Thực Hành Lập Trình Nhúng Căn Bản
Báo Cáo Lab01

Thành viên Nhóm:
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Tìm hiểu gói Board Support Package (BSP) của Nuvoton cho NUC140. Trình bày tổ chức BSP

```
NUC140BSP
+---CMSIS
|   +---CM0
|   |   +---CoreSupport
|   |   \---DeviceSupport
|   |       \---Nuvoton
|   |           \---NUC1xx
|   |               \---startup
|   |                   +---arm
|   |                   \---iar
|   \---Documentation
+---Doc
\---NuvotonPlatform_Keil
    +---Include
    |   +---Driver
    |   +---NUC1xx-LB_002
    |   +---System
    |   \---USB
    +---Lib
    |   +---libadpcm
    |   \---librf-dongle
    +---Sample
    |   +---Driver
    |   |   +---Smpl_DrvACMP
    |   |   +---Smpl_DrvADC
    |   |   +---Smpl_DrvCAN
    |   |   +---Smpl_DrvEBI
    |   |   +---Smpl_DrvFMC
    |   |   +---Smpl_DrvGPIO
    |   |   +---Smpl_DrvI2C
    |   |   +---Smpl_DrvI2S
    |   |   +---Smpl_DrvPDMA
```

```
|   |   +---Smpl_DrvPS2
|   |   +---Smpl_DrvPWM
|   |   +---Smpl_DrvRTC
|   |   +---Smpl_DrvSPI
|   |   +---Smpl_DrvSYS
|   |   +---Smpl_DrvTIMER
|   |   \---Smpl_DrvUART
|   +---EduProjCode
|   |   +---proj_ElectronicSafe
|   |   +---proj_LCD_Animation_Stickman1
|   |   +---proj_LCD_Animation_Stickman2
|   |   +---proj_LCD_Game_Invader
|   |   +---proj_LEDCube
|   |   +---proj_PlantCare
|   |   +---proj_RoboCar
|   |   +---proj_USB_Gamepad
|   |   \---proj_VacuumCleaner
|   +---EduSampleCode
|   |   +---Smpl_7seg
|   |   +---Smpl_7seg_ADC7
|   |   +---Smpl_7seg_Keypad
|   |   +---Smpl_ADC_Joystick
|   |   +---Smpl_ADC_PWM
|   |   +---Smpl_ADC_Thermistor
|   |   +---Smpl_ADC_TouchPanel
|   |   +---Smpl_ADC_VR1
|   |   +---Smpl_CAN
|   |   +---Smpl_CAN_ADC7
|   |   +---Smpl_CAN_Keypad
|   |   +---Smpl_CAN_Timer
|   |   +---Smpl_GPIO_BodyInfrared
|   |   +---Smpl_GPIO_Buzzer
|   |   +---Smpl_GPIO_DCMotor
|   |   +---Smpl_GPIO_EXTINT
|   |   +---Smpl_GPIO_Interrupt
|   |   +---Smpl_GPIO_IRdetector
|   |   +---Smpl_GPIO_Keypad
|   |   +---Smpl_GPIO_LCM16x2
|   |   +---Smpl_GPIO_LCM20x2
|   |   +---Smpl_GPIO_LCM8x2
|   |   +---Smpl_GPIO_LED1
|   |   +---Smpl_GPIO_LED16x16
|   |   +---Smpl_GPIO_LED1_macro
|   |   +---Smpl_GPIO_LED4
```

```
|   |   +---Smpl_GPIO_LED4_macro
|   |   +---Smpl_GPIO_LED8x8_MAX7219
|   |   +---Smpl_GPIO_QC12864B
|   |   +---Smpl_GPIO_RGBled
|   |   +---Smpl_GPIO_StepMotor_12V_17HS5604
|   |   +---Smpl_GPIO_StepMotor_5V_28BYJ-48
|   |   +---Smpl_I2C_ADXL345
|   |   +---Smpl_I2C_L3G4200D
|   |   +---Smpl_I2C_MMA7455
|   |   +---Smpl_I2C_MPU6050_acc
|   |   +---Smpl_I2C_MPU6050_angle
|   |   +---Smpl_I2C_MPU6050_gyro
|   |   +---Smpl_I2C_MPU6050_tilt
|   |   +---Smpl_I2C_TMP100
|   |   +---Smpl_LCD_Animation
|   |   +---Smpl_LCD_Bmp
|   |   +---Smpl_LCD_Cartoon
|   |   +---Smpl_LCD_Game_Invader
|   |   +---Smpl_LCD_Graphics
|   |   +---Smpl_LCD_Keypad
|   |   +---Smpl_LCD_PingPong
|   |   +---Smpl_LCD_Text
|   |   +---Smpl_LCD_TIMER0
|   |   +---Smpl_PWM_Capture
|   |   +---Smpl_PWM_DCservo_SG5010
|   |   +---Smpl_PWM_DCservo_SG5010_Keypad
|   |   +---Smpl_PWM_DCservo_X3109_Keypad
|   |   +---Smpl_PWM_DeadZone
|   |   +---Smpl_PWM_Music
|   |   +---Smpl_PWM_Tone_Keypad
|   |   +---Smpl_PWM_Tone_stereo
|   |   +---Smpl_RTC
|   |   +---Smpl_SDCard_ADC7
|   |   |   \---ff8
|   |   |       +---doc
|   |   |       |   +---en
|   |   |       |   +---img
|   |   |       |   \---ja
|   |   |       \---src
|   |   |           \---option
|   |   +---Smpl_SDcard_ADPCM
|   |   |   \---ff8
|   |   |       +---doc
|   |   |       |   +---en
```

```
|   |   |       |   +---img
|   |   |       |   \---ja
|   |   |       \---src
|   |   |           \---option
|   |   +---Smpl_SPI_QC12864B
|   |   +---Smpl_Timer_Counter
|   |   +---Smpl_Timer_LCD
|   |   +---Smpl_Timer_LED
|   |   +---Smpl_Timer_SR04
|   |   +---Smpl_Timer_SR04x2
|   |   +---Smpl_Timer_WDT_RTC
|   |   +---Smpl_UART0
|   |   +---Smpl_UART0_HC05
|   |   +---Smpl_UART0_RFID
|   |   +---Smpl_UART0_SRF04
|   |   +---Smpl_UART_HC05_US100
|   |   +---Smpl_USB_Keyboard
|   |   +---Smpl_USB_Mouse
|   |   +---Smpl_VCOM_UART0
|   |   |   \---Windows Driver
|   |   +---Smpl_VCOM_UART1
|   |   \---Smpl_WDT
|   +---NUC1xx-LB_002
|   |   +---Smpl_ADC_PWM
|   |   +---Smpl_Capture
|   |   +---Smpl_CDROM_HID
|   |   |   \---Software GUI
|   |   |       +---HID AP
|   |   |       |   \---res
|   |   |       \---Release
|   |   +---Smpl_FATFS_SDCard
|   |   |   \---ff8
|   |   |       +---doc
|   |   |       |   +---en
|   |   |       |   +---img
|   |   |       |   \---ja
|   |   |       \---src
|   |   |           \---option
|   |   +---Smpl_FMC
|   |   +---Smpl_HID_FILE_IO
|   |   |   \---Software GUI
|   |   |       +---HID AP
|   |   |       |   \---res
|   |   |       \---Release
```

```
|  |  +---Smpl_HID_IO
|  |  |  \---Software GUI
|  |  |      \---HID AP
|  |  |          \---res
|  |  +---Smpl_I2C_24LC64
|  |  +---Smpl_Interrupt
|  |  +---Smpl_LIN_Master
|  |  +---Smpl_LIN_Slave
|  |  +---Smpl_NAU7802
|  |  +---Smpl_SPI_Flashx2
|  |  +---Smpl_SPI_Flash_PDMA
|  |  +---Smpl_Start_Kit
|  |  +---Smpl_Timer_WDT_RTC
|  |  +---Smpl_UAC
|  |  +---Smpl_UDC_SDCard
|  |  +---Smpl_VCOM_IO
|  |  |  \---Windows Driver
|  |  \---Smpl_VCOM_USB2UART
|  \---USB
|      +---Smpl_HID
|      +---Smpl_HIDTransfer
|      |  \---WindowsTool
|      |      +---debug
|      |      \---HIDTransferTest
|      +---Smpl_UAC
|      +---Smpl_UAC_HID
|      +---Smpl_UDC
|      +---Smpl_UVC
|      \---Smpl_VCOM
|          \---Windows Driver
\---Src
    +---Driver
    +---NUC1xx-LB_002
    \---USB
```

Thực hiện chạy chương trình blinky mẫu trong BSP. Thực hiện các bước chọn xung clock 22Mhz, 32Khz cho CPUCLK và trình bày sự thay đổi.

```
void Init_LED() // Initialize GPIO pins
{
        DrvGPIO_Open(E_GPC, 12, E_IO_OUTPUT); // GPC12 pin set to output mode
        DrvGPIO_SetBit(E_GPC, 12);          // Goutput Hi to turn off LED
}
```

➔ Hàm này ta thực hiện chọn chân GPIO C 12 để làm chân xuất tín hiệu. Vì chân 12 tích cực cạnh xuống nên phải cho giá trị của nó là 1 để tắt LED.

```
void delay_mili(uint32_t x)
{
	uint32_t count;
	while(count < x)
	{
		count++;
	}
}
```

➔ Hàm delay. Truyền một giá trị vào thì nó sẽ delay theo mili giây tương ứng

DrvSYS_SetOscCtrl(E_SYS_XTL32K,1); //This function is used to enable/disable internal oscillator or external crystal

DrvSYS_SelectHCLKSource(1);

➔ Chọn xung clock cho MCU. Nếu muốn tăng xung clock lên 22MHz thì sửa E_SYS_XTL32K thành E_SYS_XTL22MHZ và 1->7

```
while(DrvSYS_GetChipClockSourceStatus(E_SYS_XTL32K)  != 1); //check E_SYS_XTL32K
                    // 12MHz crystal input, PLL output 48MHz
```

➔ Kiểm tra xem Xung Clock đã sẵn sàng hoạt động chưa.

```
while (1)                                   // forever loop to keep flashing four LEDs one at a time
	{
	DrvGPIO_ClrBit(E_GPC, 12); // output Low to turn on LED
	delay_mili(100000);	// delay
	DrvGPIO_SetBit(E_GPC, 12); // output Hi to turn off LED
	delay_mili(100000);	// delay
	}
```

➔ Bật và tắt LED. Giữa mỗi hàm bật, tắt LED ta chèn thêm một hàm delay ở giữa để duy trì trạng thái của nó.

So sánh sự khác biệt:

Khi thay đổi clock ở giá trị 32Khz với 22Mhz thì có sự thay đổi của chu kì chóp tắt led. Cụ thể là 22Mhz chóp tắt nhanh hơn vì chu kì của mỗi lệnh ngắn hơn.