

Lab6_FreeRTOS

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Contents

1	File Index	1
1.1	File List	1
2	File Documentation	3
2.1	D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/↔ ConfigPerformance.c File Reference	3
2.1.1	Macro Definition Documentation	3
2.1.1.1	hwUNLOCK_KEY_0	3
2.1.1.2	hwUNLOCK_KEY_1	3
2.1.2	Function Documentation	4
2.1.2.1	vHardwareConfigurePerformance()	4
2.1.2.2	vHardwareUseMultiVectoredInterrupts()	4
2.2	D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/↔ ConfigPerformance.h File Reference	4
2.2.1	Function Documentation	4
2.2.1.1	vHardwareConfigurePerformance()	4
2.2.1.2	vHardwareUseMultiVectoredInterrupts()	4
2.3	D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/↔ FreeRTOSConfig.h File Reference	4
2.3.1	Macro Definition Documentation	5
2.3.1.1	configASSERT	6
2.3.1.2	configCHECK_FOR_STACK_OVERFLOW	6
2.3.1.3	configCPU_CLOCK_HZ	6
2.3.1.4	configGENERATE_RUN_TIME_STATS	6
2.3.1.5	configIDLE_SHOULD_YIELD	6

2.3.1.6	configISR_STACK_SIZE	6
2.3.1.7	configKERNEL_INTERRUPT_PRIORITY	6
2.3.1.8	configMAX_CO_ROUTINE_PRIORITIES	7
2.3.1.9	configMAX_PRIORITIES	7
2.3.1.10	configMAX_SYSCALL_INTERRUPT_PRIORITY	7
2.3.1.11	configMAX_TASK_NAME_LEN	7
2.3.1.12	configMINIMAL_STACK_SIZE	7
2.3.1.13	configPERIPHERAL_CLOCK_HZ	7
2.3.1.14	configQUEUE_REGISTRY_SIZE	7
2.3.1.15	configTICK_RATE_HZ	7
2.3.1.16	configTIMER_QUEUE_LENGTH	8
2.3.1.17	configTIMER_TASK_PRIORITY	8
2.3.1.18	configTIMER_TASK_STACK_DEPTH	8
2.3.1.19	configTOTAL_HEAP_SIZE	8
2.3.1.20	configUSE_16_BIT_TICKS	8
2.3.1.21	configUSE_APPLICATION_TASK_TAG	8
2.3.1.22	configUSE_CO_ROUTINES	8
2.3.1.23	configUSE_COUNTING_SEMAPHORES	8
2.3.1.24	configUSE_IDLE_HOOK	9
2.3.1.25	configUSE_MALLOC_FAILED_HOOK	9
2.3.1.26	configUSE_MUTEXES	9
2.3.1.27	configUSE_PORT_OPTIMISED_TASK_SELECTION	9
2.3.1.28	configUSE_PREEMPTION	9
2.3.1.29	configUSE_QUEUE_SETS	9
2.3.1.30	configUSE_RECURSIVE_MUTEXES	9
2.3.1.31	configUSE_TICK_HOOK	9
2.3.1.32	configUSE_TIMERS	10
2.3.1.33	configUSE_TRACE_FACILITY	10
2.3.1.34	INCLUDE_eTaskGetState	10
2.3.1.35	INCLUDE_uxTaskGetStackHighWaterMark	10

2.3.1.36	INCLUDE_uxTaskPriorityGet	10
2.3.1.37	INCLUDE_vTaskCleanUpResources	10
2.3.1.38	INCLUDE_vTaskDelay	10
2.3.1.39	INCLUDE_vTaskDelayUntil	10
2.3.1.40	INCLUDE_vTaskDelete	11
2.3.1.41	INCLUDE_vTaskPrioritySet	11
2.3.1.42	INCLUDE_vTaskSuspend	11
2.3.1.43	INCLUDE_xTimerPendFunctionCall	11
2.3.2	Function Documentation	11
2.3.2.1	vAssertCalled()	11
2.4	D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/main.c File Reference	11
2.4.1	Function Documentation	12
2.4.1.1	_general_exception_handler()	12
2.4.1.2	main()	12
2.4.1.3	vApplicationStackOverflowHook()	12
2.4.1.4	vApplicationTickHook()	12
2.4.1.5	vAssertCalled()	12
2.5	D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/UART.c RT.c File Reference	13
2.5.1	Function Documentation	13
2.5.1.1	UART4_init()	13
2.5.1.2	UART4_putc()	13
2.5.1.3	UART4_puts()	14
2.6	D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/UART.h RT.h File Reference	14
2.6.1	Function Documentation	14
2.6.1.1	UART4_init()	14
2.6.1.2	UART4_putc()	15
2.6.1.3	UART4_puts()	15
2.7	D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/user.c File Reference	15

2.7.1	Macro Definition Documentation	16
2.7.1.1	NELEMS	16
2.7.2	Function Documentation	16
2.7.2.1	DelayMs()	16
2.7.2.2	InitApp()	17
2.7.2.3	InitGPIO()	17
2.7.2.4	SetNum()	18
2.7.2.5	Task1()	18
2.7.2.6	Task2()	18
2.7.3	Variable Documentation	18
2.7.3.1	bulls	18
2.7.3.2	cows	19
2.7.3.3	gameEnd	19
2.7.3.4	i	19
2.7.3.5	j	19
2.7.3.6	my_mass	19
2.7.3.7	num	19
2.7.3.8	random_mass	19
2.8	D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/user.h File Reference	20
2.8.1	Macro Definition Documentation	20
2.8.1.1	BIOS_BTN1_PORT_BIT	21
2.8.1.2	BIOS_BTN2_PORT_BIT	21
2.8.1.3	BIOS_BTN3_PORT_BIT	21
2.8.1.4	BIOS_BTN4_PORT_BIT	21
2.8.1.5	BIOS_LD1_PORT_BIT	21
2.8.1.6	BIOS_LD2_PORT_BIT	21
2.8.1.7	BIOS_LD3_PORT_BIT	21
2.8.1.8	BIOS_LD4_PORT_BIT	21
2.8.1.9	BIOS_LD5_PORT_BIT	22
2.8.1.10	BIOS_LD6_PORT_BIT	22
2.8.1.11	BIOS_LD7_PORT_BIT	22
2.8.1.12	BIOS_LD8_PORT_BIT	22
2.8.1.13	BTN1_PORT_BIT	22
2.8.1.14	BTN2_PORT_BIT	22
2.8.1.15	BTN3_PORT_BIT	22
2.8.2	Function Documentation	22
2.8.2.1	DelayMs()	22
2.8.2.2	InitApp()	23
2.8.2.3	Task1()	23
2.8.2.4	Task2()	23
2.8.3	Variable Documentation	23
2.8.3.1	xMutex	23

Chapter 1

File Index

1.1 File List

Here is a list of all files with brief descriptions:

D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/ Config↵	
Performance.c	3
D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/ Config↵	
Performance.h	4
D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/ FreeRTOS↵	
SConfig.h	4
D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/ main.c . .	11
D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/ UART.c . .	13
D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/ UART.h . .	14
D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/ user.c . .	15
D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/ user.h . .	20

Chapter 2

File Documentation

2.1 D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/↵ ConfigPerformance.c File Reference

```
#include "FreeRTOS.h"  
#include "ConfigPerformance.h"
```

Macros

- `#define hwUNLOCK_KEY_0 (0xAA996655UL)`
- `#define hwUNLOCK_KEY_1 (0x556699AAUL)`

Functions

- `void vHardwareConfigurePerformance (void)`
- `void vHardwareUseMultiVectoredInterrupts (void)`

2.1.1 Macro Definition Documentation

2.1.1.1 hwUNLOCK_KEY_0

```
#define hwUNLOCK_KEY_0 ( 0xAA996655UL )
```

2.1.1.2 hwUNLOCK_KEY_1

```
#define hwUNLOCK_KEY_1 ( 0x556699AAUL )
```

2.1.2 Function Documentation

2.1.2.1 vHardwareConfigurePerformance()

```
void vHardwareConfigurePerformance (
    void )
```

2.1.2.2 vHardwareUseMultiVectoredInterrupts()

```
void vHardwareUseMultiVectoredInterrupts (
    void )
```

2.2 D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/↵ ConfigPerformance.h File Reference

Functions

- void [vHardwareConfigurePerformance](#) (void)
- void [vHardwareUseMultiVectoredInterrupts](#) (void)

2.2.1 Function Documentation

2.2.1.1 vHardwareConfigurePerformance()

```
void vHardwareConfigurePerformance (
    void )
```

2.2.1.2 vHardwareUseMultiVectoredInterrupts()

```
void vHardwareUseMultiVectoredInterrupts (
    void )
```

2.3 D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/↵ FreeRTOSConfig.h File Reference

```
#include <xc.h>
```

Macros

- #define configUSE_PREEMPTION 1
- #define configUSE_PORT_OPTIMISED_TASK_SELECTION 1
- #define configUSE_QUEUE_SETS 1
- #define configUSE_IDLE_HOOK 0
- #define configUSE_TICK_HOOK 1
- #define configTICK_RATE_HZ ((TickType_t) 1000)
- #define configCPU_CLOCK_HZ (200000000UL)
- #define configPERIPHERAL_CLOCK_HZ (40000000UL)
- #define configMAX_PRIORITIES (8UL)
- #define configMINIMAL_STACK_SIZE (190)
- #define configISR_STACK_SIZE (400)
- #define configTOTAL_HEAP_SIZE ((size_t) 60000)
- #define configMAX_TASK_NAME_LEN (16)
- #define configUSE_TRACE_FACILITY 0
- #define configUSE_16_BIT_TICKS 0
- #define configIDLE_SHOULD_YIELD 1
- #define configUSE_MUTEXES 1
- #define configCHECK_FOR_STACK_OVERFLOW 3 /* Three also checks the system/interrupt stack. */
- #define configQUEUE_REGISTRY_SIZE 0
- #define configUSE_RECURSIVE_MUTEXES 1
- #define configUSE_MALLOC_FAILED_HOOK 0
- #define configUSE_APPLICATION_TASK_TAG 0
- #define configUSE_COUNTING_SEMAPHORES 1
- #define configGENERATE_RUN_TIME_STATS 0
- #define configUSE_CO_ROUTINES 0
- #define configMAX_CO_ROUTINE_PRIORITIES (2)
- #define configUSE_TIMERS 1
- #define configTIMER_TASK_PRIORITY (2)
- #define configTIMER_QUEUE_LENGTH 5
- #define configTIMER_TASK_STACK_DEPTH (configMINIMAL_STACK_SIZE * 2)
- #define INCLUDE_vTaskPrioritySet 1
- #define INCLUDE_uxTaskPriorityGet 1
- #define INCLUDE_vTaskDelete 1
- #define INCLUDE_vTaskCleanUpResources 0
- #define INCLUDE_vTaskSuspend 1
- #define INCLUDE_vTaskDelayUntil 1
- #define INCLUDE_vTaskDelay 1
- #define INCLUDE_uxTaskGetStackHighWaterMark 1
- #define INCLUDE_eTaskGetState 1
- #define INCLUDE_xTimerPendFunctionCall 1
- #define configKERNEL_INTERRUPT_PRIORITY 0x01
- #define configMAX_SYSCALL_INTERRUPT_PRIORITY 0x03
- #define configASSERT(x) if ((x) == 0) vAssertCalled(__FILE__, __LINE__)

Functions

- void vAssertCalled (const char *pcFile, unsigned long ulLine)

2.3.1 Macro Definition Documentation

2.3.1.1 configASSERT

```
#define configASSERT(  
    x ) if( ( x ) == 0 ) vAssertCalled( __FILE__, __LINE__ )
```

2.3.1.2 configCHECK_FOR_STACK_OVERFLOW

```
#define configCHECK_FOR_STACK_OVERFLOW 3 /* Three also checks the system/interrupt stack. */
```

2.3.1.3 configCPU_CLOCK_HZ

```
#define configCPU_CLOCK_HZ ( 200000000UL )
```

2.3.1.4 configGENERATE_RUN_TIME_STATS

```
#define configGENERATE_RUN_TIME_STATS 0
```

2.3.1.5 configIDLE_SHOULD_YIELD

```
#define configIDLE_SHOULD_YIELD 1
```

2.3.1.6 configISR_STACK_SIZE

```
#define configISR_STACK_SIZE ( 400 )
```

2.3.1.7 configKERNEL_INTERRUPT_PRIORITY

```
#define configKERNEL_INTERRUPT_PRIORITY 0x01
```

2.3.1.8 configMAX_CO_ROUTINE_PRIORITIES

```
#define configMAX_CO_ROUTINE_PRIORITIES ( 2 )
```

2.3.1.9 configMAX_PRIORITIES

```
#define configMAX_PRIORITIES ( 8UL )
```

2.3.1.10 configMAX_SYSCALL_INTERRUPT_PRIORITY

```
#define configMAX_SYSCALL_INTERRUPT_PRIORITY 0x03
```

2.3.1.11 configMAX_TASK_NAME_LEN

```
#define configMAX_TASK_NAME_LEN ( 16 )
```

2.3.1.12 configMINIMAL_STACK_SIZE

```
#define configMINIMAL_STACK_SIZE ( 190 )
```

2.3.1.13 configPERIPHERAL_CLOCK_HZ

```
#define configPERIPHERAL_CLOCK_HZ ( 4000000UL )
```

2.3.1.14 configQUEUE_REGISTRY_SIZE

```
#define configQUEUE_REGISTRY_SIZE 0
```

2.3.1.15 configTICK_RATE_HZ

```
#define configTICK_RATE_HZ ( ( TickType_t ) 1000 )
```

2.3.1.16 configTIMER_QUEUE_LENGTH

```
#define configTIMER_QUEUE_LENGTH 5
```

2.3.1.17 configTIMER_TASK_PRIORITY

```
#define configTIMER_TASK_PRIORITY ( 2 )
```

2.3.1.18 configTIMER_TASK_STACK_DEPTH

```
#define configTIMER_TASK_STACK_DEPTH ( configMINIMAL_STACK_SIZE * 2 )
```

2.3.1.19 configTOTAL_HEAP_SIZE

```
#define configTOTAL_HEAP_SIZE ( ( size_t ) 60000 )
```

2.3.1.20 configUSE_16_BIT_TICKS

```
#define configUSE_16_BIT_TICKS 0
```

2.3.1.21 configUSE_APPLICATION_TASK_TAG

```
#define configUSE_APPLICATION_TASK_TAG 0
```

2.3.1.22 configUSE_CO_ROUTINES

```
#define configUSE_CO_ROUTINES 0
```

2.3.1.23 configUSE_COUNTING_SEMAPHORES

```
#define configUSE_COUNTING_SEMAPHORES 1
```

2.3.1.24 configUSE_IDLE_HOOK

```
#define configUSE_IDLE_HOOK 0
```

2.3.1.25 configUSE_MALLOC_FAILED_HOOK

```
#define configUSE_MALLOC_FAILED_HOOK 0
```

2.3.1.26 configUSE_MUTEXES

```
#define configUSE_MUTEXES 1
```

2.3.1.27 configUSE_PORT_OPTIMISED_TASK_SELECTION

```
#define configUSE_PORT_OPTIMISED_TASK_SELECTION 1
```

2.3.1.28 configUSE_PREEMPTION

```
#define configUSE_PREEMPTION 1
```

2.3.1.29 configUSE_QUEUE_SETS

```
#define configUSE_QUEUE_SETS 1
```

2.3.1.30 configUSE_RECURSIVE_MUTEXES

```
#define configUSE_RECURSIVE_MUTEXES 1
```

2.3.1.31 configUSE_TICK_HOOK

```
#define configUSE_TICK_HOOK 1
```

2.3.1.32 configUSE_TIMERS

```
#define configUSE_TIMERS 1
```

2.3.1.33 configUSE_TRACE_FACILITY

```
#define configUSE_TRACE_FACILITY 0
```

2.3.1.34 INCLUDE_eTaskGetState

```
#define INCLUDE_eTaskGetState 1
```

2.3.1.35 INCLUDE_uxTaskGetStackHighWaterMark

```
#define INCLUDE_uxTaskGetStackHighWaterMark 1
```

2.3.1.36 INCLUDE_uxTaskPriorityGet

```
#define INCLUDE_uxTaskPriorityGet 1
```

2.3.1.37 INCLUDE_vTaskCleanUpResources

```
#define INCLUDE_vTaskCleanUpResources 0
```

2.3.1.38 INCLUDE_vTaskDelay

```
#define INCLUDE_vTaskDelay 1
```

2.3.1.39 INCLUDE_vTaskDelayUntil

```
#define INCLUDE_vTaskDelayUntil 1
```

2.3.1.40 INCLUDE_vTaskDelete

```
#define INCLUDE_vTaskDelete 1
```

2.3.1.41 INCLUDE_vTaskPrioritySet

```
#define INCLUDE_vTaskPrioritySet 1
```

2.3.1.42 INCLUDE_vTaskSuspend

```
#define INCLUDE_vTaskSuspend 1
```

2.3.1.43 INCLUDE_xTimerPendFunctionCall

```
#define INCLUDE_xTimerPendFunctionCall 1
```

2.3.2 Function Documentation

2.3.2.1 vAssertCalled()

```
void vAssertCalled (
    const char * pcFile,
    unsigned long ulLine )
```

2.4 D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/main.c File Reference

```
#include "FreeRTOS.h"
#include "task.h"
#include "semphr.h"
#include "queue.h"
#include "user.h"
#include "OLED.h"
#include "OLED/OledChar.h"
#include "OLED/OledGrph.h"
#include "UART.h"
#include "ConfigPerformance.h"
```

Functions

- int [main](#) (void)
- void [vApplicationStackOverflowHook](#) (TaskHandle_t pxTask, char *pcTaskName)
- void [vApplicationTickHook](#) (void)
- void [vAssertCalled](#) (const char *pcFile, unsigned long ulLine)
- void [_general_exception_handler](#) (void)

2.4.1 Function Documentation

2.4.1.1 [_general_exception_handler\(\)](#)

```
void _general_exception_handler (  
    void )
```

2.4.1.2 [main\(\)](#)

```
int main (  
    void )
```

2.4.1.3 [vApplicationStackOverflowHook\(\)](#)

```
void vApplicationStackOverflowHook (  
    TaskHandle_t pxTask,  
    char * pcTaskName )
```

2.4.1.4 [vApplicationTickHook\(\)](#)

```
void vApplicationTickHook (  
    void )
```

2.4.1.5 [vAssertCalled\(\)](#)

```
void vAssertCalled (  
    const char * pcFile,  
    unsigned long ulLine )
```

2.5 D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/UART.c File Reference

```
#include "FreeRTOS.h"
#include "task.h"
#include "semphr.h"
#include "queue.h"
#include "UART.h"
#include <sys/attribs.h>
#include "user.h"
```

Functions

- void [UART4_init](#) (void)
- void [UART4_putc](#) (char c)
- void [UART4_puts](#) (char *s)

2.5.1 Function Documentation

2.5.1.1 UART4_init()

```
void UART4_init (
    void )
```

Function prototype:

Summary:

Description:

Precondition:

Parameters:

Returns:

Example:

Remarks:

2.5.1.2 UART4_putc()

```
void UART4_putc (
    char c )
```

2.5.1.3 UART4_puts()

```
void UART4_puts (
    char * s )
```

2.6 D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/UART.h File Reference

```
#include <xc.h>
#include "FreeRTOS.h"
#include "task.h"
#include "semphr.h"
#include "queue.h"
```

Functions

- void [UART4_init](#) (void)
- void [UART4_putc](#) (char c)
- void [UART4_puts](#) (char *s)

2.6.1 Function Documentation

2.6.1.1 UART4_init()

```
void UART4_init (
    void )
```

Function prototype:

Summary:

Description:

Precondition:

Parameters:

Returns:

Example:

Remarks:

2.6.1.2 UART4_putc()

```
void UART4_putc (
    char c )
```

2.6.1.3 UART4_puts()

```
void UART4_puts (
    char * s )
```

2.7 D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/user.c File Reference

```
#include <xc.h>
#include <stdint.h>
#include <sys/attrs.h>
#include <time.h>
#include "FreeRTOS.h"
#include "task.h"
#include "semphr.h"
#include "user.h"
#include "OLED.h"
#include "OledChar.h"
#include "OledGrph.h"
#include "UART.h"
```

Macros

- `#define NELEMS(x) (sizeof(x) / sizeof((x)[0]))`
Array length calculator.

Functions

- void `InitGPIO` (void)
This function is using for setting buttons on I/O shield.
- void `InitApp` (void)
This function is using for setting all used devices.
- int32_t `SetNum` ()
This function is using for choose a number for game.
- void `Task1` (void *pvParameters)
Game status.
- void `Task2` (void *pvParameters)
Points tatus.
- void `DelayMs` (int t)
Delay function.

Variables

- `int32_t random_mass` [4]
- `int32_t my_mass` [4]
- `int cows` = 0
- `int bulls` = 0
- `int32_t i`
- `int32_t j`
- `int32_t num`
- `int32_t gameEnd` = 0

2.7.1 Macro Definition Documentation

2.7.1.1 NELEMS

```
#define NELEMS(  
    x ) (sizeof(x) / sizeof((x)[0]))
```

Array length calculator.

Software realization of delay function, using empty for cycle

Parameters

in	<i>x</i>	type of vars into array
out	<i>length</i>	of mass

Returns

array length

2.7.2 Function Documentation

2.7.2.1 DelayMs()

```
void DelayMs (  
    int t )
```

Delay function.

This function is using for delay between operations

Parameters

in	<i>delay</i>	in ms
----	--------------	-------

Returns

NONE

2.7.2.2 InitApp()

```
void InitApp (  
    void )
```

This function is using for setting all used devices.

This function is using for setting all used devices

Parameters

NONE	
------	--

Returns

NONE

2.7.2.3 InitGPIO()

```
void InitGPIO (  
    void )
```

This function is using for setting buttons on I/O shield.

This function is using for setting all used devices

Parameters

NONE	
------	--

Returns

NONE

2.7.2.4 SetNum()

```
int32_t SetNum ( )
```

This function is using for choose a number for game.

This function is using for chhose a number for game

Parameters

out	<i>integer</i>	number from 0 to 9
-----	----------------	--------------------

Returns

integer number from 0 to 9

2.7.2.5 Task1()

```
void Task1 (
    void * pvParameters )
```

Game status.

This task is using for input user numbers or reseting the game

2.7.2.6 Task2()

```
void Task2 (
    void * pvParameters )
```

Points tatus.

This task is using for checking points status at the game

2.7.3 Variable Documentation

2.7.3.1 bulls

```
int bulls = 0
```

2.7.3.2 cows

```
int cows = 0
```

vars for bulls and cows

2.7.3.3 gameEnd

```
int32_t gameEnd = 0
```

2.7.3.4 i

```
int32_t i
```

iterators

2.7.3.5 j

```
int32_t j
```

2.7.3.6 my_mass

```
int32_t my_mass[4]
```

array for user numbers

2.7.3.7 num

```
int32_t num
```

2.7.3.8 random_mass

```
int32_t random_mass[4]
```

array for random numbers

2.8 D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6_RTOS/Lab10_Adv_Concurrency/src/user.h File Reference

```
#include "FreeRTOS.h"
#include "semphr.h"
```

Macros

- #define [BTN1_PORT_BIT](#) PORTAbits.RA3
- #define [BTN2_PORT_BIT](#) PORTDbits.RD5
Define name for BTN2 on I/O shield.
- #define [BTN3_PORT_BIT](#) PORTFbits.RF1
Define name for BTN3 on I/O shield.
- #define [BIOS_LD1_PORT_BIT](#) LATEbits.LATE0
- #define [BIOS_LD2_PORT_BIT](#) LATEbits.LATE1
- #define [BIOS_LD3_PORT_BIT](#) LATEbits.LATE2
- #define [BIOS_LD4_PORT_BIT](#) LATEbits.LATE3
- #define [BIOS_LD5_PORT_BIT](#) LATEbits.LATE4
- #define [BIOS_LD6_PORT_BIT](#) LATEbits.LATE5
- #define [BIOS_LD7_PORT_BIT](#) LATEbits.LATE6
- #define [BIOS_LD8_PORT_BIT](#) LATEbits.LATE7
- #define [BIOS_BTN1_PORT_BIT](#) PORTGbits.RG7
- #define [BIOS_BTN2_PORT_BIT](#) PORTDbits.RD5
- #define [BIOS_BTN3_PORT_BIT](#) PORTFbits.RF1
- #define [BIOS_BTN4_PORT_BIT](#) PORTAbits.RA2

Functions

- void [InitApp](#) (void)
This function is using for setting all used devices.
- void [Task1](#) (void *pvParameters)
Game status.
- void [Task2](#) (void *pvParameters)
Points tatus.
- void [DelayMs](#) (int t)
Delay function.

Variables

- SemaphoreHandle_t [xMutex](#)

2.8.1 Macro Definition Documentation

2.8.1.1 BIOS_BTN1_PORT_BIT

```
#define BIOS_BTN1_PORT_BIT PORTGbits.RG7
```

2.8.1.2 BIOS_BTN2_PORT_BIT

```
#define BIOS_BTN2_PORT_BIT PORTDbits.RD5
```

2.8.1.3 BIOS_BTN3_PORT_BIT

```
#define BIOS_BTN3_PORT_BIT PORTFbits.RF1
```

2.8.1.4 BIOS_BTN4_PORT_BIT

```
#define BIOS_BTN4_PORT_BIT PORTAbits.RA2
```

2.8.1.5 BIOS_LD1_PORT_BIT

```
#define BIOS_LD1_PORT_BIT LATEbits.LATE0
```

2.8.1.6 BIOS_LD2_PORT_BIT

```
#define BIOS_LD2_PORT_BIT LATEbits.LATE1
```

2.8.1.7 BIOS_LD3_PORT_BIT

```
#define BIOS_LD3_PORT_BIT LATEbits.LATE2
```

2.8.1.8 BIOS_LD4_PORT_BIT

```
#define BIOS_LD4_PORT_BIT LATEbits.LATE3
```

2.8.1.9 BIOS_LD5_PORT_BIT

```
#define BIOS_LD5_PORT_BIT LATEbits.LATE4
```

2.8.1.10 BIOS_LD6_PORT_BIT

```
#define BIOS_LD6_PORT_BIT LATEbits.LATE5
```

2.8.1.11 BIOS_LD7_PORT_BIT

```
#define BIOS_LD7_PORT_BIT LATEbits.LATE6
```

2.8.1.12 BIOS_LD8_PORT_BIT

```
#define BIOS_LD8_PORT_BIT LATEbits.LATE7
```

2.8.1.13 BTN1_PORT_BIT

```
#define BTN1_PORT_BIT PORTAbits.RA3
```

2.8.1.14 BTN2_PORT_BIT

```
#define BTN2_PORT_BIT PORTDbits.RD5
```

Define name for BTN2 on I/O shield.

2.8.1.15 BTN3_PORT_BIT

```
#define BTN3_PORT_BIT PORTFbits.RF1
```

Define name for BTN3 on I/O shield.

2.8.2 Function Documentation

2.8.2.1 DelayMs()

```
void DelayMs (  
    int t )
```

Delay function.

This function is using for delay between operations

Parameters

in	<i>delay</i>	in ms
----	--------------	-------

Returns

NONE

2.8.2.2 InitApp()

```
void InitApp (
    void )
```

This function is using for setting all used devices.

This function is using for setting all used devices

Parameters

NONE	
------	--

Returns

NONE

2.8.2.3 Task1()

```
void Task1 (
    void * pvParameters )
```

Game status.

This task is using for input user numbers or reseting the game

2.8.2.4 Task2()

```
void Task2 (
    void * pvParameters )
```

Points tatus.

This task is using for checking points status at the game

2.8.3 Variable Documentation

2.8.3.1 xMutex

```
SemaphoreHandle_t xMutex
```


Index

- `_general_exception_handler`
 - `main.c`, [12](#)
- `BIOS_BTN1_PORT_BIT`
 - `user.h`, [20](#)
- `BIOS_BTN2_PORT_BIT`
 - `user.h`, [21](#)
- `BIOS_BTN3_PORT_BIT`
 - `user.h`, [21](#)
- `BIOS_BTN4_PORT_BIT`
 - `user.h`, [21](#)
- `BIOS_LD1_PORT_BIT`
 - `user.h`, [21](#)
- `BIOS_LD2_PORT_BIT`
 - `user.h`, [21](#)
- `BIOS_LD3_PORT_BIT`
 - `user.h`, [21](#)
- `BIOS_LD4_PORT_BIT`
 - `user.h`, [21](#)
- `BIOS_LD5_PORT_BIT`
 - `user.h`, [21](#)
- `BIOS_LD6_PORT_BIT`
 - `user.h`, [22](#)
- `BIOS_LD7_PORT_BIT`
 - `user.h`, [22](#)
- `BIOS_LD8_PORT_BIT`
 - `user.h`, [22](#)
- `BTN1_PORT_BIT`
 - `user.h`, [22](#)
- `BTN2_PORT_BIT`
 - `user.h`, [22](#)
- `BTN3_PORT_BIT`
 - `user.h`, [22](#)
- `bulls`
 - `user.c`, [18](#)
- `configASSERT`
 - `FreeRTOSConfig.h`, [5](#)
- `configCHECK_FOR_STACK_OVERFLOW`
 - `FreeRTOSConfig.h`, [6](#)
- `configCPU_CLOCK_HZ`
 - `FreeRTOSConfig.h`, [6](#)
- `configGENERATE_RUN_TIME_STATS`
 - `FreeRTOSConfig.h`, [6](#)
- `configIDLE_SHOULD_YIELD`
 - `FreeRTOSConfig.h`, [6](#)
- `configISR_STACK_SIZE`
 - `FreeRTOSConfig.h`, [6](#)
- `configKERNEL_INTERRUPT_PRIORITY`
 - `FreeRTOSConfig.h`, [6](#)
- `configMAX_CO_ROUTINE_PRIORITIES`
 - `FreeRTOSConfig.h`, [6](#)
- `configMAX_PRIORITIES`
 - `FreeRTOSConfig.h`, [7](#)
- `configMAX_SYSCALL_INTERRUPT_PRIORITY`
 - `FreeRTOSConfig.h`, [7](#)
- `configMAX_TASK_NAME_LEN`
 - `FreeRTOSConfig.h`, [7](#)
- `configMINIMAL_STACK_SIZE`
 - `FreeRTOSConfig.h`, [7](#)
- `configPERIPHERAL_CLOCK_HZ`
 - `FreeRTOSConfig.h`, [7](#)
- `ConfigPerformance.c`
 - `hwUNLOCK_KEY_0`, [3](#)
 - `hwUNLOCK_KEY_1`, [3](#)
 - `vHardwareConfigurePerformance`, [4](#)
 - `vHardwareUseMultiVectoredInterrupts`, [4](#)
- `ConfigPerformance.h`
 - `vHardwareConfigurePerformance`, [4](#)
 - `vHardwareUseMultiVectoredInterrupts`, [4](#)
- `configQUEUE_REGISTRY_SIZE`
 - `FreeRTOSConfig.h`, [7](#)
- `configTICK_RATE_HZ`
 - `FreeRTOSConfig.h`, [7](#)
- `configTIMER_QUEUE_LENGTH`
 - `FreeRTOSConfig.h`, [7](#)
- `configTIMER_TASK_PRIORITY`
 - `FreeRTOSConfig.h`, [8](#)
- `configTIMER_TASK_STACK_DEPTH`
 - `FreeRTOSConfig.h`, [8](#)
- `configTOTAL_HEAP_SIZE`
 - `FreeRTOSConfig.h`, [8](#)
- `configUSE_16_BIT_TICKS`
 - `FreeRTOSConfig.h`, [8](#)
- `configUSE_APPLICATION_TASK_TAG`
 - `FreeRTOSConfig.h`, [8](#)
- `configUSE_CO_ROUTINES`
 - `FreeRTOSConfig.h`, [8](#)
- `configUSE_COUNTING_SEMAPHORES`
 - `FreeRTOSConfig.h`, [8](#)
- `configUSE_IDLE_HOOK`
 - `FreeRTOSConfig.h`, [8](#)
- `configUSE_MALLOC_FAILED_HOOK`
 - `FreeRTOSConfig.h`, [9](#)
- `configUSE_MUTEXES`
 - `FreeRTOSConfig.h`, [9](#)
- `configUSE_PORT_OPTIMISED_TASK_SELECTION`
 - `FreeRTOSConfig.h`, [9](#)
- `configUSE_PREEMPTION`

- FreeRTOSConfig.h, 9
- configUSE_QUEUE_SETS
 - FreeRTOSConfig.h, 9
- configUSE_RECURSIVE_MUTEXES
 - FreeRTOSConfig.h, 9
- configUSE_TICK_HOOK
 - FreeRTOSConfig.h, 9
- configUSE_TIMERS
 - FreeRTOSConfig.h, 9
- configUSE_TRACE_FACILITY
 - FreeRTOSConfig.h, 10
- cows
 - user.c, 18
- D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6↔
 - _RTOS/Lab10_Adv_Concurrency/src/↔
 - ConfigPerformance.c, 3
- D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6↔
 - _RTOS/Lab10_Adv_Concurrency/src/↔
 - ConfigPerformance.h, 4
- D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6↔
 - _RTOS/Lab10_Adv_Concurrency/src/Free↔
 - RTOSConfig.h, 4
- D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6↔
 - _RTOS/Lab10_Adv_Concurrency/src/UAR↔
 - T.c, 13
- D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6↔
 - _RTOS/Lab10_Adv_Concurrency/src/UAR↔
 - T.h, 14
- D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6↔
 - _RTOS/Lab10_Adv_Concurrency/src/main.c, 11
- D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6↔
 - _RTOS/Lab10_Adv_Concurrency/src/user.c, 15
- D:/KPI/pic32/TheConnectedMCU_Labs/nhutsenko/lab6↔
 - _RTOS/Lab10_Adv_Concurrency/src/user.h, 20
- DelayMs
 - user.c, 16
 - user.h, 22
- FreeRTOSConfig.h
 - configASSERT, 5
 - configCHECK_FOR_STACK_OVERFLOW, 6
 - configCPU_CLOCK_HZ, 6
 - configGENERATE_RUN_TIME_STATS, 6
 - configIDLE_SHOULD_YIELD, 6
 - configISR_STACK_SIZE, 6
 - configKERNEL_INTERRUPT_PRIORITY, 6
 - configMAX_CO_ROUTINE_PRIORITIES, 6
 - configMAX_PRIORITIES, 7
 - configMAX_SYSCALL_INTERRUPT_PRIORITY, 7
 - configMAX_TASK_NAME_LEN, 7
 - configMINIMAL_STACK_SIZE, 7
 - configPERIPHERAL_CLOCK_HZ, 7
 - configQUEUE_REGISTRY_SIZE, 7
 - configTICK_RATE_HZ, 7
 - configTIMER_QUEUE_LENGTH, 7
 - configTIMER_TASK_PRIORITY, 8
 - configTIMER_TASK_STACK_DEPTH, 8
 - configTOTAL_HEAP_SIZE, 8
 - configUSE_16_BIT_TICKS, 8
 - configUSE_APPLICATION_TASK_TAG, 8
 - configUSE_CO_ROUTINES, 8
 - configUSE_COUNTING_SEMAPHORES, 8
 - configUSE_IDLE_HOOK, 8
 - configUSE_MALLOC_FAILED_HOOK, 9
 - configUSE_MUTEXES, 9
 - configUSE_PORT_OPTIMISED_TASK_SELECTION, 9
 - configUSE_PREEMPTION, 9
 - configUSE_QUEUE_SETS, 9
 - configUSE_RECURSIVE_MUTEXES, 9
 - configUSE_TICK_HOOK, 9
 - configUSE_TIMERS, 9
 - configUSE_TRACE_FACILITY, 10
 - INCLUDE_eTaskGetState, 10
 - INCLUDE_uxTaskGetStackHighWaterMark, 10
 - INCLUDE_uxTaskPriorityGet, 10
 - INCLUDE_vTaskCleanUpResources, 10
 - INCLUDE_vTaskDelay, 10
 - INCLUDE_vTaskDelayUntil, 10
 - INCLUDE_vTaskDelete, 10
 - INCLUDE_vTaskPrioritySet, 11
 - INCLUDE_vTaskSuspend, 11
 - INCLUDE_xTimerPendFunctionCall, 11
 - vAssertCalled, 11
- gameEnd
 - user.c, 19
- hwUNLOCK_KEY_0
 - ConfigPerformance.c, 3
- hwUNLOCK_KEY_1
 - ConfigPerformance.c, 3
- i
 - user.c, 19
 - INCLUDE_eTaskGetState
 - FreeRTOSConfig.h, 10
 - INCLUDE_uxTaskGetStackHighWaterMark
 - FreeRTOSConfig.h, 10
 - INCLUDE_uxTaskPriorityGet
 - FreeRTOSConfig.h, 10
 - INCLUDE_vTaskCleanUpResources
 - FreeRTOSConfig.h, 10
 - INCLUDE_vTaskDelay
 - FreeRTOSConfig.h, 10
 - INCLUDE_vTaskDelayUntil
 - FreeRTOSConfig.h, 10
 - INCLUDE_vTaskDelete
 - FreeRTOSConfig.h, 10
 - INCLUDE_vTaskPrioritySet
 - FreeRTOSConfig.h, 11
 - INCLUDE_vTaskSuspend
 - FreeRTOSConfig.h, 11
 - INCLUDE_xTimerPendFunctionCall

- FreeRTOSConfig.h, 11
- InitApp
 - user.c, 17
 - user.h, 23
- InitGPIO
 - user.c, 17
- j
 - user.c, 19
- main
 - main.c, 12
- main.c
 - _general_exception_handler, 12
 - main, 12
 - vApplicationStackOverflowHook, 12
 - vApplicationTickHook, 12
 - vAssertCalled, 12
- my_mass
 - user.c, 19
- NELEMS
 - user.c, 16
- num
 - user.c, 19
- random_mass
 - user.c, 19
- SetNum
 - user.c, 17
- Task1
 - user.c, 18
 - user.h, 23
- Task2
 - user.c, 18
 - user.h, 23
- UART.c
 - UART4_init, 13
 - UART4_putc, 13
 - UART4_puts, 13
- UART.h
 - UART4_init, 14
 - UART4_putc, 14
 - UART4_puts, 15
- UART4_init
 - UART.c, 13
 - UART.h, 14
- UART4_putc
 - UART.c, 13
 - UART.h, 14
- UART4_puts
 - UART.c, 13
 - UART.h, 15
- user.c
 - bulls, 18
 - cows, 18
 - DelayMs, 16
 - gameEnd, 19
 - i, 19
 - InitApp, 17
 - InitGPIO, 17
 - j, 19
 - my_mass, 19
 - NELEMS, 16
 - num, 19
 - random_mass, 19
 - SetNum, 17
 - Task1, 18
 - Task2, 18
- user.h
 - BIOS_BTN1_PORT_BIT, 20
 - BIOS_BTN2_PORT_BIT, 21
 - BIOS_BTN3_PORT_BIT, 21
 - BIOS_BTN4_PORT_BIT, 21
 - BIOS_LD1_PORT_BIT, 21
 - BIOS_LD2_PORT_BIT, 21
 - BIOS_LD3_PORT_BIT, 21
 - BIOS_LD4_PORT_BIT, 21
 - BIOS_LD5_PORT_BIT, 21
 - BIOS_LD6_PORT_BIT, 22
 - BIOS_LD7_PORT_BIT, 22
 - BIOS_LD8_PORT_BIT, 22
 - BTN1_PORT_BIT, 22
 - BTN2_PORT_BIT, 22
 - BTN3_PORT_BIT, 22
 - DelayMs, 22
 - InitApp, 23
 - Task1, 23
 - Task2, 23
 - xMutex, 23
- vApplicationStackOverflowHook
 - main.c, 12
- vApplicationTickHook
 - main.c, 12
- vAssertCalled
 - FreeRTOSConfig.h, 11
 - main.c, 12
- vHardwareConfigurePerformance
 - ConfigPerformance.c, 4
 - ConfigPerformance.h, 4
- vHardwareUseMultiVectoredInterrupts
 - ConfigPerformance.c, 4
 - ConfigPerformance.h, 4
- xMutex
 - user.h, 23