TP MCC - CHAPUIS & SUTRA

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Chapter 1

Module Index

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Chapter 2

File Index

2.1 File List

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Chapter 3

Module Documentation

3.1 CMSIS

Modules

- Stm32g4xx_system
- 3.1.1 Detailed Description
- 3.2 Stm32g4xx_system

Modules

- STM32G4xx_System_Private_Includes
- STM32G4xx_System_Private_TypesDefinitions
- STM32G4xx_System_Private_Defines
- STM32G4xx_System_Private_Macros
- STM32G4xx_System_Private_Variables
- STM32G4xx_System_Private_FunctionPrototypes
- STM32G4xx_System_Private_Functions

3.2.1 Detailed Description

3.3 STM32G4xx_System_Private_Includes

Macros

- #define HSE_VALUE 24000000U
- #define HSI_VALUE 16000000U

6 Module Documentation

3.3.1 Detailed Description

3.3.2 Macro Definition Documentation

3.3.2.1 HSE_VALUE

#define HSE_VALUE 24000000U

Value of the External oscillator in Hz

3.3.2.2 HSI_VALUE

#define HSI_VALUE 16000000U

Value of the Internal oscillator in Hz

- 3.4 STM32G4xx_System_Private_TypesDefinitions
- 3.5 STM32G4xx System Private Defines
- 3.6 STM32G4xx System Private Macros
- 3.7 STM32G4xx System Private Variables

Variables

- uint32 t SystemCoreClock = HSI_VALUE
- const uint8_t AHBPrescTable [16] = {0U, 0U, 0U, 0U, 0U, 0U, 0U, 0U, 1U, 2U, 3U, 4U, 6U, 7U, 8U, 9U}
- const uint8_t **APBPrescTable** [8] = {0U, 0U, 0U, 0U, 1U, 2U, 3U, 4U}
- 3.7.1 Detailed Description
- 3.8 STM32G4xx_System_Private_FunctionPrototypes
- 3.9 STM32G4xx System Private Functions

Functions

void SystemInit (void)

Setup the microcontroller system.

void SystemCoreClockUpdate (void)

Update SystemCoreClock variable according to Clock Register Values. The SystemCoreClock variable contains the core clock (HCLK), it can be used by the user application to setup the SysTick timer or configure other parameters.

3.9.1 Detailed Description

3.9.2 Function Documentation

3.9.2.1 SystemCoreClockUpdate()

```
\begin{tabular}{ll} \beg
```

Update SystemCoreClock variable according to Clock Register Values. The SystemCoreClock variable contains the core clock (HCLK), it can be used by the user application to setup the SysTick timer or configure other parameters.

Note

Each time the core clock (HCLK) changes, this function must be called to update SystemCoreClock variable value. Otherwise, any configuration based on this variable will be incorrect.

- The system frequency computed by this function is not the real frequency in the chip. It is calculated based on the predefined constant and the selected clock source:
- If SYSCLK source is HSI, SystemCoreClock will contain the HSI_VALUE(**) (p. 6)
- If SYSCLK source is HSE, SystemCoreClock will contain the HSE_VALUE(***) (p. 6)
- If SYSCLK source is PLL, SystemCoreClock will contain the **HSE_VALUE(***)** (p. 6) or **HSI_VALUE(*)** (p. 6) multiplied/divided by the PLL factors.

(**) HSI_VALUE is a constant defined in stm32g4xx_hal.h file (default value 16 MHz) but the real value may vary depending on the variations in voltage and temperature.

(***) HSE_VALUE is a constant defined in stm32g4xx_hal.h file (default value 24 MHz), user has to ensure that HSE_VALUE is same as the real frequency of the crystal used. Otherwise, this function may have wrong result.

· The result of this function could be not correct when using fractional value for HSE crystal.

Parameters

None

Return values

None

3.9.2.2 SystemInit()

void SystemInit (

8 Module Documentation

void)

Setup the microcontroller system.

Parameters

None

Return values

Chapter 4

File Documentation

4.1 main.c File Reference

: Main program body

#include "main.h"

Functions

void SystemClock Config (void)

System Clock Configuration.

void newcom (void)

This function makes the initialization for the PI controller.

• void delete (void)

This function allows us the delete letters in the shell.

void new_carac (void)

This function allows us to write a new letter in the shell.

· void get (void)

This function writes a message in the shell in the case the command is not found.

· void set (void)

This function switch on/off the led if the user writes PA5.

• void help (void)

This function displays all the usable functions for the user.

void pinout (void)

This function shows all the connections for the pinouts.

· void start (void)

This function makes the initialization for the chopper, the PWM for the motor and the initialization for the encoder.

void stop (void)

This function makes the initialization for the PI controller.

void set_speed (char *vit)

This function allows the user to set the motor speed.

void read_enc (void)

This function read the encoder value.

void read_speed (void)

This function read the value of the speed (measured by the encoder).

void set_current (char *set_cur)

This function makes the conversion for the current value for the motor and its enslavement.

• float get_current ()

This function make the measure of the current for the current enslavement.

• void data (void)

This function shows all the data needed from the motor for this project: current value, encoder value and speed value.

• void **HAL_TIM_PeriodElapsedCallback** (TIM_HandleTypeDef *htim)

The function which generate the interruptions.

• int main (void)

The application entry point.

- void HAL_UART_RxCpltCallback (UART_HandleTypeDef *huart)
- void **HAL_ADC_ConvCpltCallback** (ADC_HandleTypeDef *hadc)
- void Error_Handler (void)

This function is executed in case of error occurrence.

Variables

- · ADC_HandleTypeDef hadc1
- DMA HandleTypeDef hdma adc1
- TIM_HandleTypeDef htim1
- TIM_HandleTypeDef htim3
- TIM HandleTypeDef htim4
- UART_HandleTypeDef huart2
- uint8_t prompt [] ="user@Nucleo-STM32G474>>"
- uint8_t started []
- uint8_t **newline** [] ="\r\n"
- uint8 t cmdNotFound [] ="Command not found\r\n"
- · uint32 t uartRxReceived
- uint8 t uartRxBuffer [UART RX BUFFER SIZE]
- uint8_t uartTxBuffer [UART_TX_BUFFER_SIZE]
- uint8_t powerOn [] ="Allumage du moteur\r\n"
- uint8_t powerOff [] ="Extinction du moteur\r\n"
- uint32_t adcBuffer [ADC_BUFFER_SIZE]
- char cmdBuffer [CMD_BUFFER_SIZE]
- int idx_cmd
- char * argv [MAX_ARGS]
- int **argc** = 0
- char * token
- int newCmdReady = 0
- int **abs speed** = 50
- int adcDMAFlag = 0
- int it tim3 = 0
- int it tim1 = 0
- int **enc** = 0
- int **speed** = 0
- int **inc** = 0
- float targetcur
- char pi_buffer [256]
- PIController pi = {PI_KP, PI_KI, PI_LIM_MIN, PI_LIM_MAX, PI_LIM_MIN_INT, PI_LIM_MAX_INT, SAMPLE TIME S}

4.1 main.c File Reference

4.1.1 Detailed Description

: Main program body

Author

: Clément Chapuis & Aurélien Sutra

Date

: Date du dernier commit&push : 03/01/2023

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4.1.2 Function Documentation

4.1.2.1 data()

```
void data (
     void )
```

This function shows all the data needed from the motor for this project: current value, encoder value and speed value.

Parameters



Return values

None

4.1.2.2 delete()

```
void delete (
     void )
```

This function allows us the delete letters in the shell.

4.1 main.c File Reference

Parameters

in	None	
----	------	--

Return values

None	
------	--

4.1.2.3 Error_Handler()

This function is executed in case of error occurrence.

Return values

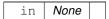


4.1.2.4 get()

```
void get (
     void )
```

This function writes a message in the shell in the case the command is not found.

Parameters



Return values



4.1.2.5 get_current()

```
float get_current ( )
```

This function make the measure of the current for the current enslavement.

Parameters

Return values

None

4.1.2.6 HAL_TIM_PeriodElapsedCallback()

```
void HAL_TIM_PeriodElapsedCallback ( {\tt TIM\_HandleTypeDef} \ * \ htim \ )
```

The function which generate the interruptions.

Parameters

in htim timer adress

Return values

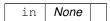
None

4.1.2.7 help()

```
void help (
     void )
```

This function displays all the usable functions for the user.

Parameters



Return values

None

4.1.2.8 main()

int main (

4.1 main.c File Reference

void)

The application entry point.

Return values

```
int
```

4.1.2.9 new_carac()

```
void new_carac (
     void )
```

This function allows us to write a new letter in the shell.

Parameters

```
in None
```

Return values

```
None
```

4.1.2.10 newcom()

```
void newcom (
     void )
```

This function makes the initialization for the PI controller.

Parameters

in	PIController	The structure for all the PI parameters
----	--------------	---

Return values

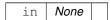
None

4.1.2.11 pinout()

```
void pinout (
     void )
```

This function shows all the connections for the pinouts.

Parameters



Return values

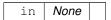
```
None
```

4.1.2.12 read_enc()

```
void read_enc (
     void )
```

This function read the encoder value.

Parameters



Return values

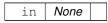
```
None
```

4.1.2.13 read_speed()

```
void read_speed (
     void )
```

This function read the value of the speed (measured by the encoder).

Parameters



Return values

4.1 main.c File Reference

4.1.2.14 set()

```
void set (
     void )
```

This function switch on/off the led if the user writes PA5.

Parameters

```
in None
```

Return values

```
None
```

4.1.2.15 set_current()

This function makes the conversion for the current value for the motor and its enslavement.

Parameters

	in set_cur	The value of current the user wants for the motor enslavement
--	------------	---

Return values

None

4.1.2.16 set_speed()

This function allows the user to set the motor speed.

Parameters

l in l	vit	The speed wanted by	the user ((0-49 in one	direction.	51-100 in the other	, 50 the motor doesn't turn)
--------	-----	---------------------	------------	--------------	------------	---------------------	------------------------------

Return values

4.1.2.17 start()

```
void start (
     void )
```

This function makes the initialization for the chopper, the PWM for the motor and the initialization for the encoder.

Parameters

Return values

```
None
```

4.1.2.18 stop()

```
void stop (
     void )
```

This function makes the initialization for the PI controller.

Parameters

```
in None
```

Return values

None

4.1.2.19 SystemClock_Config()

```
void SystemClock_Config (
     void )
```

System Clock Configuration.

Return values

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

4.1.3 Variable Documentation

4.1.3.1 started

```
uint8_t started[]
```

Initial value:

4.2 stm32g4xx hal msp.c File Reference

This file provides code for the MSP Initialization and de-Initialization codes.

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

Functions

- void HAL TIM MspPostInit (TIM HandleTypeDef *htim)
- void HAL_Msplnit (void)
- void HAL_ADC_MspInit (ADC_HandleTypeDef *hadc)

ADC MSP Initialization This function configures the hardware resources used in this example.

void HAL_ADC_MspDeInit (ADC_HandleTypeDef *hadc)

ADC MSP De-Initialization This function freeze the hardware resources used in this example.

 $\bullet \ \ \mathsf{void} \ \ \textbf{HAL_TIM_Base_MspInit} \ (\mathsf{TIM_HandleTypeDef} \ * \mathsf{htim_base})$

TIM_Base MSP Initialization This function configures the hardware resources used in this example.

void HAL_TIM_Encoder_MspInit (TIM_HandleTypeDef *htim_encoder)

TIM_Encoder MSP Initialization This function configures the hardware resources used in this example.

void HAL_TIM_Base_MspDeInit (TIM_HandleTypeDef *htim_base)

TIM_Base MSP De-Initialization This function freeze the hardware resources used in this example.

void HAL_TIM_Encoder_MspDeInit (TIM_HandleTypeDef *htim_encoder)

TIM_Encoder MSP De-Initialization This function freeze the hardware resources used in this example.

void HAL_UART_MspInit (UART HandleTypeDef *huart)

UART MSP Initialization This function configures the hardware resources used in this example.

void HAL_UART_MspDeInit (UART_HandleTypeDef *huart)

UART MSP De-Initialization This function freeze the hardware resources used in this example.

Variables

• DMA_HandleTypeDef hdma_adc1

4.2.1 Detailed Description

This file provides code for the MSP Initialization and de-Initialization codes.

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4.2.2 Function Documentation

4.2.2.1 HAL_ADC_MspDeInit()

ADC MSP De-Initialization This function freeze the hardware resources used in this example.

Parameters

hadc	ADC handle pointer

Return values

None

ADC1 GPIO Configuration PA0 ----> ADC1_IN1

4.2.2.2 HAL_ADC_MspInit()

ADC MSP Initialization This function configures the hardware resources used in this example.

Parameters

hadc	ADC handle pointer
------	--------------------

Return values

```
None
```

Initializes the peripherals clocks

ADC1 GPIO Configuration PA0 ----> ADC1_IN1

4.2.2.3 HAL MspInit()

```
void HAL_MspInit (
    void )
```

Initializes the Global MSP. Disable the internal Pull-Up in Dead Battery pins of UCPD peripheral

4.2.2.4 HAL_TIM_Base_MspDeInit()

TIM_Base MSP De-Initialization This function freeze the hardware resources used in this example.

Parameters

Return values

None

4.2.2.5 HAL_TIM_Base_MspInit()

TIM_Base MSP Initialization This function configures the hardware resources used in this example.

Parameters

htim	haaa	TIM	Dooo	bandla	pointer
TIUITI I	vase I	I IIVI	Dase	nandie	politier

Reti	11410	1/0	
Reli	ILU	va	HIPS

None	
------	--

4.2.2.6 HAL TIM Encoder MspDeInit()

TIM_Encoder MSP De-Initialization This function freeze the hardware resources used in this example.

Parameters

htim_encoder	TIM_Encoder handle pointer
--------------	----------------------------

Return values

None

TIM4 GPIO Configuration PB6 ----> TIM4_CH1 PB7 ----> TIM4_CH2

4.2.2.7 HAL_TIM_Encoder_MspInit()

TIM_Encoder MSP Initialization This function configures the hardware resources used in this example.

Parameters

htim_encoder	TIM_Encoder handle pointer
--------------	----------------------------

Return values

None

TIM4 GPIO Configuration PB6 ----> TIM4_CH1 PB7 ----> TIM4_CH2

4.2.2.8 HAL_TIM_MspPostInit()

TIM1 GPIO Configuration PA8 ----> TIM1_CH1 PA9 ----> TIM1_CH2 PA11 ----> TIM1_CH2N PA12 ----> TIM1_CH2N

4.2.2.9 HAL_UART_MspDeInit()

UART MSP De-Initialization This function freeze the hardware resources used in this example.

Parameters

huart UART handle pointer

Return values

None

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

4.2.2.10 HAL UART Msplnit()

UART MSP Initialization This function configures the hardware resources used in this example.

Parameters

huart UART handle pointer

Return values

None

Initializes the peripherals clocks

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

4.3 stm32g4xx_it.c File Reference

Interrupt Service Routines.

```
#include "main.h"
#include "stm32g4xx_it.h"
```

Functions

· void NMI_Handler (void)

This function handles Non maskable interrupt.

void HardFault_Handler (void)

This function handles Hard fault interrupt.

void MemManage_Handler (void)

This function handles Memory management fault.

void BusFault_Handler (void)

This function handles Prefetch fault, memory access fault.

void UsageFault_Handler (void)

This function handles Undefined instruction or illegal state.

void SVC_Handler (void)

This function handles System service call via SWI instruction.

void DebugMon_Handler (void)

This function handles Debug monitor.

• void PendSV_Handler (void)

This function handles Pendable request for system service.

void SysTick Handler (void)

This function handles System tick timer.

• void EXTI1_IRQHandler (void)

This function handles EXTI line1 interrupt.

void DMA1_Channel1_IRQHandler (void)

This function handles DMA1 channel1 global interrupt.

void TIM1_UP_TIM16_IRQHandler (void)

This function handles TIM1 update interrupt and TIM16 global interrupt.

void TIM3_IRQHandler (void)

This function handles TIM3 global interrupt.

void USART2 IRQHandler (void)

This function handles USART2 global interrupt / USART2 wake-up interrupt through EXTI line 26.

void EXTI15_10_IRQHandler (void)

This function handles EXTI line[15:10] interrupts.

Variables

- DMA HandleTypeDef hdma_adc1
- TIM HandleTypeDef htim1
- TIM_HandleTypeDef htim3
- UART_HandleTypeDef huart2

4.3.1 Detailed Description

Interrupt Service Routines.

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4.4 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
```

4.4.1 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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4.5 sysmem.c File Reference

STM32CubeIDE System Memory calls file.

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

Functions

```
    void * _sbrk (ptrdiff_t incr)
    _sbrk() (p. 26) allocates memory to the newlib heap and is used by malloc and others from the C library
```

4.5.1 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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4.5.2 Function Documentation

```
4.5.2.1 _sbrk()
```

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

_sbrk() (p. 26) allocates memory to the newlib heap and is used by malloc and others from the C library

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

incr Memory size

Returns

Pointer to allocated memory

4.6 system stm32g4xx.c File Reference

CMSIS Cortex-M4 Device Peripheral Access Layer System Source File.

#include "stm32g4xx.h"

Macros

- #define HSE_VALUE 24000000U
- #define HSI_VALUE 16000000U

Functions

• void SystemInit (void)

Setup the microcontroller system.

void SystemCoreClockUpdate (void)

Update SystemCoreClock variable according to Clock Register Values. The SystemCoreClock variable contains the core clock (HCLK), it can be used by the user application to setup the SysTick timer or configure other parameters.

Variables

- uint32_t SystemCoreClock = HSI_VALUE
- const uint8_t **AHBPrescTable** [16] = {0U, 0U, 0U, 0U, 0U, 0U, 0U, 0U, 1U, 2U, 3U, 4U, 6U, 7U, 8U, 9U}
- const uint8_t **APBPrescTable** [8] = {0U, 0U, 0U, 0U, 1U, 2U, 3U, 4U}

4.6.1 Detailed Description

CMSIS Cortex-M4 Device Peripheral Access Layer System Source File.

Author

MCD Application Team

This file provides two functions and one global variable to be called from user application:

- **SystemInit()** (p. 7): This function is called at startup just after reset and before branch to main program. This call is made inside the "startup_stm32g4xx.s" file.
- SystemCoreClock variable: Contains the core clock (HCLK), it can be used by the user application to setup the SysTick timer or configure other parameters.
- SystemCoreClockUpdate() (p. 7): Updates the variable SystemCoreClock and must be called whenever the core clock is changed during program execution.

After each device reset the HSI (16 MHz) is used as system clock source. Then **SystemInit()** (p. 7) function is called, in "startup_stm32g4xx.s" file, to configure the system clock before to branch to main program.

4.6.2 This file configures the system clock as follows:

```
4.6.2.1 System Clock source | HSI
4.6.2.2 SYSCLK(Hz) | 16000000
4.6.2.3 HCLK(Hz) | 16000000
4.6.2.4 AHB Prescaler | 1
4.6.2.5 APB1 Prescaler | 1
4.6.2.6 APB2 Prescaler | 1
4.6.2.7 PLL_M | 1
4.6.2.8 PLL_N | 16
4.6.2.9 PLL_P | 7
4.6.2.10 PLL_Q | 2
4.6.2.11 PLL_R | 2
4.6.2.12 Require 48MHz for RNG | Disabled
```

Attention

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