert ullTickCount to timespec. */
00054 UTILS_NanosecondsToTimespec( ( int64_t ) ullTickCount * NANoseconds_PER_TICK, tp );
00055
00056 return 0;
00057 }

```

5.36 motorCommand.c

```

00001 /*
00002  * MotorCommand.c
00003  */
00004
00005 #include "motorCommand.h"
00006
00007 static TIM_HandleTypeDef TimHandle;
00008 static TIM_OC_InitTypeDef sConfigOC;
00009
00010 //=====
00011 //          PWM INIT
00012 // TIMER 3 (PWM) : CH1 et CH2
00013 // ENABLE : Sortie Logique (GPIO) PA7
00014 //=====
00015
00016 void motorCommand_Init(void)
00017 {
00018     unsigned int uwPrescalerValue = 0;
00019
00020     /* Compute the prescaler value to have TIM4 counter clock equal to 10MHz */
00021     uwPrescalerValue = (unsigned int) ((SystemCoreClock / 10000000) - 1);
00022     TimHandle.Instance = TIM3;
00023     TimHandle.Init.Period = 200 - 1; // 100MHz/200=50kHz
00024     TimHandle.Init.Prescaler = uwPrescalerValue;
00025     TimHandle.Init.ClockDivision = 0;
00026     TimHandle.Init.CounterMode = TIM_COUNTERMODE_UP;
00027
00028     HAL_TIM_Base_Init(&TimHandle);
00029
00030     sConfigOC.OCMode = TIM_OCMode_PWM1;
00031     sConfigOC.Pulse = 0x5; // Specifies the pulse value to be loaded into the Capture Compare
    Register. This parameter can be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF */
00032
00033     sConfigOC.OCpolarity = TIM_OCPolarity_HIGH;
00034     sConfigOC.OCFastMode = TIM_OCFAST_DISABLE;
00035
00036     HAL_TIM_PWM_ConfigChannel(&TimHandle, &sConfigOC, TIM_CHANNEL_1);
00037     HAL_TIM_PWM_ConfigChannel(&TimHandle, &sConfigOC, TIM_CHANNEL_2);
00038
00039     // CHANGEMENT DU RAPPORT CYCLIQUE
00040     __HAL_TIM_SetCompare(&TimHandle, TIM_CHANNEL_1, 100); // 100 : moteurs au repos
00041     __HAL_TIM_SetCompare(&TimHandle, TIM_CHANNEL_2, 100);
00042
00043     HAL_TIM_PWM_Start(&TimHandle, TIM_CHANNEL_1); // MOTOR RIGHT
00044     HAL_TIM_PWM_Start(&TimHandle, TIM_CHANNEL_2); // MOTOR LEFT
00045
00046     // ENABLE MOTEUR (SI INVERSEUR)
00047     //HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, 0);
00048     HAL_GPIO_WritePin(GPIOB, GPIO_PIN_3, 0);
00049 }
00050
00051 //=====
00052 //          SET DUTY CYCLE LEFT
00053 //=====
00054 void motorLeft_SetDuty(int duty)
00055 {
00056     __HAL_TIM_SetCompare(&TimHandle, TIM_CHANNEL_1, duty);
00057 }
00058 //=====
00059 //          SET DUTY CYCLE RIGHT
00060 //=====
00061 void motorRight_SetDuty(int duty)
00062 {

```

```

00063     __HAL_TIM_SetCompare(&TimHandle, TIM_CHANNEL_2, duty);
00064 }
00065 //=====
00066
00067

```

5.37 quadEncoder.c

```

00001 /*
00002  * QuadEncoder.c
00003  */
00004 #include "quadEncoder.h"
00005
00006 #define SAMPLING_PERIOD_ms      5
00007 #define TE_ms      SAMPLING_PERIOD_ms
00008 #define USE_QUAD_ENCODER_1250_CPR 1
00009
00010 #if USE_QUAD_ENCODER_1250_CPR
00011 #define COUNT_PER_ROUND 1250
00012 #define MAX_CNT_PER_REV (COUNT_PER_ROUND * 4 - 1)
00013 #define MAX_COUNT (int) (((unsigned long)MAX_CNT_PER_REV*6555)/1000)
00014 #define HALF_MAX_COUNT (MAX_COUNT>1)
00015 #define COEFF      6555
00016 #endif
00017
00018 #if USE_QUAD_ENCODER_1000_CPR
00019 #define COUNT_PER_ROUND 1000
00020 #define MAX_CNT_PER_REV (COUNT_PER_ROUND * 4 - 1)
00021 #define MAX_COUNT (int) (((unsigned long)MAX_CNT_PER_REV*8192)/1000)
00022 #define HALF_MAX_COUNT (MAX_COUNT>1)
00023 #define COEFF      8192
00024 #endif
00025
00026 #if USE_QUAD_ENCODER_500_CPR
00027 #define COUNT_PER_ROUND 500
00028 #define MAX_CNT_PER_REV (COUNT_PER_ROUND * 4 - 1)
00029 #define MAX_COUNT (int) (((unsigned long)MAX_CNT_PER_REV*16392)/1000)
00030 #define HALF_MAX_COUNT (MAX_COUNT>1)
00031 #define COEFF      16392
00032 #endif
00033
00034 #if USE_QUAD_ENCODER_250_CPR
00035 #define COUNT_PER_ROUND 250
00036 #define MAX_CNT_PER_REV (COUNT_PER_ROUND * 4 - 1)
00037 #define MAX_COUNT (int) (((unsigned long)MAX_CNT_PER_REV*32768)/1000)
00038 #define HALF_MAX_COUNT (MAX_COUNT>1)
00039 #define COEFF      32768
00040 #endif
00041
00042
00043
00044 TIM_HandleTypeDef      TimEncoderHandleLeft;
00045 TIM_HandleTypeDef      TimEncoderHandleRight;
00046
00047 /*****
00048  * TIMER 1, CHANNEL 1 et 2 --> RIGHT
00049  * TIMER 2, CHANNEL 1 et 2 --> LEFT
00050  *****/
00051 int indexL=0;
00052 static int indexR=0;
00053
00054 //=====
00055 //      TIMER INIT
00056 //=====
00057
00058 void quadEncoder_Init(void)
00059 {
00060     TIM_Encoder_InitTypeDef sConfig;
00061     //-----
00062     // TIMER 1
00063     //-----
00064     TimEncoderHandleLeft.Instance = TIM1;
00065     TimEncoderHandleLeft.Init.Prescaler = 0;
00066     TimEncoderHandleLeft.Init.CounterMode = TIM_COUNTERMODE_UP;
00067     TimEncoderHandleLeft.Init.Period = COUNT_PER_ROUND*4;
00068     TimEncoderHandleLeft.Init.ClockDivision = TIM_CLOCKDIVISION_DIV1;
00069
00070     sConfig.EncoderMode = TIM_ENCODERMODE_TI12;
00071     sConfig.IC1Polarity = TIM_INPUTCHANNELPOLARITY_RISING;
00072     sConfig.IC1Selection = TIM_ICSELECTION_DIRECTTI;
00073     sConfig.IC1Prescaler = TIM_ICPSC_DIV4;
00074     sConfig.IC1Filter = 0x0F;
00075     sConfig.IC2Polarity = TIM_INPUTCHANNELPOLARITY_RISING;

```

```

00076     sConfig.IC2Selection = TIM_ICSELECTION_DIRECTTI; //TIM_ICSELECTION_DIRECTTI;
//TIM_TI1SELECTION_XORCOMBINATION
00077     sConfig.IC2Prescaler = TIM_ICPSC_DIV4;
00078     sConfig.IC2Filter = 0x0F;
00079
00080     HAL_TIM_Encoder_Init(&TimEncoderHandleLeft, &sConfig);
00081
00082     __HAL_TIM_SetCounter(&TimEncoderHandleLeft, 0);
00083
00084     HAL_TIM_Encoder_Start(&TimEncoderHandleLeft, TIM_CHANNEL_1);
00085     HAL_TIM_Encoder_Start(&TimEncoderHandleLeft, TIM_CHANNEL_2);
00086
00087     //-----
00088     // TIMER 2
00089     //-----
00090     TimEncoderHandleRight.Instance = TIM2;
00091     TimEncoderHandleRight.Init.Prescaler = 0;
00092     TimEncoderHandleRight.Init.CounterMode = TIM_COUNTERMODE_UP;
00093     TimEncoderHandleRight.Init.Period = COUNT_PER_ROUND*4;
00094     TimEncoderHandleRight.Init.ClockDivision = TIM_CLOCKDIVISION_DIV1;
00095
00096     sConfig.EncoderMode = TIM_ENCODERMODE_TI12;
00097     sConfig.IC1Polarity = TIM_INPUTCHANNELPOLARITY_RISING;
00098     sConfig.IC1Selection = TIM_ICSELECTION_DIRECTTI;
00099     sConfig.IC1Prescaler = TIM_ICPSC_DIV4;
00100     sConfig.IC1Filter = 0x0F;
00101     sConfig.IC2Polarity = TIM_INPUTCHANNELPOLARITY_RISING;
00102     sConfig.IC2Selection = TIM_ICSELECTION_DIRECTTI; //TIM_ICSELECTION_DIRECTTI;
//TIM_TI1SELECTION_XORCOMBINATION
00103     sConfig.IC2Prescaler = TIM_ICPSC_DIV4;
00104     sConfig.IC2Filter = 0x0F;
00105
00106     HAL_TIM_Encoder_Init(&TimEncoderHandleRight, &sConfig);
00107
00108     __HAL_TIM_SetCounter(&TimEncoderHandleRight, 0);
00109
00110     HAL_TIM_Encoder_Start(&TimEncoderHandleRight, TIM_CHANNEL_1);
00111     HAL_TIM_Encoder_Start(&TimEncoderHandleRight, TIM_CHANNEL_2);
00112 }
00113
00114 //=====
00115 //      POSITION LEFT CALC
00116 //=====
00117
00118 void quadEncoder_PosCalcL(int* AngPos)
00119 {
00120
00121     int POSCNTcopy = 0;
00122     POSCNTcopy = (int)TIM1->CNT;
00123     AngPos[1] = AngPos[0];
00124     AngPos[0] = (unsigned int)(((unsigned long)POSCNTcopy * COEFF)/1000); // 0 <= POSCNT <= 4999 to 0 <=
AngPos <= 32767
00125 }
00126
00127 //=====
00128 //      POSITION RIGHT CALC
00129 //=====
00130
00131 void quadEncoder_PosCalcR(int* AngPos)
00132 {
00133
00134     int POSCNTcopy = 0;
00135     POSCNTcopy = (int)TIM2->CNT;
00136     AngPos[1] = AngPos[0];
00137     AngPos[0] = (unsigned int)(((unsigned long)POSCNTcopy * COEFF)/1000); // 0 <= POSCNT <= 4999 to 0 <=
AngPos <= 32767
00138 }
00139
00140 //=====
00141 //      POSITION LEFT 16 BITS
00142 //=====
00143
00144 int16_t quadEncoder_GetPos16L(void)
00145 {
00146     uint16_t PosL = 0;
00147     PosL=TIM1->CNT;
00148     return (int16_t)PosL;
00149 }
00150
00151
00152 //=====
00153 //      POSITION RIGHT 16 BITS
00154 //=====
00155
00156 int16_t quadEncoder_GetPos16R(void)
00157 {
00158     uint16_t PosR = 0;

```

```

00159     PosR=TIM2->CNT;
00160     return (int16_t)PosR;
00161 }
00162 //=====
00163 //     POSITION LEFT 32 BITS    (pos 16 bits + nombre de tours)
00164 //=====
00165 int32_t quadEncoder_GetPos32L(void)
00166 {
00167     int32_t PosL = 0;
00168     PosL=indexL*4*COUNT_PER_ROUND + (int32_t) quadEncoder_GetPos16L();
00169     return PosL;
00170 }
00171 }
00172 //=====
00173 //     POSITION RIGHT 32 BITS   (pos 16 bits + nombre de tours)
00174 //=====
00175 int32_t quadEncoder_GetPos32R(void)
00176 {
00177     int32_t PosR = 0;
00178     PosR=indexR*4*COUNT_PER_ROUND + (int32_t) quadEncoder_GetPos16R();
00179     return PosR;
00180 }
00181 }
00182 //=====
00183 //     SPEED LEFT
00184 //--> must be called every Te
00185 //=====
00186 int16_t quadEncoder_GetSpeedL(void)
00187 {
00188     static int AngPos[2] = {0,0};
00189     static int16_t SpeedL=0;
00190     quadEncoder_PosCalcL(AngPos);
00191     SpeedL = AngPos[0] - AngPos[1];
00192     if (SpeedL >= 0)
00193     {
00194         if (SpeedL >= HALF_MAX_COUNT)
00195         {
00196             SpeedL = SpeedL - MAX_COUNT;
00197         }
00198     }
00199     else
00200     {
00201         if (SpeedL < -HALF_MAX_COUNT)
00202         {
00203             SpeedL = SpeedL + MAX_COUNT;
00204         }
00205     }
00206     //*****
00207     // CONVERT RPM
00208     // 1 tour = 32767
00209     // Nbre de Tours pendant Te: DELTA_pos/32767
00210     // Nbre de Tours pendant 1s (Te en ms) : (DELTA_pos/32767)*(1000/Te)
00211     // Nbre de Tours par minute : : (DELTA_pos/32767)*((60*1000)/Te)
00212     SpeedL=(SpeedL*60*1000)/(32767*TE_ms);
00213     return SpeedL;
00214 }
00215 //=====
00216 //     SPEED RIGHT
00217 //--> must be called every Te
00218 //=====
00219 int16_t quadEncoder_GetSpeedR(void)
00220 {
00221     static int AngPos[2] = {0,0};
00222     static int16_t SpeedR=0;
00223     quadEncoder_PosCalcR(AngPos);
00224     SpeedR = AngPos[0] - AngPos[1];
00225     if (SpeedR >= 0)
00226     {
00227         if (SpeedR >= HALF_MAX_COUNT)
00228         {
00229             SpeedR = SpeedR - MAX_COUNT;
00230         }
00231     }
00232     else
00233     {
00234         if (SpeedR < -HALF_MAX_COUNT)
00235         {
00236             SpeedR = SpeedR + MAX_COUNT;
00237         }
00238     }
00239     //*****
00240     // CONVERT RPM
00241     // 1 tour = 32767
00242     // Nbre de Tours pendant Te: DELTA_pos/32767
00243     // Nbre de Tours pendant 1s (Te en ms) : (DELTA_pos/32767)*(1000/Te)
00244     // Nbre de Tours par minute : : (DELTA_pos/32767)*((60*1000)/Te)
00245     SpeedR=(SpeedR*60*1000)/(32767*TE_ms);
00246     return SpeedR;
00247 }

```

```

00246         SpeedR = SpeedR + MAX_COUNT;
00247     }
00248 }
00249 //*****
00250 // CONVERT RPM
00251 // 1 tour = 32767
00252 // Nbre de Tours pendant Te: DELTA_pos/32767
00253 // Nbre de Tours pendant 1s (Te en ms) : (DELTA_pos/32767)*(1000/Te)
00254 // Nbre de Tours par minute : : (DELTA_pos/32767)*((60*1000)/Te)
00255
00256 SpeedR=(SpeedR*60*1000)/(32767*TE_ms);
00257 return SpeedR;
00258 }
00259
00260 //=====
00261 //      MAJ index Left
00262 //=====
00263
00264 void quadEncoder_CallbackIndexL()
00265 {
00266     if (__HAL_TIM_DIRECTION_STATUS(&TimEncoderHandleLeft)==1)
00267     {
00268         indexL--;
00269     }
00270     else
00271     {
00272         indexL++;
00273     }
00274
00275
00276     __HAL_TIM_SetCounter(&TimEncoderHandleLeft, 0); // RAZ Counter
00277     HAL_TIM_Encoder_Start (&TimEncoderHandleLeft,TIM_CHANNEL_1);
00278     HAL_TIM_Encoder_Start (&TimEncoderHandleLeft,TIM_CHANNEL_2);
00279
00280 }
00281 //=====
00282 //      MAJ index Right
00283 //=====
00284
00285 void quadEncoder_CallbackIndexR()
00286 {
00287     if (__HAL_TIM_DIRECTION_STATUS(&TimEncoderHandleRight)==1)
00288     {
00289         indexR--;
00290     }
00291     else
00292     {
00293         indexR++;
00294     }
00295
00296
00297     __HAL_TIM_SetCounter(&TimEncoderHandleRight, 0); // RAZ Counter
00298     HAL_TIM_Encoder_Start (&TimEncoderHandleRight,TIM_CHANNEL_1);
00299     HAL_TIM_Encoder_Start (&TimEncoderHandleRight,TIM_CHANNEL_2);
00300
00301 }
00302 //=====
00303
00304
00305

```

5.38 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_↵ Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Src/retarget.c File Reference

: Contain function to add printf and scanf function use the UART2 All credit to Carmine Noviello for this code <https://github.com/cnoviello/mastering-stm32/blob/master/nucleo-f030↵R8/system/src/retarget/>

```

#include <_ansi.h>
#include <_syslist.h>
#include <errno.h>
#include <sys/time.h>
#include <sys/times.h>

```



```
#include <limits.h>
#include <signal.h>
#include <../Inc/retarget.h>
#include <stdint.h>
#include <stdio.h>
```

Macros

- #define [STDIN_FILENO](#) 0
- #define [STDOUT_FILENO](#) 1
- #define [STDERR_FILENO](#) 2

Functions

- void [RetargetInit](#) (UART_HandleTypeDef *huart)
- int [_isatty](#) (int fd)
- int [_write](#) (int fd, char *ptr, int len)
- int [_close](#) (int fd)
- int [_lseek](#) (int fd, int ptr, int dir)
- int [_read](#) (int fd, char *ptr, int len)
- int [_fstat](#) (int fd, struct stat *st)
- int [_getpid](#) (void)
- int [_kill](#) (int pid, int sig)

Variables

- UART_HandleTypeDef * [gHuart](#)

5.38.1 Detailed Description

: Contain function to add printf and scanf function use the UART2 All credit to Carmine Noviello for this code <https://github.com/cnoviello/mastering-stm32/blob/master/nucleo-f030↔R8/system/src/retarget/>

Definition in file [retarget.c](#).

5.38.2 Macro Definition Documentation

5.38.2.1 STDERR_FILENO

```
#define STDERR_FILENO 2
```

Definition at line [23](#) of file [retarget.c](#).

5.38.2.2 STDIN_FILENO

```
#define STDIN_FILENO 0
```

Definition at line [21](#) of file [retarget.c](#).

5.38.2.3 STDOUT_FILENO

```
#define STDOUT_FILENO 1
```

Definition at line 22 of file [retarget.c](#).

5.38.3 Function Documentation

5.38.3.1 _close()

```
int _close (  
    int fd )
```

Definition at line 57 of file [retarget.c](#).

5.38.3.2 _fstat()

```
int _fstat (  
    int fd,  
    struct stat * st )
```

Definition at line 88 of file [retarget.c](#).

5.38.3.3 _getpid()

```
int _getpid (  
    void )
```

Definition at line 98 of file [retarget.c](#).

5.38.3.4 _isatty()

```
int _isatty (  
    int fd )
```

Definition at line 35 of file [retarget.c](#).

5.38.3.5 _kill()

```
int _kill (  
    int pid,  
    int sig )
```

Definition at line 103 of file [retarget.c](#).

5.38.3.6 _lseek()

```
int _lseek (
    int fd,
    int ptr,
    int dir )
```

Definition at line 65 of file [retarget.c](#).

5.38.3.7 _read()

```
int _read (
    int fd,
    char * ptr,
    int len )
```

Definition at line 74 of file [retarget.c](#).

5.38.3.8 _write()

```
int _write (
    int fd,
    char * ptr,
    int len )
```

Definition at line 43 of file [retarget.c](#).

5.38.3.9 RetargetInit()

```
void RetargetInit (
    UART_HandleTypeDef * huart )
```

Reconfigure stdin, stdout and stderr to use UART

Parameters

<i>huart</i>	Structure wich represent an UART
--------------	----------------------------------

Definition at line 27 of file [retarget.c](#).

5.38.4 Variable Documentation

5.38.4.1 gHuart

```
UART_HandleTypeDef* gHuart
```

Definition at line 25 of file [retarget.c](#).

5.39 retarget.c

[Go to the documentation of this file.](#)

```

00001
00008 #include <_ansi.h>
00009 #include <_syslist.h>
00010 #include <errno.h>
00011 #include <sys/time.h>
00012 #include <sys/times.h>
00013 #include <limits.h>
00014 #include <signal.h>
00015 #include <../Inc/retarget.h>
00016 #include <stdint.h>
00017 #include <stdio.h>
00018
00019 #if !defined(OS_USE_SEMIHOSTING)
00020
00021 #define STDIN_FILENO 0
00022 #define STDOUT_FILENO 1
00023 #define STDERR_FILENO 2
00024
00025 UART_HandleTypeDef *gHuart;
00026
00027 void RetargetInit(UART_HandleTypeDef *huart) {
00028     gHuart = huart;
00029
00030     /* Disable I/O buffering for STDOUT stream, so that
00031      * chars are sent out as soon as they are printed. */
00032     setvbuf(stdout, NULL, _IONBF, 0);
00033 }
00034
00035 int _isatty(int fd) {
00036     if (fd >= STDIN_FILENO && fd <= STDERR_FILENO)
00037         return 1;
00038
00039     errno = EBADF;
00040     return 0;
00041 }
00042
00043 int _write(int fd, char* ptr, int len) {
00044     HAL_StatusTypeDef hstatus;
00045
00046     if (fd == STDOUT_FILENO || fd == STDERR_FILENO) {
00047         hstatus = HAL_UART_Transmit(gHuart, (uint8_t *) ptr, len, HAL_MAX_DELAY);
00048         if (hstatus == HAL_OK)
00049             return len;
00050         else
00051             return EIO;
00052     }
00053     errno = EBADF;
00054     return -1;
00055 }
00056
00057 int _close(int fd) {
00058     if (fd >= STDIN_FILENO && fd <= STDERR_FILENO)
00059         return 0;
00060
00061     errno = EBADF;
00062     return -1;
00063 }
00064
00065 int _lseek(int fd, int ptr, int dir) {
00066     (void) fd;
00067     (void) ptr;
00068     (void) dir;
00069
00070     errno = EBADF;
00071     return -1;
00072 }
00073
00074 int _read(int fd, char* ptr, int len) {
00075     HAL_StatusTypeDef hstatus;
00076
00077     if (fd == STDIN_FILENO) {
00078         hstatus = HAL_UART_Receive(gHuart, (uint8_t *) ptr, 1, HAL_MAX_DELAY);
00079         if (hstatus == HAL_OK)
00080             return 1;
00081         else
00082             return EIO;
00083     }
00084     errno = EBADF;
00085     return -1;
00086 }
00087
00088 int _fstat(int fd, struct stat* st) {

```

```

00089     if (fd >= STDIN_FILENO && fd <= STDERR_FILENO) {
00090         st->st_mode = S_IFCHR;
00091         return 0;
00092     }
00093
00094     errno = EBADF;
00095     return 0;
00096 }
00097
00098 int _getpid(void)
00099 {
00100     return 1;
00101 }
00102
00103 int _kill(int pid, int sig)
00104 {
00105     errno = EINVAL;
00106     return -1;
00107 }
00108
00109 #endif // #if !defined(OS_USE_SEMIHOSTING)

```

5.40 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Src/stm32f4xx_hal_msp.c File Reference

: function to configure the pinout of STM32

```
#include "main.h"
```

Macros

- #define [USART2_IRQ_PRIO](#) 9
- #define [USART6_IRQ_PRIO](#) 10
- #define [EXTI0_IRQ_PRIO](#) 6
- #define [EXTI15_10_IRQ_PRIO](#) 7
- #define [I2C1_ER_IRQ_PRIO](#) 2
- #define [I2C1_EV_IRQ_PRIO](#) 11
- #define [TIM5_IRQ_PRIO](#) 12

Functions

- void [HAL_PWM_Timer3_MspInit](#) (void)
- void [HAL_Encoder_Timer1_MspInit](#) (void)
- void [HAL_Encoder_Timer2_MspInit](#) (void)
- void [HAL_adcir_MspInit](#) (void)
- void [HAL_MspInit](#) (void)
- void [HAL_I2C_MspInit](#) (I2C_HandleTypeDef *hi2c)
- void [HAL_I2C_MspDeInit](#) (I2C_HandleTypeDef *hi2c)
- void [HAL_UART_MspInit](#) (UART_HandleTypeDef *huart)
- void [HAL_UART_MspDeInit](#) (UART_HandleTypeDef *huart)

Variables

- DMA_HandleTypeDef [hdma_usart1_rx](#)
- DMA_HandleTypeDef [hdma_usart1_tx](#)
- DMA_HandleTypeDef [hdma_usart2_rx](#)
- DMA_HandleTypeDef [hdma_usart2_tx](#)

5.40.1 Detailed Description

: function to configure the pinout of STM32

Definition in file [stm32f4xx_hal_msp.c](#).

5.40.2 Macro Definition Documentation

5.40.2.1 EXTI0_IRQ_PRIO

```
#define EXTI0_IRQ_PRIO 6
```

Definition at line 10 of file [stm32f4xx_hal_msp.c](#).

5.40.2.2 EXTI15_10_IRQ_PRIO

```
#define EXTI15_10_IRQ_PRIO 7
```

Definition at line 11 of file [stm32f4xx_hal_msp.c](#).

5.40.2.3 I2C1_ER_IRQ_PRIO

```
#define I2C1_ER_IRQ_PRIO 2
```

Definition at line 12 of file [stm32f4xx_hal_msp.c](#).

5.40.2.4 I2C1_EV_IRQ_PRIO

```
#define I2C1_EV_IRQ_PRIO 11
```

Definition at line 13 of file [stm32f4xx_hal_msp.c](#).

5.40.2.5 TIM5_IRQ_PRIO

```
#define TIM5_IRQ_PRIO 12
```

Definition at line 14 of file [stm32f4xx_hal_msp.c](#).

5.40.2.6 USART2_IRQ_PRIO

```
#define USART2_IRQ_PRIO 9
```

Definition at line 7 of file [stm32f4xx_hal_msp.c](#).

5.40.2.7 USART6_IRQ_PRIO

```
#define USART6_IRQ_PRIO 10
```

Definition at line 8 of file [stm32f4xx_hal_msp.c](#).

5.40.3 Function Documentation

5.40.3.1 HAL_adcir_MspInit()

```
void HAL_adcir_MspInit (  
    void )
```

Definition at line 162 of file [stm32f4xx_hal_msp.c](#).

5.40.3.2 HAL_Encoder_Timer1_MspInit()

```
void HAL_Encoder_Timer1_MspInit (  
    void )
```

Definition at line 53 of file [stm32f4xx_hal_msp.c](#).

5.40.3.3 HAL_Encoder_Timer2_MspInit()

```
void HAL_Encoder_Timer2_MspInit (  
    void )
```

Definition at line 84 of file [stm32f4xx_hal_msp.c](#).

5.40.3.4 HAL_I2C_MspDeInit()

```
void HAL_I2C_MspDeInit (  
    I2C_HandleTypeDef * hi2c )
```

I2C1 GPIO Configuration PB6 ----> I2C1_SCL PB7 ----> I2C1_SDA

Definition at line 222 of file [stm32f4xx_hal_msp.c](#).

5.40.3.5 HAL_I2C_MspInit()

```
void HAL_I2C_MspInit (  
    I2C_HandleTypeDef * hi2c )
```

Definition at line 192 of file [stm32f4xx_hal_msp.c](#).

5.40.3.6 HAL_MspInit()

```
void HAL_MspInit (
    void )
```

Definition at line 26 of file [stm32f4xx_hal_msp.c](#).

5.40.3.7 HAL_PWM_Timer3_MspInit()

```
void HAL_PWM_Timer3_MspInit (
    void )
```

Definition at line 115 of file [stm32f4xx_hal_msp.c](#).

5.40.3.8 HAL_UART_MspDeInit()

```
void HAL_UART_MspDeInit (
    UART_HandleTypeDef * huart )
```

USART1 GPIO Configuration PA9 ----> USART1_TX PA10 ----> USART1_RX

USART2 GPIO Configuration PA2 ----> USART2_TX PA3 ----> USART2_RX

Definition at line 403 of file [stm32f4xx_hal_msp.c](#).

5.40.3.9 HAL_UART_MspInit()

```
void HAL_UART_MspInit (
    UART_HandleTypeDef * huart )
```

Definition at line 260 of file [stm32f4xx_hal_msp.c](#).

5.40.4 Variable Documentation

5.40.4.1 hdma_usart1_rx

```
DMA_HandleTypeDef hdma_usart1_rx [extern]
```

Definition at line 6 of file [drv_uart.c](#).

5.40.4.2 hdma_usart1_tx

```
DMA_HandleTypeDef hdma_usart1_tx [extern]
```

Definition at line 7 of file [drv_uart.c](#).

5.40.4.3 hdma_usart2_rx

DMA_HandleTypeDef hdma_usart2_rx [extern]

Definition at line 8 of file [drv_uart.c](#).

5.40.4.4 hdma_usart2_tx

DMA_HandleTypeDef hdma_usart2_tx [extern]

Definition at line 9 of file [drv_uart.c](#).

5.41 stm32f4xx_hal_msp.c

[Go to the documentation of this file.](#)

```

00001
00005 #include "main.h"
00006
00007 #define USART2_IRQ_PRIO 9
00008 #define USART6_IRQ_PRIO 10
00009 // #define EXTI1_IRQ_PRIO 7
00010 #define EXTI0_IRQ_PRIO 6
00011 #define EXTI15_10_IRQ_PRIO 7
00012 #define I2C1_ER_IRQ_PRIO 2
00013 #define I2C1_EV_IRQ_PRIO 11
00014 #define TIM5_IRQ_PRIO 12
00015
00016 extern DMA_HandleTypeDef hdma_usart1_rx;
00017 extern DMA_HandleTypeDef hdma_usart1_tx;
00018 extern DMA_HandleTypeDef hdma_usart2_rx;
00019 extern DMA_HandleTypeDef hdma_usart2_tx;
00020
00021 void HAL_PWM_Timer3_MspInit(void);
00022 void HAL_Encoder_Timer1_MspInit(void);
00023 void HAL_Encoder_Timer2_MspInit(void);
00024 void HAL_adcir_MspInit(void);
00025
00026 void HAL_MspInit(void)
00027 {
00028     __HAL_RCC_SYSCFG_CLK_ENABLE();
00029     __HAL_RCC_PWR_CLK_ENABLE();
00030
00031     __HAL_RCC_GPIOC_CLK_ENABLE();
00032     __HAL_RCC_GPIOH_CLK_ENABLE();
00033     __HAL_RCC_GPIOA_CLK_ENABLE();
00034     __HAL_RCC_GPIOB_CLK_ENABLE();
00035
00036     /* System interrupt init*/
00037     /* PendSV_IRQn interrupt configuration */
00038     HAL_NVIC_SetPriority(PendSV_IRQn, 15, 0);
00039
00040     HAL_PWM_Timer3_MspInit();
00041     HAL_Encoder_Timer1_MspInit();
00042     HAL_Encoder_Timer2_MspInit();
00043     HAL_adcir_MspInit();
00044 }
00045
00046 /*****
00047  * Initialise the timer1
00048  *          ENCODER - TIMER1
00049  * PWM1/1 --> PA8    -- Encodeur Voie A
00050  * PWM1/2 --> PA9    -- Encodeur Voie B
00051  * EXTI10 --> PB10   -- Index encodeur
00052 *****/
00053 void HAL_Encoder_Timer1_MspInit(void)
00054 {
00055     GPIO_InitTypeDef GPIO_InitStruct;
00056
00057     __TIM1_CLK_ENABLE();
00058
00059     GPIO_InitStruct.Pin = GPIO_PIN_8 | GPIO_PIN_9;
00060     GPIO_InitStruct.Mode = GPIO_MODE_AF_PP; // hal_gpio.h
00061     GPIO_InitStruct.Pull = GPIO_PULLUP;

```

```

00062     GPIO_InitStruct.Speed = GPIO_SPEED_MEDIUM;
00063     GPIO_InitStruct.Alternate = GPIO_AF1_TIM1 ; // hal_gpio_ex.h
00064
00065     HAL_GPIO_Init(GPIOA, &GPIO_InitStruct); //PA8 & PA9
00066
00067     GPIO_InitStruct.Pin = GPIO_PIN_10;
00068     GPIO_InitStruct.Mode = GPIO_MODE_IT_FALLING;
00069     GPIO_InitStruct.Pull = GPIO_NOPULL;
00070
00071     HAL_GPIO_Init(GPIOB, &GPIO_InitStruct); //PB10
00072
00073     /* Enable and set EXTI Line0 Interrupt to the lowest priority */
00074     HAL_NVIC_SetPriority(EXTI15_10_IRQn, EXTI15_10_IRQ_PRIO, 0);
00075     HAL_NVIC_EnableIRQ(EXTI15_10_IRQn);
00076 }
00077 /*****
00078  * Initialise the timer2
00079  *          ENCODER - TIMER2
00080  * PWM2/1 --> PA0    -- Encodeur Voie A
00081  * PWM2/2 --> PA1    -- Encodeur Voie B
00082  * EXTI0  --> PC0    -- Index Moteur
00083 *****/
00084 void HAL_Encoder_Timer2_MspInit(void)
00085 {
00086     GPIO_InitTypeDef GPIO_InitStruct;
00087
00088     __TIM2_CLK_ENABLE();
00089
00090     GPIO_InitStruct.Pin = GPIO_PIN_0 | GPIO_PIN_1;
00091     GPIO_InitStruct.Mode = GPIO_MODE_AF_PP; // hal_gpio.h
00092     GPIO_InitStruct.Pull = GPIO_PULLUP;
00093     GPIO_InitStruct.Speed = GPIO_SPEED_MEDIUM;
00094     GPIO_InitStruct.Alternate = GPIO_AF1_TIM2 ; // hal_gpio_ex.h
00095
00096     HAL_GPIO_Init(GPIOA, &GPIO_InitStruct); //PA0 & PA1
00097
00098     GPIO_InitStruct.Pin = GPIO_PIN_0;
00099     GPIO_InitStruct.Mode = GPIO_MODE_IT_FALLING;
00100     GPIO_InitStruct.Pull = GPIO_NOPULL;
00101
00102     HAL_GPIO_Init(GPIOC, &GPIO_InitStruct); //PC0
00103
00104     /* Enable and set EXTI Line0 Interrupt to the lowest priority */
00105     HAL_NVIC_SetPriority(EXTI0_IRQn, EXTI0_IRQ_PRIO, 0);
00106     HAL_NVIC_EnableIRQ(EXTI0_IRQn);
00107 }
00108
00109 /*****
00110  *          PWM - TIMER3 COMMANDE MOTEURS
00111  * PA6 --> PWM3/1
00112  * PC7 --> PWM3/2
00113  * PB3 --> ENABLE MOTEUR (Active at low level)
00114 *****/
00115 void HAL_PWM_Timer3_MspInit(void)
00116 {
00117     GPIO_InitTypeDef GPIO_InitStruct;
00118
00119     __TIM3_CLK_ENABLE();
00120
00121     GPIO_InitStruct.Pin = GPIO_PIN_6;
00122     GPIO_InitStruct.Mode = GPIO_MODE_AF_PP;
00123     GPIO_InitStruct.Pull = GPIO_PULLUP;
00124     GPIO_InitStruct.Speed = GPIO_SPEED_MEDIUM;
00125     GPIO_InitStruct.Alternate = GPIO_AF2_TIM3 ; // hal_gpio_ex.h
00126
00127     HAL_GPIO_Init(GPIOA, &GPIO_InitStruct); //PA6
00128
00129     GPIO_InitStruct.Pin = GPIO_PIN_7;
00130     GPIO_InitStruct.Mode = GPIO_MODE_AF_PP;
00131     GPIO_InitStruct.Pull = GPIO_PULLUP;
00132     GPIO_InitStruct.Speed = GPIO_SPEED_MEDIUM;
00133     GPIO_InitStruct.Alternate = GPIO_AF2_TIM3 ; // hal_gpio_ex.h
00134
00135     HAL_GPIO_Init(GPIOC, &GPIO_InitStruct); //PC7
00136
00137     /* ENABLE MOTEUR : SORTIE LOGIQUE PB3
00138     GPIO_InitStruct.Pin = GPIO_PIN_3;
00139     GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
00140     GPIO_InitStruct.Pull = GPIO_PULLUP;
00141     GPIO_InitStruct.Speed = GPIO_SPEED_FAST;
00142
00143     HAL_GPIO_Init(GPIOB, &GPIO_InitStruct); //PB3
00144     HAL_GPIO_WritePin(GPIOB, GPIO_PIN_3, 1);
00145
00146     /* ENABLE MOTEUR carte proto
00147     GPIO_InitStruct.Pin = GPIO_PIN_7;
00148     GPIO_InitStruct.Mode = GPIO_MODE_INPUT;

```

```

00149     GPIO_InitStruct.Pull = GPIO_NOPULL;
00150
00151     HAL_GPIO_Init(GPIOA, &GPIO_InitStruct);
00152     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, 1);*/
00153 }
00154
00155 /*****
00156  * Initialise the ADC channel
00157  *
00158  * ADC1_4 --> PA4
00159  * ADC1_8 --> PB0
00160  * http://stm32f4-discovery.com/2014/04/library-06-ad-converter-on-stm32f4xx/
00161  *****/
00162 void HAL_adcir_MspInit(void)
00163 {
00164     GPIO_InitTypeDef GPIO_InitStruct;
00165     /* Peripheral clock enable */
00166     __ADC1_CLK_ENABLE();
00167
00168     GPIO_InitStruct.Pin = GPIO_PIN_4 ;
00169     GPIO_InitStruct.Mode = GPIO_MODE_ANALOG;
00170     GPIO_InitStruct.Pull = GPIO_NOPULL;
00171
00172     HAL_GPIO_Init(GPIOA, &GPIO_InitStruct); //PA4
00173
00174     GPIO_InitStruct.Pin = GPIO_PIN_0 ;
00175     GPIO_InitStruct.Mode = GPIO_MODE_ANALOG;
00176     GPIO_InitStruct.Pull = GPIO_NOPULL;
00177
00178     HAL_GPIO_Init(GPIOB, &GPIO_InitStruct); //PB0
00179 }
00180
00181
00182
00183 /*****
00184  * @brief I2C MSP Initialization
00185  * This function configures the hardware resources used in this example
00186  * I2C1 GPIO Configuration
00187  * PB8 -----> I2C1_SCL
00188  * PB9 -----> I2C1_SDA
00189  * @param hi2c: I2C handle pointer
00190  * @retval None
00191  *****/
00192 void HAL_I2C_MspInit(I2C_HandleTypeDef* hi2c)
00193 {
00194     GPIO_InitTypeDef GPIO_InitStruct = {0};
00195     if(hi2c->Instance==I2C1)
00196     {
00197         __HAL_RCC_GPIOB_CLK_ENABLE();
00198
00199         GPIO_InitStruct.Pin = GPIO_PIN_8|GPIO_PIN_9;
00200         GPIO_InitStruct.Mode = GPIO_MODE_AF_OD;
00201         GPIO_InitStruct.Pull = GPIO_NOPULL;
00202         GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_VERY_HIGH;
00203         GPIO_InitStruct.Alternate = GPIO_AF4_I2C1;
00204         HAL_GPIO_Init(GPIOB, &GPIO_InitStruct); //PB8 & PB9
00205
00206         /* Peripheral clock enable */
00207         __HAL_RCC_I2C1_CLK_ENABLE();
00208
00209         HAL_NVIC_SetPriority(I2C1_ER_IRQn, I2C1_ER_IRQ_Prio, 0);
00210         HAL_NVIC_EnableIRQ(I2C1_ER_IRQn);
00211         HAL_NVIC_SetPriority(I2C1_EV_IRQn, I2C1_EV_IRQ_Prio, 0);
00212         HAL_NVIC_EnableIRQ(I2C1_EV_IRQn);
00213     }
00214 }
00215
00216 /*****
00217  * @brief I2C MSP De-Initialization
00218  * This function freeze the hardware resources used in this example
00219  * @param hi2c: I2C handle pointer
00220  * @retval None
00221  *****/
00222 void HAL_I2C_MspDeInit(I2C_HandleTypeDef* hi2c)
00223 {
00224     if(hi2c->Instance==I2C1)
00225     {
00226         /* USER CODE BEGIN I2C1_MspDeInit 0 */
00227
00228         /* USER CODE END I2C1_MspDeInit 0 */
00229         /* Peripheral clock disable */
00230         __HAL_RCC_I2C1_CLK_DISABLE();
00231
00232         HAL_GPIO_DeInit(GPIOB, GPIO_PIN_6);
00233
00234         HAL_GPIO_DeInit(GPIOB, GPIO_PIN_7);
00235     }

```

```

00240  /* USER CODE BEGIN I2C1_MspDeInit 1 */
00241
00242  /* USER CODE END I2C1_MspDeInit 1 */
00243  }
00244
00245  }
00246
00247  /*****
00248  * @brief UART MSP Initialization
00249  * This function configures the hardware resources used in this example
00250  * USART1 GPIO Configuration
00251  * PB6      -----> USART1_TX
00252  * PA10     -----> USART1_RX
00253  *
00254  * USART2 GPIO Configuration
00255  * PA2      -----> USART2_TX
00256  * PA3      -----> USART2_RX
00257  * @param huart: UART handle pointer
00258  * @retval None
00259  *****/
00260  void HAL_UART_MspInit(UART_HandleTypeDef* huart)
00261  {
00262      GPIO_InitTypeDef GPIO_InitStruct = {0};
00263      if(huart->Instance==USART1)
00264      {
00265          /* USER CODE BEGIN USART1_MspInit 0 */
00266
00267          /* USER CODE END USART1_MspInit 0 */
00268          /* Peripheral clock enable */
00269          __HAL_RCC_USART1_CLK_ENABLE();
00270
00271          __HAL_RCC_GPIOA_CLK_ENABLE();
00272
00273          // USART1
00274          GPIO_InitStruct.Pin = GPIO_PIN_10;
00275          GPIO_InitStruct.Mode = GPIO_MODE_AF_PP;
00276          GPIO_InitStruct.Pull = GPIO_NOPULL;
00277          GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_VERY_HIGH;
00278          GPIO_InitStruct.Alternate = GPIO_AF7_USART1;
00279          HAL_GPIO_Init(GPIOA, &GPIO_InitStruct); //PA10
00280
00281          GPIO_InitStruct.Pin = GPIO_PIN_6;
00282          GPIO_InitStruct.Mode = GPIO_MODE_AF_PP;
00283          GPIO_InitStruct.Pull = GPIO_NOPULL;
00284          GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_VERY_HIGH;
00285          GPIO_InitStruct.Alternate = GPIO_AF7_USART1;
00286          HAL_GPIO_Init(GPIOB, &GPIO_InitStruct); //PB6
00287
00288          /* USART1 DMA Init */
00289          /* USART1_RX Init */
00290          hdma_usart1_rx.Instance = DMA2_Stream2;
00291          hdma_usart1_rx.Init.Channel = DMA_CHANNEL_4;
00292          hdma_usart1_rx.Init.Direction = DMA_PERIPH_TO_MEMORY;
00293          hdma_usart1_rx.Init.PeriphInc = DMA_PINC_DISABLE;
00294          hdma_usart1_rx.Init.MemInc = DMA_MINC_ENABLE;
00295          hdma_usart1_rx.Init.PeriphDataAlignment = DMA_PDATAALIGN_BYTE;
00296          hdma_usart1_rx.Init.MemDataAlignment = DMA_MDATAALIGN_BYTE;
00297          hdma_usart1_rx.Init.Mode = DMA_CIRCULAR;
00298          hdma_usart1_rx.Init.Priority = DMA_PRIORITY_VERY_HIGH;
00299          hdma_usart1_rx.Init.FIFOMode = DMA_FIFOMODE_DISABLE;
00300          if (HAL_DMA_Init(&hdma_usart1_rx) != HAL_OK)
00301          {
00302              Error_Handler();
00303          }
00304
00305          __HAL_LINKDMA(huart,hdmarx,hdma_usart1_rx);
00306
00307          /* USART1_TX Init */
00308          hdma_usart1_tx.Instance = DMA2_Stream7;
00309          hdma_usart1_tx.Init.Channel = DMA_CHANNEL_4;
00310          hdma_usart1_tx.Init.Direction = DMA_MEMORY_TO_PERIPH;
00311          hdma_usart1_tx.Init.PeriphInc = DMA_PINC_DISABLE;
00312          hdma_usart1_tx.Init.MemInc = DMA_MINC_ENABLE;
00313          hdma_usart1_tx.Init.PeriphDataAlignment = DMA_PDATAALIGN_BYTE;
00314          hdma_usart1_tx.Init.MemDataAlignment = DMA_MDATAALIGN_BYTE;
00315          hdma_usart1_tx.Init.Mode = DMA_NORMAL;
00316          hdma_usart1_tx.Init.Priority = DMA_PRIORITY_VERY_HIGH;
00317          hdma_usart1_tx.Init.FIFOMode = DMA_FIFOMODE_DISABLE;
00318          if (HAL_DMA_Init(&hdma_usart1_tx) != HAL_OK)
00319          {
00320              Error_Handler();
00321          }
00322
00323          __HAL_LINKDMA(huart,hdmatx,hdma_usart1_tx);
00324
00325          /* USART1 interrupt Init */
00326          HAL_NVIC_SetPriority(USART1_IRQn, 5, 0);

```

```

00327     HAL_NVIC_EnableIRQ(USART1_IRQn);
00328     /* USER CODE BEGIN USART1_MspInit 1 */
00329
00330     /* USER CODE END USART1_MspInit 1 */
00331 }
00332 else if(huart->Instance==USART2)
00333 {
00334     /* USER CODE BEGIN USART2_MspInit 0 */
00335
00336     /* USER CODE END USART2_MspInit 0 */
00337     /* Peripheral clock enable */
00338     __HAL_RCC_USART2_CLK_ENABLE();
00339
00340     __HAL_RCC_GPIOA_CLK_ENABLE();
00341
00342     // USART2
00343     GPIO_InitStruct.Pin = USART_TX_Pin|USART_RX_Pin;
00344     GPIO_InitStruct.Mode = GPIO_MODE_AF_PP;
00345     GPIO_InitStruct.Pull = GPIO_NOPULL;
00346     GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_VERY_HIGH;
00347     GPIO_InitStruct.Alternate = GPIO_AF7_USART2;
00348     HAL_GPIO_Init(GPIOA, &GPIO_InitStruct); //PA4 & PA8
00349
00350     /* USART2 DMA Init */
00351     /* USART2_RX Init */
00352     hdma_usart2_rx.Instance = DMA1_Stream5;
00353     hdma_usart2_rx.Init.Channel = DMA_CHANNEL_4;
00354     hdma_usart2_rx.Init.Direction = DMA_PERIPH_TO_MEMORY;
00355     hdma_usart2_rx.Init.PeriphInc = DMA_PINC_DISABLE;
00356     hdma_usart2_rx.Init.MemInc = DMA_MINC_ENABLE;
00357     hdma_usart2_rx.Init.PeriphDataAlignment = DMA_PDATAALIGN_BYTE;
00358     hdma_usart2_rx.Init.MemDataAlignment = DMA_MDATAALIGN_BYTE;
00359     hdma_usart2_rx.Init.Mode = DMA_CIRCULAR;
00360     hdma_usart2_rx.Init.Priority = DMA_PRIORITY_VERY_HIGH;
00361     hdma_usart2_rx.Init.FIFOMode = DMA_FIFOMODE_DISABLE;
00362     if (HAL_DMA_Init(&hdma_usart2_rx) != HAL_OK)
00363     {
00364         Error_Handler();
00365     }
00366
00367     __HAL_LINKDMA(huart,hdmarx,hdma_usart2_rx);
00368
00369     /* USART2_TX Init */
00370     hdma_usart2_tx.Instance = DMA1_Stream6;
00371     hdma_usart2_tx.Init.Channel = DMA_CHANNEL_4;
00372     hdma_usart2_tx.Init.Direction = DMA_MEMORY_TO_PERIPH;
00373     hdma_usart2_tx.Init.PeriphInc = DMA_PINC_DISABLE;
00374     hdma_usart2_tx.Init.MemInc = DMA_MINC_ENABLE;
00375     hdma_usart2_tx.Init.PeriphDataAlignment = DMA_PDATAALIGN_BYTE;
00376     hdma_usart2_tx.Init.MemDataAlignment = DMA_MDATAALIGN_BYTE;
00377     hdma_usart2_tx.Init.Mode = DMA_NORMAL;
00378     hdma_usart2_tx.Init.Priority = DMA_PRIORITY_VERY_HIGH;
00379     hdma_usart2_tx.Init.FIFOMode = DMA_FIFOMODE_DISABLE;
00380     if (HAL_DMA_Init(&hdma_usart2_tx) != HAL_OK)
00381     {
00382         Error_Handler();
00383     }
00384
00385     __HAL_LINKDMA(huart,hdmatx,hdma_usart2_tx);
00386
00387     /* USART2 interrupt Init */
00388     HAL_NVIC_SetPriority(USART2_IRQn, 5, 0);
00389     HAL_NVIC_EnableIRQ(USART2_IRQn);
00390     /* USER CODE BEGIN USART2_MspInit 1 */
00391
00392     /* USER CODE END USART2_MspInit 1 */
00393 }
00394
00395 }
00396
00397 //*****
00398 /** @brief UART MSP De-Initialization
00399  * This function freeze the hardware resources used in this example
00400  * @param huart: UART handle pointer
00401  * @retval None
00402  */
00403 void HAL_UART_MspDeInit (UART_HandleTypeDef huart)
00404 {
00405     if(huart->Instance==USART1)
00406     {
00407         /* USER CODE BEGIN USART1_MspDeInit 0 */
00408
00409         /* USER CODE END USART1_MspDeInit 0 */
00410         /* Peripheral clock disable */
00411         __HAL_RCC_USART1_CLK_DISABLE();
00412
00413         HAL_GPIO_DeInit(GPIOA, GPIO_PIN_9|GPIO_PIN_10);

```

```

00418
00419     /* USART1 DMA DeInit */
00420     HAL_DMA_DeInit(huart->hdmarx);
00421     HAL_DMA_DeInit(huart->hdmatx);
00422
00423     /* USART1 interrupt DeInit */
00424     HAL_NVIC_DisableIRQ(USART1_IRQn);
00425     /* USER CODE BEGIN USART1_MspDeInit 1 */
00426
00427     /* USER CODE END USART1_MspDeInit 1 */
00428 }
00429 else if(huart->Instance==USART2)
00430 {
00431     /* USER CODE BEGIN USART2_MspDeInit 0 */
00432
00433     /* USER CODE END USART2_MspDeInit 0 */
00434     /* Peripheral clock disable */
00435     __HAL_RCC_USART2_CLK_DISABLE();
00436
00441     HAL_GPIO_DeInit(GPIOA, USART_TX_Pin|USART_RX_Pin);
00442
00443     /* USART2 DMA DeInit */
00444     HAL_DMA_DeInit(huart->hdmarx);
00445     HAL_DMA_DeInit(huart->hdmatx);
00446
00447     /* USART2 interrupt DeInit */
00448     HAL_NVIC_DisableIRQ(USART2_IRQn);
00449     /* USER CODE BEGIN USART2_MspDeInit 1 */
00450
00451     /* USER CODE END USART2_MspDeInit 1 */
00452 }
00453
00454 }
00455
00456 /* USER CODE BEGIN 1 */
00457
00458 /* USER CODE END 1 */

```

5.42 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_↵ Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Src/stm32f4xx_↵ _hal_timebase_tim.c File Reference

HAL time base based on the hardware TIM.

```

#include "stm32f4xx_hal.h"
#include "stm32f4xx_hal_tim.h"

```

Functions

- HAL_StatusTypeDef [HAL_InitTick](#) (uint32_t TickPriority)
This function configures the TIM1 as a time base source. The time source is configured to have 1ms time base with a dedicated Tick interrupt priority.
- void [HAL_SuspendTick](#) (void)
Suspend Tick increment.
- void [HAL_ResumeTick](#) (void)
Resume Tick increment.

Variables

- TIM_HandleTypeDef [htim4](#)

5.42.1 Detailed Description

HAL time base based on the hardware TIM.

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Definition in file [stm32f4xx_hal_timebase_tim.c](#).

5.42.2 Function Documentation

5.42.2.1 HAL_InitTick()

```
HAL_StatusTypeDef HAL_InitTick (
    uint32_t TickPriority )
```

This function configures the TIM1 as a time base source. The time source is configured to have 1ms time base with a dedicated Tick interrupt priority.

Note

This function is called automatically at the beginning of program after reset by HAL_Init() or at any time when clock is configured, by HAL_RCC_ClockConfig().

Parameters

<i>TickPriority</i>	Tick interrupt priority.
---------------------	--------------------------

Return values

<i>HAL</i>	status
------------	--------

Definition at line 41 of file [stm32f4xx_hal_timebase_tim.c](#).

5.42.2.2 HAL_ResumeTick()

```
void HAL_ResumeTick (
    void )
```

Resume Tick increment.

Note

Enable the tick increment by Enabling TIM1 update interrupt.

Parameters

None	
------	--

Return values

None	
------	--

Definition at line 122 of file [stm32f4xx_hal_timebase_tim.c](#).

5.42.2.3 HAL_SuspendTick()

```
void HAL_SuspendTick (
    void )
```

Suspend Tick increment.

Note

Disable the tick increment by disabling TIM1 update interrupt.

Parameters

None	
------	--

Return values

None	
------	--

Definition at line 110 of file [stm32f4xx_hal_timebase_tim.c](#).

5.42.3 Variable Documentation**5.42.3.1 htim4**

```
TIM_HandleTypeDef htim4
```

Definition at line 28 of file [stm32f4xx_hal_timebase_tim.c](#).

5.43 stm32f4xx_hal_timebase_tim.c

[Go to the documentation of this file.](#)

```
00001 /* USER CODE BEGIN Header */
00018 /* USER CODE END Header */
00019
00020 /* Includes -----*/
00021 #include "stm32f4xx_hal.h"
```



```

00022 #include "stm32f4xx_hal_tim.h"
00023
00024 /* Private typedef -----*/
00025 /* Private define -----*/
00026 /* Private macro -----*/
00027 /* Private variables -----*/
00028 TIM_HandleTypeDef htim4;
00029 /* Private function prototypes -----*/
00030 /* Private functions -----*/
00031
00041 HAL_StatusTypeDef HAL_InitTick(uint32_t TickPriority)
00042 {
00043     RCC_ClkInitTypeDef clkconfig;
00044     uint32_t uwTimclock = 0U;
00045
00046     uint32_t uwPrescalerValue = 0U;
00047     uint32_t pFLatency;
00048     HAL_StatusTypeDef status;
00049
00050     /* Enable TIM1 clock */
00051     __HAL_RCC_TIM4_CLK_ENABLE();
00052
00053     /* Get clock configuration */
00054     HAL_RCC_GetClockConfig(&clkconfig, &pFLatency);
00055
00056     /* Compute TIM1 clock */
00057     uwTimclock = 2*HAL_RCC_GetPCLK2Freq();
00058
00059     /* Compute the prescaler value to have TIM1 counter clock equal to 1MHz */
00060     uwPrescalerValue = (uint32_t) ((uwTimclock / 1000000U) - 1U);
00061
00062     /* Initialize TIM1 */
00063     htim4.Instance = TIM4;
00064
00065     /* Initialize TIMx peripheral as follow:
00066     + Period = [(TIM1CLK/1000) - 1]. to have a (1/1000) s time base.
00067     + Prescaler = (uwTimclock/1000000 - 1) to have a 1MHz counter clock.
00068     + ClockDivision = 0
00069     + Counter direction = Up
00070     */
00071     htim4.Init.Period = (1000000U / 1000U) - 1U;
00072     htim4.Init.Prescaler = uwPrescalerValue;
00073     htim4.Init.ClockDivision = 0;
00074     htim4.Init.CounterMode = TIM_COUNTERMODE_UP;
00075     htim4.Init.AutoReloadPreload = TIM_AUTORELOAD_PRELOAD_DISABLE;
00076
00077     status = HAL_TIM_Base_Init(&htim4);
00078     if (status == HAL_OK)
00079     {
00080         /* Start the TIM time Base generation in interrupt mode */
00081         status = HAL_TIM_Base_Start_IT(&htim4);
00082         if (status == HAL_OK)
00083         {
00084             /* Enable the TIM1 global Interrupt */
00085             HAL_NVIC_EnableIRQ(TIM4_IRQn);
00086             /* Configure the SysTick IRQ priority */
00087             if (TickPriority < (1UL << __NVIC_PRIO_BITS))
00088             {
00089                 /* Configure the TIM IRQ priority */
00090                 HAL_NVIC_SetPriority(TIM4_IRQn, TickPriority, 0U);
00091                 uwTickPrio = TickPriority;
00092             }
00093             else
00094             {
00095                 status = HAL_ERROR;
00096             }
00097         }
00098     }
00099
00100     /* Return function status */
00101     return status;
00102 }
00103
00110 void HAL_SuspendTick(void)
00111 {
00112     /* Disable TIM1 update Interrupt */
00113     __HAL_TIM_DISABLE_IT(&htim4, TIM_IT_UPDATE);
00114 }
00115
00122 void HAL_ResumeTick(void)
00123 {
00124     /* Enable TIM1 Update interrupt */
00125     __HAL_TIM_ENABLE_IT(&htim4, TIM_IT_UPDATE);
00126 }
00127

```

5.44 stm32f4xx_it.c

```

00001
00002 #include "main.h"
00003 #include "stm32f4xx_it.h"
00004
00005 extern DMA_HandleTypeDef hdma_usart1_rx;
00006 extern DMA_HandleTypeDef hdma_usart1_tx;
00007 extern DMA_HandleTypeDef hdma_usart2_rx;
00008 extern DMA_HandleTypeDef hdma_usart2_tx;
00009 extern UART_HandleTypeDef huart1;
00010 extern UART_HandleTypeDef huart2;
00011 extern TIM_HandleTypeDef htim4;
00012 extern I2C_HandleTypeDef hi2c1;
00013
00014
00015 void NMI_Handler(void)
00016 {
00017     while (1)
00018     {
00019     }
00020 }
00021
00022 void HardFault_Handler(void)
00023 {
00024
00025     while (1)
00026     {
00027     }
00028 }
00029
00030 void MemManage_Handler(void)
00031 {
00032     while (1)
00033     {
00034     }
00035 }
00036
00037
00038 void BusFault_Handler(void)
00039 {
00040     while (1)
00041     {
00042     }
00043 }
00044
00048 void UsageFault_Handler(void)
00049 {
00050     while (1)
00051     {
00052     }
00053 }
00054
00055 void DebugMon_Handler(void)
00056 {
00057 }
00058
00059 /*****
00060 /* STM32F4xx Peripheral Interrupt Handlers
00061 /* Add here the Interrupt Handlers for the used peripherals.
00062 /* For the available peripheral interrupt handler names,
00063 /* please refer to the startup file (startup_stm32f4xx.s).
00064 *****/
00065
00066 void DMA1_Stream5_IRQHandler(void)
00067 {
00068     HAL_DMA_IRQHandler(&hdma_usart2_rx);
00069 }
00070
00071
00072 void DMA1_Stream6_IRQHandler(void)
00073 {
00074     HAL_DMA_IRQHandler(&hdma_usart2_tx);
00075 }
00076
00077 /*void TIM1_UP_TIM10_IRQHandler(void)
00078 {
00079     HAL_TIM_IRQHandler(&htim1);
00080 }*/
00081
00082 void TIM4_IRQHandler(void)
00083 {
00084     HAL_TIM_IRQHandler(&htim4);
00085 }
00086
00087 void USART1_IRQHandler(void)
00088 {

```

```

00089 HAL_UART_IRQHandler(&huart1);
00090 }
00091
00092 void USART2_IRQHandler(void)
00093 {
00094     HAL_UART_IRQHandler(&huart2);
00095 }
00096
00097 void DMA2_Stream2_IRQHandler(void)
00098 {
00099     HAL_DMA_IRQHandler(&hdma_usart1_rx);
00100 }
00101
00102 void DMA2_Stream7_IRQHandler(void)
00103 {
00104     HAL_DMA_IRQHandler(&hdma_usart1_tx);
00105 }
00106
00107
00108
00109
00110 //=====
00111 //      ENCODER INDEX LEFT
00112 //=====
00113 void EXTI15_10_IRQHandler(void)
00114 {
00115     HAL_GPIO_EXTI_IRQHandler(GPIO_PIN_10);
00116 }
00117 //=====
00118 //      ENCODER INDEX RIGHT
00119 //=====
00120
00121 void EXTI0_IRQHandler(void)
00122 {
00123     HAL_GPIO_EXTI_IRQHandler(GPIO_PIN_0);
00124 }
00125
00126
00127 void I2C1_EV_IRQHandler(void)
00128 {
00129     HAL_I2C_EV_IRQHandler(&hi2c1);
00130 }
00131
00132 void I2C1_ER_IRQHandler(void)
00133 {
00134     HAL_I2C_ER_IRQHandler(&hi2c1);
00135 }
00136

```

5.45 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Src/syscalls.c File Reference

STM32CubeIDE Minimal System calls file.

```

#include <sys/stat.h>
#include <stdlib.h>
#include <errno.h>
#include <stdio.h>
#include <signal.h>
#include <time.h>
#include <sys/time.h>
#include <sys/times.h>

```

Functions

- int `__io_putchar` (int ch) `__attribute__((weak))`
- int `__io_getchar` (void)

- void [initialise_monitor_handles](#) ()
- int [_getpid](#) (void)
- int [_kill](#) (int pid, int sig)
- void [_exit](#) (int status)
- [__attribute__](#) ((weak))
- int [_close](#) (int file)
- int [_fstat](#) (int file, struct stat *st)
- int [_isatty](#) (int file)
- int [_lseek](#) (int file, int ptr, int dir)
- int [_open](#) (char *path, int flags,...)
- int [_wait](#) (int *status)
- int [_unlink](#) (char *name)
- int [_times](#) (struct tms *buf)
- int [_stat](#) (char *file, struct stat *st)
- int [_link](#) (char *old, char *new)
- int [_fork](#) (void)
- int [_execve](#) (char *name, char **argv, char **env)

Variables

- char ** [environ](#) = `__env`

5.45.1 Detailed Description

STM32CubeIDE Minimal System calls file.

Author

Auto-generated by STM32CubeIDE

```
For more information about which c-functions
need which of these lowlevel functions
please consult the Newlib libc-manual
```

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Definition in file [syscalls.c](#).

5.45.2 Function Documentation

5.45.2.1 [__attribute__](#) ()

```
\_\_attribute\_\_ (
    (weak) )
```

Definition at line 65 of file [syscalls.c](#).

5.45.2.2 `__io_getchar()`

```
int __io_getchar (
    void ) [extern]
```

Definition at line 36 of file [syscalls.c](#).

5.45.2.3 `_close()`

```
int _close (
    int file )
```

Definition at line 88 of file [syscalls.c](#).

5.45.2.4 `_execve()`

```
int _execve (
    char * name,
    char ** argv,
    char ** env )
```

Definition at line 151 of file [syscalls.c](#).

5.45.2.5 `_exit()`

```
void _exit (
    int status )
```

Definition at line 59 of file [syscalls.c](#).

5.45.2.6 `_fork()`

```
int _fork (
    void )
```

Definition at line 145 of file [syscalls.c](#).

5.45.2.7 `_fstat()`

```
int _fstat (
    int file,
    struct stat * st )
```

Definition at line 94 of file [syscalls.c](#).

5.45.2.8 `_getpid()`

```
int _getpid (  
    void )
```

Definition at line 48 of file [syscalls.c](#).

5.45.2.9 `_isatty()`

```
int _isatty (  
    int file )
```

Definition at line 100 of file [syscalls.c](#).

5.45.2.10 `_kill()`

```
int _kill (  
    int pid,  
    int sig )
```

Definition at line 53 of file [syscalls.c](#).

5.45.2.11 `_link()`

```
int _link (  
    char * old,  
    char * new )
```

Definition at line 139 of file [syscalls.c](#).

5.45.2.12 `_lseek()`

```
int _lseek (  
    int file,  
    int ptr,  
    int dir )
```

Definition at line 105 of file [syscalls.c](#).

5.45.2.13 `_open()`

```
int _open (  
    char * path,  
    int flags,  
    ... )
```

Definition at line 110 of file [syscalls.c](#).

5.45.2.14 `_stat()`

```
int _stat (
    char * file,
    struct stat * st )
```

Definition at line [133](#) of file [syscalls.c](#).

5.45.2.15 `_times()`

```
int _times (
    struct tms * buf )
```

Definition at line [128](#) of file [syscalls.c](#).

5.45.2.16 `_unlink()`

```
int _unlink (
    char * name )
```

Definition at line [122](#) of file [syscalls.c](#).

5.45.2.17 `_wait()`

```
int _wait (
    int * status )
```

Definition at line [116](#) of file [syscalls.c](#).

5.45.2.18 `initialise_monitor_handles()`

```
void initialise_monitor_handles ( )
```

Definition at line [44](#) of file [syscalls.c](#).

5.45.3 Variable Documentation

5.45.3.1 `environ`

```
char** environ = __env
```

Definition at line [40](#) of file [syscalls.c](#).

5.46 syscalls.c

[Go to the documentation of this file.](#)

```

00001
00023 /* Includes */
00024 #include <sys/stat.h>
00025 #include <stdlib.h>
00026 #include <errno.h>
00027 #include <stdio.h>
00028 #include <signal.h>
00029 #include <time.h>
00030 #include <sys/time.h>
00031 #include <sys/times.h>
00032
00033
00034 /* Variables */
00035 extern int __io_putchar(int ch) __attribute__((weak));
00036 extern int __io_getchar(void) __attribute__((weak));
00037
00038
00039 char *__env[1] = { 0 };
00040 char **environ = __env;
00041
00042
00043 /* Functions */
00044 void initialise_monitor_handles()
00045 {
00046 }
00047
00048 int _getpid(void)
00049 {
00050     return 1;
00051 }
00052
00053 int _kill(int pid, int sig)
00054 {
00055     errno = EINVAL;
00056     return -1;
00057 }
00058
00059 void _exit (int status)
00060 {
00061     _kill(status, -1);
00062     while (1) {} /* Make sure we hang here */
00063 }
00064
00065 __attribute__((weak)) int _read(int file, char *ptr, int len)
00066 {
00067     int DataIdx;
00068
00069     for (DataIdx = 0; DataIdx < len; DataIdx++)
00070     {
00071         *ptr++ = __io_getchar();
00072     }
00073
00074     return len;
00075 }
00076
00077 __attribute__((weak)) int _write(int file, char *ptr, int len)
00078 {
00079     int DataIdx;
00080
00081     for (DataIdx = 0; DataIdx < len; DataIdx++)
00082     {
00083         __io_putchar(*ptr++);
00084     }
00085     return len;
00086 }
00087
00088 int _close(int file)
00089 {
00090     return -1;
00091 }
00092
00093
00094 int _fstat(int file, struct stat *st)
00095 {
00096     st->st_mode = S_IFCHR;
00097     return 0;
00098 }
00099
00100 int _isatty(int file)
00101 {
00102     return 1;
00103 }

```



```
00104
00105 int _lseek(int file, int ptr, int dir)
00106 {
00107     return 0;
00108 }
00109
00110 int _open(char *path, int flags, ...)
00111 {
00112     /* Pretend like we always fail */
00113     return -1;
00114 }
00115
00116 int _wait(int *status)
00117 {
00118     errno = ECHILD;
00119     return -1;
00120 }
00121
00122 int _unlink(char *name)
00123 {
00124     errno = ENOENT;
00125     return -1;
00126 }
00127
00128 int _times(struct tms *buf)
00129 {
00130     return -1;
00131 }
00132
00133 int _stat(char *file, struct stat *st)
00134 {
00135     st->st_mode = S_IFCHR;
00136     return 0;
00137 }
00138
00139 int _link(char *old, char *new)
00140 {
00141     errno = EMLINK;
00142     return -1;
00143 }
00144
00145 int _fork(void)
00146 {
00147     errno = EAGAIN;
00148     return -1;
00149 }
00150
00151 int _execve(char *name, char **argv, char **env)
00152 {
00153     errno = ENOMEM;
00154     return -1;
00155 }
```

5.47 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Src/sysmem.c File Reference

STM32CubeIDE System Memory calls file.

```
#include <errno.h>
#include <stdint.h>
```

Functions

- void * [_sbrk](#) (ptrdiff_t incr)
[_sbrk\(\)](#) allocates memory to the newlib heap and is used by malloc and others from the C library

Variables

- static uint8_t * [__sbrk_heap_end](#) = NULL

5.47.1 Detailed Description

STM32CubeIDE System Memory calls file.

Author

Generated by STM32CubeIDE

```
For more information about which C functions
need which of these lowlevel functions
please consult the newlib libc manual
```

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Definition in file [systemem.c](#).

5.47.2 Function Documentation

5.47.2.1 `_sbrk()`

```
void * _sbrk (
    ptrdiff_t incr )
```

[_sbrk\(\)](#) allocates memory to the newlib heap and is used by malloc and others from the C library

```
* #####
* # .data # .bss #          newlib heap          #          MSP stack          #
* #          #          #          #          # Reserved by _Min_Stack_Size #
* #####
* ^-- RAM start          ^-- _end          _estack, RAM end --^
*
```

This implementation starts allocating at the '_end' linker symbol The '_Min_Stack_Size' linker symbol reserves a memory for the MSP stack The implementation considers '_estack' linker symbol to be RAM end NOTE: If the MSP stack, at any point during execution, grows larger than the reserved size, please increase the '_Min_Stack_Size'.

Parameters

<i>incr</i>	Memory size
-------------	-------------

Returns

Pointer to allocated memory

Definition at line 53 of file [systemem.c](#).

5.47.3 Variable Documentation

5.47.3.1 __sbrk_heap_end

```
uint8_t* __sbrk_heap_end = NULL [static]
```

Pointer to the current high watermark of the heap usage

Definition at line 30 of file [systemem.c](#).

5.48 systemem.c

[Go to the documentation of this file.](#)

```
00001
00023 /* Includes */
00024 #include <errno.h>
00025 #include <stdint.h>
00026
00030 static uint8_t *__sbrk_heap_end = NULL;
00031
00053 void *_sbrk(ptrdiff_t incr)
00054 {
00055     extern uint8_t _end; /* Symbol defined in the linker script */
00056     extern uint8_t _estack; /* Symbol defined in the linker script */
00057     extern uint32_t _Min_Stack_Size; /* Symbol defined in the linker script */
00058     const uint32_t stack_limit = (uint32_t)&_estack - (uint32_t)&_Min_Stack_Size;
00059     const uint8_t *max_heap = (uint8_t *)stack_limit;
00060     uint8_t *prev_heap_end;
00061
00062     /* Initialize heap end at first call */
00063     if (NULL == __sbrk_heap_end)
00064     {
00065         __sbrk_heap_end = &_end;
00066     }
00067
00068     /* Protect heap from growing into the reserved MSP stack */
00069     if (__sbrk_heap_end + incr > max_heap)
00070     {
00071         errno = ENOMEM;
00072         return (void *)-1;
00073     }
00074
00075     prev_heap_end = __sbrk_heap_end;
00076     __sbrk_heap_end += incr;
00077
00078     return (void *)prev_heap_end;
00079 }
```

5.49 systemclock.c

```
00001 /*
00002  * systemclock.c
00003  *
00004  * Created on: Mar 13, 2023
00005  * Author: kerhoas
00006  */
00007
00008
00009 #include "main.h"
00010
00011 void SystemClock_Config(void)
00012 {
00013     RCC_OscInitTypeDef RCC_OscInitStruct = {};
00014     RCC_ClkInitTypeDef RCC_ClkInitStruct = {};
00015
00018     __HAL_RCC_PWR_CLK_ENABLE();
00019     __HAL_PWR_VOLTAGESCALING_CONFIG(PWR_REGULATOR_VOLTAGE_SCALE1);
00020
00024     RCC_OscInitStruct.OscillatorType = RCC_OSCILLATORTYPE_HSE;
00025     RCC_OscInitStruct.HSEState = RCC_HSE_BYPASS;
00026     RCC_OscInitStruct.PLL.PLLState = RCC_PLL_ON;
00027     RCC_OscInitStruct.PLL.PLLSource = RCC_PLLSOURCE_HSE;
```

```

00028 RCC_OscInitStruct.PLL.PLLM = 8;
00029 RCC_OscInitStruct.PLL.PLLN = 432;
00030 RCC_OscInitStruct.PLL.PLLP = RCC_PLLP_DIV6;
00031 RCC_OscInitStruct.PLL.PLLQ = 4;
00032 if (HAL_RCC_OscConfig(&RCC_OscInitStruct) != HAL_OK)
00033 {
00034     Error_Handler();
00035 }
00036
00039 RCC_ClkInitStruct.ClockType = RCC_CLOCKTYPE_HCLK|RCC_CLOCKTYPE_SYSCLK
00040                               |RCC_CLOCKTYPE_PCLK1|RCC_CLOCKTYPE_PCLK2;
00041 RCC_ClkInitStruct.SYSCLKSource = RCC_SYSCLKSOURCE_PLLCLK;
00042 RCC_ClkInitStruct.AHBCLKDivider = RCC_SYSCLK_DIV1;
00043 RCC_ClkInitStruct.APB1CLKDivider = RCC_HCLK_DIV4;
00044 RCC_ClkInitStruct.APB2CLKDivider = RCC_HCLK_DIV4;
00045
00046 if (HAL_RCC_ClockConfig(&RCC_ClkInitStruct, FLASH_LATENCY_2) != HAL_OK)
00047 {
00048     Error_Handler();
00049 }
00050 }

```

5.50 util.c

```

00001 #include "util.h"
00002
00003 //=====
00004 void num2str(char *s, unsigned int number, unsigned int base, unsigned int size, int sp)
00005 {
00006     static char hexChars[] = "0123456789ABCDEF";
00007
00008     char *p=s;
00009     unsigned int cnt;
00010     unsigned int i;
00011     char tmp;
00012
00013     // get digits
00014     do {
00015         *s+=hexChars[number % base];
00016     } while (number /= base);
00017     *s='\0';
00018
00019     // reverse string
00020     cnt=s-p;
00021     for (i=0;i<cnt/2;i++) {
00022         tmp=p[i]; p[i] = p[cnt-i-1]; p[cnt-i-1]=tmp;
00023     }
00024
00025     // add extra space
00026     if (cnt<size) {
00027         for (i=cnt;i==0;i--)
00028             {p[i+size-cnt]=p[i];}
00029         if (sp) tmp=' '; else tmp='0';
00030         for (i=0;i<size-cnt;i++) p[i]=tmp;
00031     }
00032 }
00033
00034 //=====
00035 unsigned int str2num(char *s, unsigned base)
00036 {
00037     unsigned int u=0, d;
00038     char ch=*s++;
00039     while (ch) {
00040         if ((ch>='0') && (ch<='9')) d=ch-'0';
00041         else if ((base==16) && (ch>='A') && (ch<='F')) d=ch-'A'+10;
00042         else if ((base==16) && (ch>='a') && (ch<='f')) d=ch-'a'+10;
00043         else break;
00044         u=d+base*u;
00045         ch=*s++;
00046     }
00047     return u;
00048 }
00049
00050 //=====
00051 void reverse(char *str, int len)
00052 {
00053     int i=0, j=len-1, temp;
00054     while (i<j)
00055     {
00056         temp = str[i];
00057         str[i] = str[j];
00058         str[j] = temp;
00059         i++; j--;
00060     }
00061 }

```

```

00060     }
00061 }
00062
00063 //=====
00064 int intToStr(int x, char str[], int d)
00065 {
00066     int i = 0;
00067     while (x)
00068     {
00069         str[i++] = (x%10) + '0';
00070         x = x/10;
00071     }
00072
00073     // If number of digits required is more, then
00074     // add 0s at the beginning
00075     while (i < d)
00076         str[i++] = '0';
00077
00078     reverse(str, i);
00079     str[i] = '\0';
00080     return i;
00081 }
00082 //=====
00083 void float2str( char *res, float n, int afterpoint)
00084 {
00085     // Extract integer part
00086     int ipart = (int)n;
00087
00088     // Extract floating part
00089     float fpart = n - (float)ipart;
00090
00091     // convert integer part to string
00092     int i = intToStr(ipart, res, 0);
00093
00094     // check for display option after point
00095     if (afterpoint != 0)
00096     {
00097         res[i] = '.'; // add dot
00098
00099         // Get the value of fraction part upto given no.
00100         // of points after dot. The third parameter is needed
00101         // to handle cases like 233.007
00102         fpart = fpart * (float)myPow(10.0, afterpoint);
00103
00104         intToStr((int)fpart, res + i + 1, afterpoint);
00105     }
00106 }
00107 //=====
00108 double myPow(double x, int n) {
00109     unsigned int p = abs(n);
00110     double result = 1;
00111     while(p > 0)
00112     {
00113         if(p & 1) // if bit is set
00114         {
00115             result = result * x;
00116         }
00117         p = p >> 1;
00118         x = x * x;
00119     }
00120
00121     if(n < 0)
00122     {
00123         return 1/result;
00124     }
00125     return result;
00126 }
00127
00128 //=====
00129 void flush_ch(char* ch, int ch_size)
00130 {
00131     int i=0;
00132     for (i=0 ; i<ch_size ; i++)
00133     {
00134         ch[i]=0;
00135     }
00136 }
00137 }
00138 //=====
00139
00140 int size_ch(char* ch, int ch_size_max)
00141 {
00142
00143     int i=0;
00144     for (i=0 ; i<ch_size_max ; i++)
00145     {
00146         if (ch[i]==0)

```

```

00147             break;
00148         }
00149
00150         return i;
00151     }
00152
00153 //=====

```

5.51 C:/Users/Administrator/Documents/GitHub/ENIB_Robot_Mobile_↔ Ros2/WORKSPACE_F411_uROS6/base_robot/Core/Src/VL53L0X.c File Reference

: VL53L0X API STSW-IMG005 portage Most of the functionality of this library is based on the VL53L0X API provided by ST (STSW-IMG005), and some of the explanatory comments are quoted or paraphrased from the API source code, API user manual (UM2039), and the VL53L0X datasheet.

```

#include "main.h"
#include <unistd.h>
#include <stdint.h>
#include "VL53L0X.h"
#include "drv_i2c.h"

```

Functions

- uint8_t [performSingleRefCalibration](#) (uint8_t vhw_init_byte)
- void [writeReg](#) (uint8_t reg, uint8_t value)
- void [writeReg16Bit](#) (uint8_t reg, uint16_t value)
- void [writeReg32Bit](#) (uint8_t reg, uint32_t value)
- uint8_t [readReg](#) (uint8_t reg)
- uint16_t [readReg16Bit](#) (uint8_t reg)
- uint32_t [readReg32Bit](#) (uint8_t reg)
- void [writeMulti](#) (uint8_t reg, uint8_t const *src, uint8_t count)
- void [setAddress](#) (uint8_t new_addr)
- uint8_t [getAddress](#) ()
- uint8_t [initVL53L0X](#) ()
- uint8_t [setSignalRateLimit](#) (float limit_Mcps)
- float [getSignalRateLimit](#) (void)
- uint16_t [readRangeSingleMillimeters](#) ()

Variables

- uint8_t [g_i2cAddr](#) = [ADDRESS](#)
- uint8_t [g_stopVariable](#)
- uint16_t [addr_read](#) = 0

5.51.1 Detailed Description

: VL53L0X API STSW-IMG005 portage Most of the functionality of this library is based on the VL53L0X API provided by ST (STSW-IMG005), and some of the explanatory comments are quoted or paraphrased from the API source code, API user manual (UM2039), and the VL53L0X datasheet.

Definition in file [VL53L0X.c](#).

5.51.2 Function Documentation

5.51.2.1 getAddress()

```
uint8_t getAddress (
    void )
```

Definition at line 99 of file [VL53L0X.c](#).

5.51.2.2 getSignalRateLimit()

```
float getSignalRateLimit (
    void )
```

Definition at line 325 of file [VL53L0X.c](#).

5.51.2.3 initVL53L0X()

```
uint8_t initVL53L0X ( )
```

Definition at line 111 of file [VL53L0X.c](#).

5.51.2.4 performSingleRefCalibration()

```
uint8_t performSingleRefCalibration (
    uint8_t vhw_init_byte )
```

Definition at line 365 of file [VL53L0X.c](#).

5.51.2.5 readRangeSingleMillimeters()

```
uint16_t readRangeSingleMillimeters ( )
```

Definition at line 338 of file [VL53L0X.c](#).

5.51.2.6 readReg()

```
uint8_t readReg (
    uint8_t reg )
```

Definition at line 58 of file [VL53L0X.c](#).

5.51.2.7 readReg16Bit()

```
uint16_t readReg16Bit (
    uint8_t reg )
```

Definition at line 66 of file [VL53L0X.c](#).

5.51.2.8 readReg32Bit()

```
uint32_t readReg32Bit (
    uint8_t reg )
```

Definition at line 75 of file [VL53L0X.c](#).

5.51.2.9 setAddress()

```
void setAddress (
    uint8_t new_addr )
```

Definition at line 94 of file [VL53L0X.c](#).

5.51.2.10 setSignalRateLimit()

```
uint8_t setSignalRateLimit (
    float limit_Mcps )
```

Definition at line 315 of file [VL53L0X.c](#).

5.51.2.11 writeMulti()

```
void writeMulti (
    uint8_t reg,
    uint8_t const * src,
    uint8_t count )
```

Definition at line 85 of file [VL53L0X.c](#).

5.51.2.12 writeReg()

```
void writeReg (
    uint8_t reg,
    uint8_t value )
```

Definition at line 35 of file [VL53L0X.c](#).

5.51.2.13 writeReg16Bit()

```
void writeReg16Bit (
    uint8_t reg,
    uint16_t value )
```

Definition at line 40 of file [VL53L0X.c](#).

5.51.2.14 writeReg32Bit()

```
void writeReg32Bit (
    uint8_t reg,
    uint32_t value )
```

Definition at line 48 of file [VL53L0X.c](#).

5.51.3 Variable Documentation

5.51.3.1 addr_read

```
uint16_t addr_read = 0
```

Definition at line 25 of file [VL53L0X.c](#).

5.51.3.2 g_i2cAddr

```
uint8_t g_i2cAddr = ADDRESS
```

Definition at line 22 of file [VL53L0X.c](#).

5.51.3.3 g_stopVariable

```
uint8_t g_stopVariable
```

Definition at line 23 of file [VL53L0X.c](#).

5.52 VL53L0X.c

[Go to the documentation of this file.](#)

```
00001
00010 // "${workspace_loc}/${ProjName}/Drivers/vl53l0x" into include path of c++ buider properties
00011
00012 #include "main.h"
00013 #include <unistd.h>
00014
00015 #include <stdint.h>
00016 #include "VL53L0X.h"
00017 #include "drv_i2c.h"
00018
00019 //-----
00020 // Local variables within this file (private)
00021 //-----
00022 uint8_t g_i2cAddr = ADDRESS;
00023 uint8_t g_stopVariable; // read by init and used when starting measurement; is StopVariable field of
00024 VL53L0X_DevData_t structure in API
00025
00025 uint16_t addr_read = 0;
00026
00027 //-----
00028 // Locally used functions (private)
00029 //-----
00030 uint8_t performSingleRefCalibration(uint8_t vhw_init_byte);
00031 //-----
00032 // I2C communication Functions
00033 //-----
00034 // Write an 8-bit register
00035 void writeReg(uint8_t reg, uint8_t value) {
```

```

00036     i2c1_WriteRegBuffer(g_i2cAddr, reg, &value, 1);
00037 }
00038
00039 // Write a 16-bit register
00040 void writeReg16Bit(uint8_t reg, uint16_t value){
00041     uint8_t tab[2];
00042     tab[0] = ((value >> 8));
00043     tab[1] = ((value) & 0xFF);
00044     i2c1_WriteRegBuffer(g_i2cAddr, reg, tab, 2);
00045 }
00046
00047 // Write a 32-bit register
00048 void writeReg32Bit(uint8_t reg, uint32_t value){
00049     uint8_t tab[4];
00050     tab[3] = ((value >> 24) & 0xFF);
00051     tab[2] = ((value >> 16) & 0xFF);
00052     tab[1] = ((value >> 8) & 0xFF);
00053     tab[0] = ((value) & 0xFF);
00054     i2c1_WriteRegBuffer(g_i2cAddr, reg, tab, 4);
00055 }
00056
00057 // Read an 8-bit register
00058 uint8_t readReg(uint8_t reg) {
00059     uint8_t value=0;
00060     i2c1_WriteBuffer(g_i2cAddr, &reg, 1);
00061     i2c1_ReadBuffer(g_i2cAddr|0x01, &value, 1);
00062     return value;
00063 }
00064
00065 // Read a 16-bit register
00066 uint16_t readReg16Bit(uint8_t reg) {
00067     uint8_t tab[2];
00068     i2c1_WriteBuffer(g_i2cAddr, &reg, 1);
00069     i2c1_ReadBuffer(g_i2cAddr|0x01, tab, 2);
00070     uint16_t value= ((uint16_t)tab[0] << 8) | (uint16_t)tab[1];
00071     return value;
00072 }
00073
00074 // Read a 32-bit register
00075 uint32_t readReg32Bit(uint8_t reg) {
00076     uint8_t tab[4];
00077     i2c1_WriteBuffer(g_i2cAddr, &reg, 1);
00078     i2c1_ReadBuffer(g_i2cAddr|0x01, tab, 4);
00079     uint32_t value= (tab[3] << 24) | (tab[2] << 16) | (tab[1] << 8) | tab[0];
00080     return value;
00081 }
00082
00083 // Write an arbitrary number of bytes from the given array to the sensor,
00084 // starting at the given register
00085 void writeMulti(uint8_t reg, uint8_t const *src, uint8_t count){
00086     while ( count-- > 0 ) {
00087         i2c1_WriteRegBuffer(g_i2cAddr, reg, (uint8_t *)src, 1);
00088     }
00089 }
00090
00091
00092
00093 // Public Methods //////////////////////////////////////
00094 void setAddress(uint8_t new_addr) {
00095     writeReg( I2C_SLAVE_DEVICE_ADDRESS, (new_addr<<1) & 0x7F );
00096     g_i2cAddr = new_addr;
00097 }
00098
00099 uint8_t getAddress() {
00100     return g_i2cAddr;
00101 }
00102
00103 // Initialize sensor using sequence based on VL53L0X_DataInit(),
00104 // VL53L0X_StaticInit(), and VL53L0X_PerformRefCalibration().
00105 // This function does not perform reference SPAD calibration
00106 // (VL53L0X_PerformRefSpadManagement()), since the API user manual says that it
00107 // is performed by ST on the bare modules; it seems like that should work well
00108 // enough unless a cover glass is added.
00109 // If io_2v8 (optional) is true or not given, the sensor is configured for 2V8
00110 // mode.
00111 uint8_t initVL53L0X() {
00112     // VL53L0X_DataInit() begin
00113
00114
00115     // sensor uses 1V8 mode for I/O by default; switch to 2V8 mode if necessary
00116     if (IO_2V8)
00117     {
00118         writeReg(VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV,
00119             readReg(VHV_CONFIG_PAD_SCL_SDA__EXTSUP_HV) | 0x01); // set bit 0
00120     }
00121
00122     // "Set I2C standard mode"

```

```
00123     writeReg(0x88, 0x00);
00124
00125     writeReg(0x80, 0x01);
00126     writeReg(0xFF, 0x01);
00127     writeReg(0x00, 0x00);
00128     g_stopVariable = readReg(0x91);
00129     writeReg(0x00, 0x01);
00130     writeReg(0xFF, 0x00);
00131     writeReg(0x80, 0x00);
00132
00133     // disable SIGNAL_RATE_MSRC (bit 1) and SIGNAL_RATE_PRE_RANGE (bit 4) limit checks
00134     writeReg(MSRC_CONFIG_CONTROL, readReg(MSRC_CONFIG_CONTROL) | 0x12);
00135
00136     // set final range signal rate limit to 0.25 MCPS (million counts per second)
00137     setSignalRateLimit(0.25);
00138
00139     writeReg(SYSTEM_SEQUENCE_CONFIG, 0xFF);
00140
00141     // VL53L0X_DataInit() end
00142
00143     // VL53L0X_StaticInit() begin
00144
00145     // The SPAD map (RefGoodSpadMap) is read by VL53L0X_get_info_from_device() in
00146     // the API, but the same data seems to be more easily readable from
00147     // GLOBAL_CONFIG_SPAD_ENABLEREF_0 through _6, so read it from there
00148
00149     // -- VL53L0X_set_reference_spads() begin (assume NVM values are valid)
00150
00151     writeReg(0xFF, 0x01);
00152     writeReg(DYNAMIC_SPAD_REF_EN_START_OFFSET, 0x00);
00153     writeReg(DYNAMIC_SPAD_NUM_REQUESTED_REF_SPAD, 0x2C);
00154     writeReg(0xFF, 0x00);
00155     writeReg(GLOBAL_CONFIG_REF_EN_START_SELECT, 0xB4);
00156
00157     // -- VL53L0X_set_reference_spads() end
00158
00159     // -- VL53L0X_load_tuning_settings() begin
00160     // DefaultTuningSettings from vl53l0x_tuning.h
00161
00162     writeReg(0xFF, 0x01);
00163     writeReg(0x00, 0x00);
00164
00165     writeReg(0xFF, 0x00);
00166     writeReg(0x09, 0x00);
00167     writeReg(0x10, 0x00);
00168     writeReg(0x11, 0x00);
00169
00170     writeReg(0x24, 0x01);
00171     writeReg(0x25, 0xFF);
00172     writeReg(0x75, 0x00);
00173
00174     writeReg(0xFF, 0x01);
00175     writeReg(0x4E, 0x2C);
00176     writeReg(0x48, 0x00);
00177     writeReg(0x30, 0x20);
00178
00179     writeReg(0xFF, 0x00);
00180     writeReg(0x30, 0x09);
00181     writeReg(0x54, 0x00);
00182     writeReg(0x31, 0x04);
00183     writeReg(0x32, 0x03);
00184     writeReg(0x40, 0x83);
00185     writeReg(0x46, 0x25);
00186     writeReg(0x60, 0x00);
00187     writeReg(0x27, 0x00);
00188     writeReg(0x50, 0x06);
00189     writeReg(0x51, 0x00);
00190     writeReg(0x52, 0x96);
00191     writeReg(0x56, 0x08);
00192     writeReg(0x57, 0x30);
00193     writeReg(0x61, 0x00);
00194     writeReg(0x62, 0x00);
00195     writeReg(0x64, 0x00);
00196     writeReg(0x65, 0x00);
00197     writeReg(0x66, 0xA0);
00198
00199     writeReg(0xFF, 0x01);
00200     writeReg(0x22, 0x32);
00201     writeReg(0x47, 0x14);
00202     writeReg(0x49, 0xFF);
00203     writeReg(0x4A, 0x00);
00204
00205     writeReg(0xFF, 0x00);
00206     writeReg(0x7A, 0x0A);
00207     writeReg(0x7B, 0x00);
00208     writeReg(0x78, 0x21);
```

```
00210
00211     writeReg(0xFF, 0x01);
00212     writeReg(0x23, 0x34);
00213     writeReg(0x42, 0x00);
00214     writeReg(0x44, 0xFF);
00215     writeReg(0x45, 0x26);
00216     writeReg(0x46, 0x05);
00217     writeReg(0x40, 0x40);
00218     writeReg(0x0E, 0x06);
00219     writeReg(0x20, 0x1A);
00220     writeReg(0x43, 0x40);
00221
00222     writeReg(0xFF, 0x00);
00223     writeReg(0x34, 0x03);
00224     writeReg(0x35, 0x44);
00225
00226     writeReg(0xFF, 0x01);
00227     writeReg(0x31, 0x04);
00228     writeReg(0x4B, 0x09);
00229     writeReg(0x4C, 0x05);
00230     writeReg(0x4D, 0x04);
00231
00232     writeReg(0xFF, 0x00);
00233     writeReg(0x44, 0x00);
00234     writeReg(0x45, 0x20);
00235     writeReg(0x47, 0x08);
00236     writeReg(0x48, 0x28);
00237     writeReg(0x67, 0x00);
00238     writeReg(0x70, 0x04);
00239     writeReg(0x71, 0x01);
00240     writeReg(0x72, 0xFE);
00241     writeReg(0x76, 0x00);
00242     writeReg(0x77, 0x00);
00243
00244     writeReg(0xFF, 0x01);
00245     writeReg(0x0D, 0x01);
00246
00247     writeReg(0xFF, 0x00);
00248     writeReg(0x80, 0x01);
00249     writeReg(0x01, 0xF8);
00250
00251     writeReg(0xFF, 0x01);
00252     writeReg(0x8E, 0x01);
00253     writeReg(0x00, 0x01);
00254     writeReg(0xFF, 0x00);
00255     writeReg(0x80, 0x00);
00256
00257     // -- VL53L0X_load_tuning_settings() end
00258
00259     // "Set interrupt config to new sample ready"
00260     // -- VL53L0X_SetGpioConfig() begin
00261
00262     writeReg(SYSTEM_INTERRUPT_CONFIG_GPIO, 0x04);
00263     writeReg(GPIO_HV_MUX_ACTIVE_HIGH, readReg(GPIO_HV_MUX_ACTIVE_HIGH) & ~0x10); // active low
00264     writeReg(SYSTEM_INTERRUPT_CLEAR, 0x01);
00265
00266     // -- VL53L0X_SetGpioConfig() end
00267
00268
00269
00270     // "Disable MSRC and TCC by default"
00271     // MSRC = Minimum Signal Rate Check
00272     // TCC = Target CentreCheck
00273     // -- VL53L0X_SetSequenceStepEnable() begin
00274
00275     writeReg(SYSTEM_SEQUENCE_CONFIG, 0xE8);
00276
00277     // -- VL53L0X_SetSequenceStepEnable() end
00278
00279
00280
00281     // VL53L0X_StaticInit() end
00282
00283     // VL53L0X_PerformRefCalibration() begin (VL53L0X_perform_ref_calibration())
00284
00285     // -- VL53L0X_perform_vhv_calibration() begin
00286
00287     writeReg(SYSTEM_SEQUENCE_CONFIG, 0x01);
00288     if (performSingleRefCalibration(0x40)) { return 1; }
00289
00290     // -- VL53L0X_perform_vhv_calibration() end
00291
00292     // -- VL53L0X_perform_phase_calibration() begin
00293
00294     writeReg(SYSTEM_SEQUENCE_CONFIG, 0x02);
00295     if (performSingleRefCalibration(0x00)) { return 1; }
00296
```

```

00297 // -- VL53L0X_perform_phase_calibration() end
00298
00299 // "restore the previous Sequence Config"
00300 writeReg(SYSTEM_SEQUENCE_CONFIG, 0xE8);
00301
00302 // VL53L0X_PerformRefCalibration() end
00303
00304 return 0;
00305 }
00306
00307 // Set the return signal rate limit check value in units of MCPS (mega counts
00308 // per second). "This represents the amplitude of the signal reflected from the
00309 // target and detected by the device"; setting this limit presumably determines
00310 // the minimum measurement necessary for the sensor to report a valid reading.
00311 // Setting a lower limit increases the potential range of the sensor but also
00312 // seems to increase the likelihood of getting an inaccurate reading because of
00313 // unwanted reflections from objects other than the intended target.
00314 // Defaults to 0.25 MCPS as initialized by the ST API and this library.
00315 uint8_t setSignalRateLimit(float limit_Mcps)
00316 {
00317     if (limit_Mcps < 0 || limit_Mcps > 511.99) { return false; }
00318
00319     // Q9.7 fixed point format (9 integer bits, 7 fractional bits)
00320     writeReg16Bit(FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT, limit_Mcps * (1 << 7));
00321     return 0;
00322 }
00323
00324 // Get the return signal rate limit check value in MCPS
00325 float getSignalRateLimit(void)
00326 {
00327     return (float)readReg16Bit(FINAL_RANGE_CONFIG_MIN_COUNT_RATE_RTN_LIMIT) / (1 << 7);
00328 }
00329
00330
00331
00332
00333
00334 // Performs a single-shot range measurement and returns the reading in
00335 // millimeters
00336 // based on VL53L0X_PerformSingleRangingMeasurement()
00337 // extraStats provides additional info for this measurment. Set to 0 if not needed.
00338 uint16_t readRangeSingleMillimeters( /*statInfo_t *extraStats */) {
00339     writeReg(0x80, 0x01);
00340     writeReg(0xFF, 0x01);
00341     writeReg(0x00, 0x00);
00342     writeReg(0x91, g_stopVariable);
00343     writeReg(0x00, 0x01);
00344     writeReg(0xFF, 0x00);
00345     writeReg(0x80, 0x00);
00346     writeReg(SYSRANGE_START, 0x01);
00347
00348     uint16_t temp;
00349
00350     if (ACTIVE_WHILE)
00351     {
00352         while (readReg(SYSRANGE_START) & 0x01){};
00353         while ((readReg(RESULT_INTERRUPT_STATUS) & 0x07) == 0){};
00354     }
00355     // assumptions: Linearity Corrective Gain is 1000 (default);
00356     // fractional ranging is not enabled
00357     temp = readReg16Bit(RESULT_RANGE_STATUS + 10);
00358     temp+=0;
00359
00360     return temp;
00361 }
00362
00363
00364 // based on VL53L0X_perform_single_ref_calibration()
00365 uint8_t performSingleRefCalibration(uint8_t vhw_init_byte)
00366 {
00367     writeReg(SYSRANGE_START, 0x01 | vhw_init_byte); // VL53L0X_REG_SYSRANGE_MODE_START_STOP
00368
00369     if (ACTIVE_WHILE)
00370         while ((readReg(RESULT_INTERRUPT_STATUS) & 0x07) == 0){};
00371
00372     writeReg(SYSTEM_INTERRUPT_CLEAR, 0x01);
00373
00374     writeReg(SYSRANGE_START, 0x00);
00375
00376     return 0;
00377 }

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