NuMaker Brick

Chris Hsieh

www.nuvoton.com

June 2016

大綱

- 系統介紹
- 新增裝置

系統介紹

使用說明
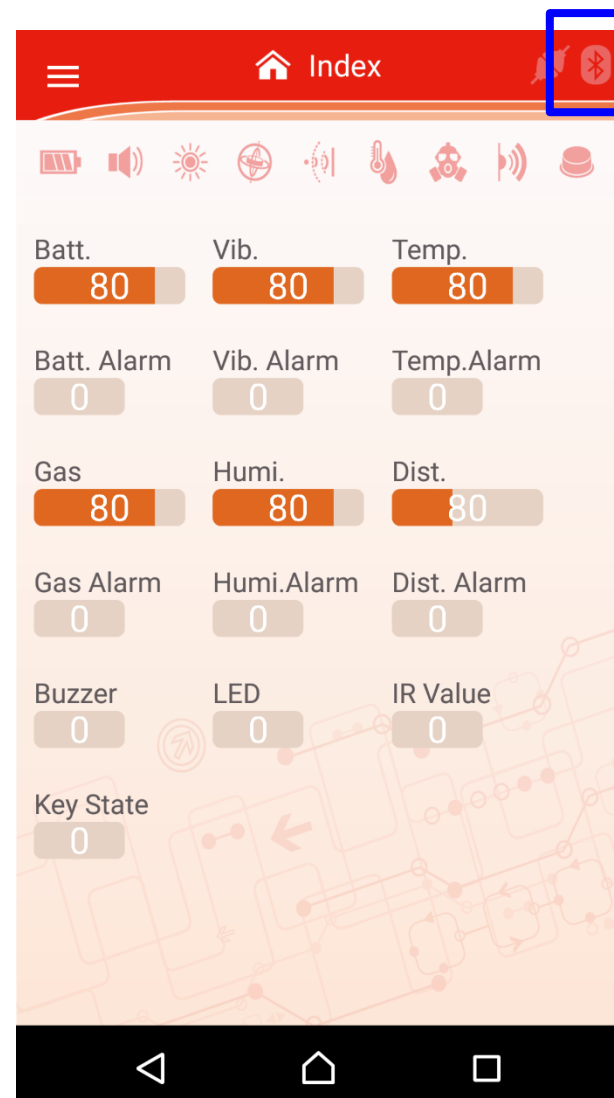
各模組程式

通訊架構(I2C, TID)
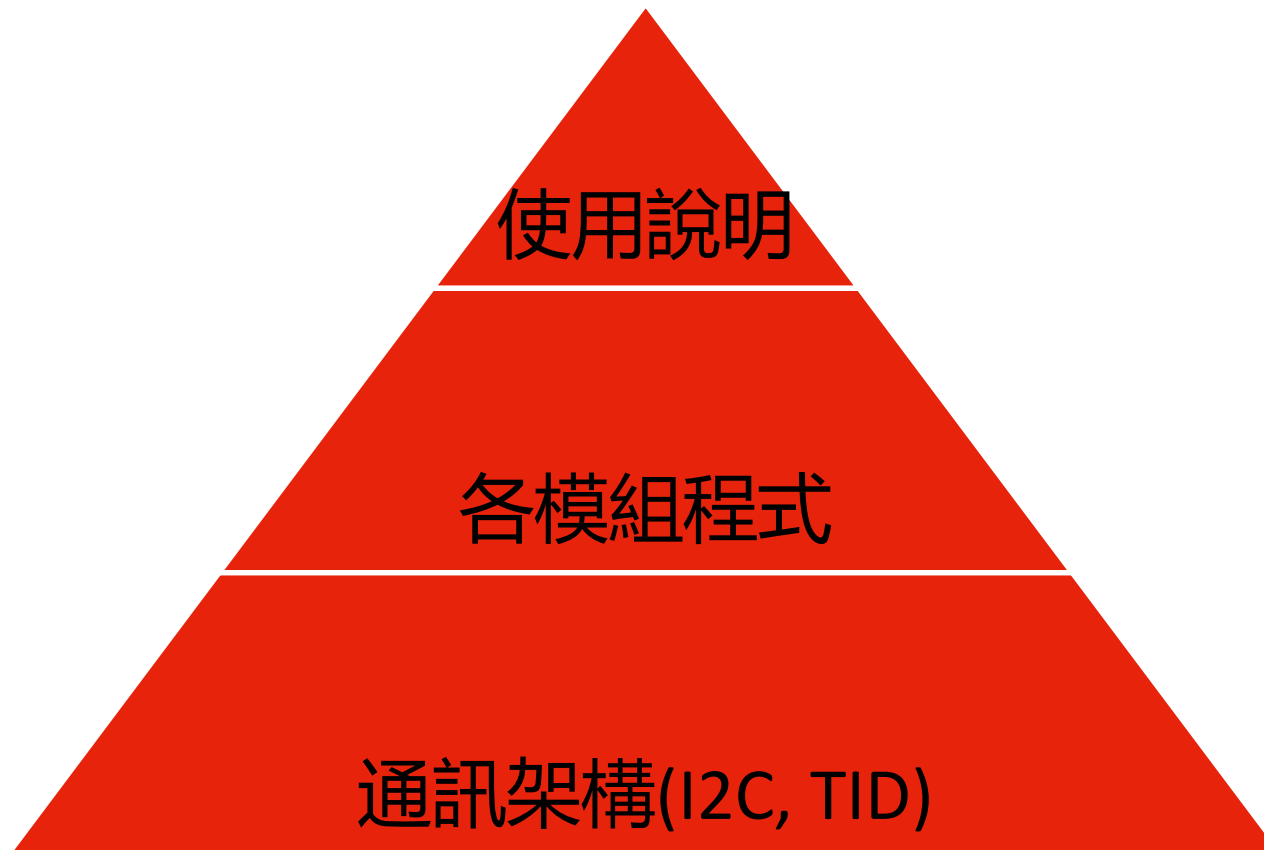
NuMaker Brick平台架構

使用說明

- 手機APP
  - 藍芽連線
  - 模組操作
  - 裝置連接

使用說明 - 手機APP

- 藍芽連線

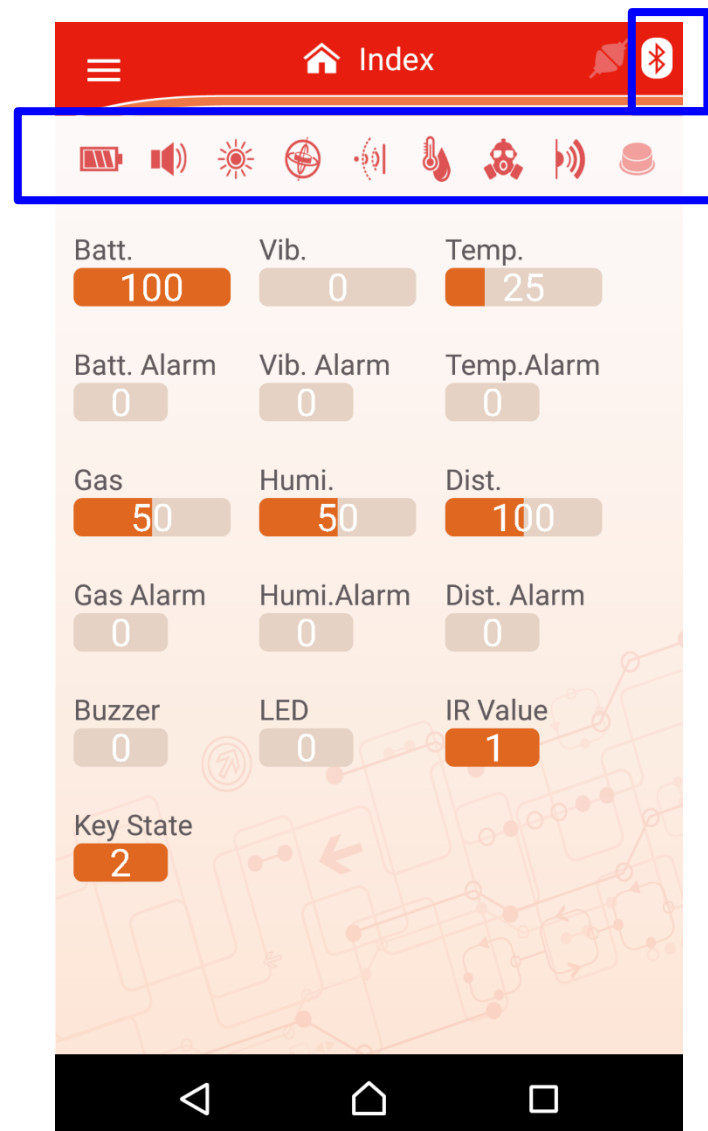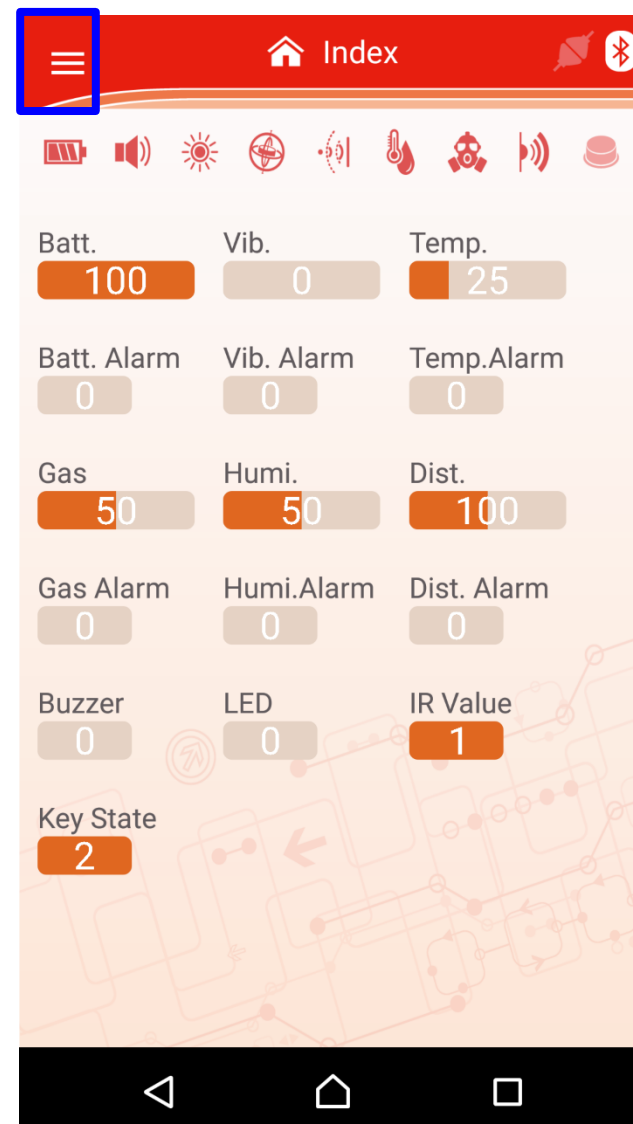# 使用說明 - 手機APP

- 藍芽連線

使用說明 - 手機APP

- 藍芽連線

使用說明 - 手機APP

- 模組操作

使用說明 - 手機APP

- 模組操作

使用說明 - 手機APP

- 模組操作

使用說明 - 手機APP

- 裝置連接

系統介紹

使用說明

各模組程式

通訊架構(I2C, TID)
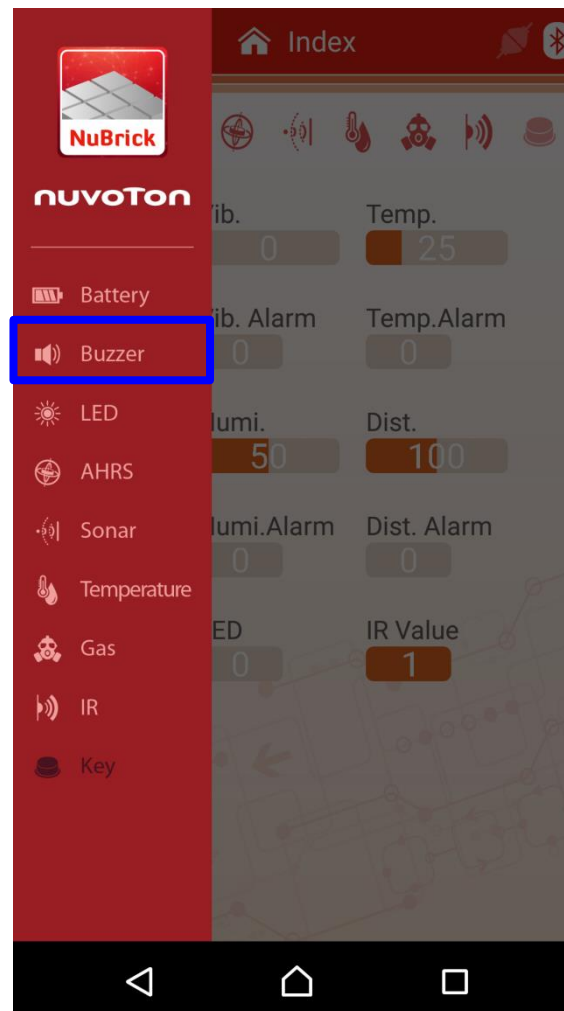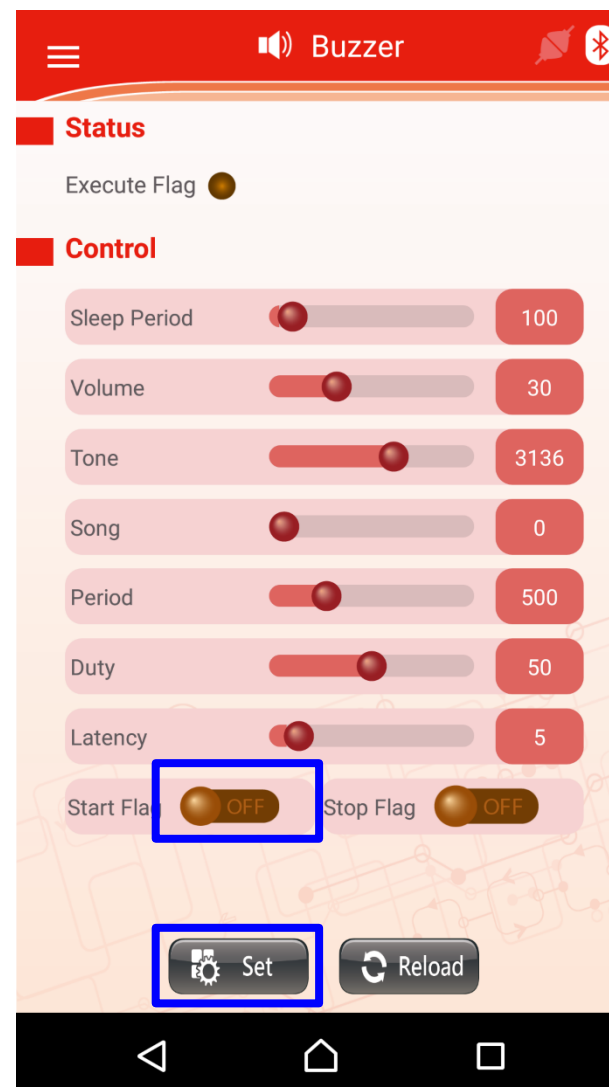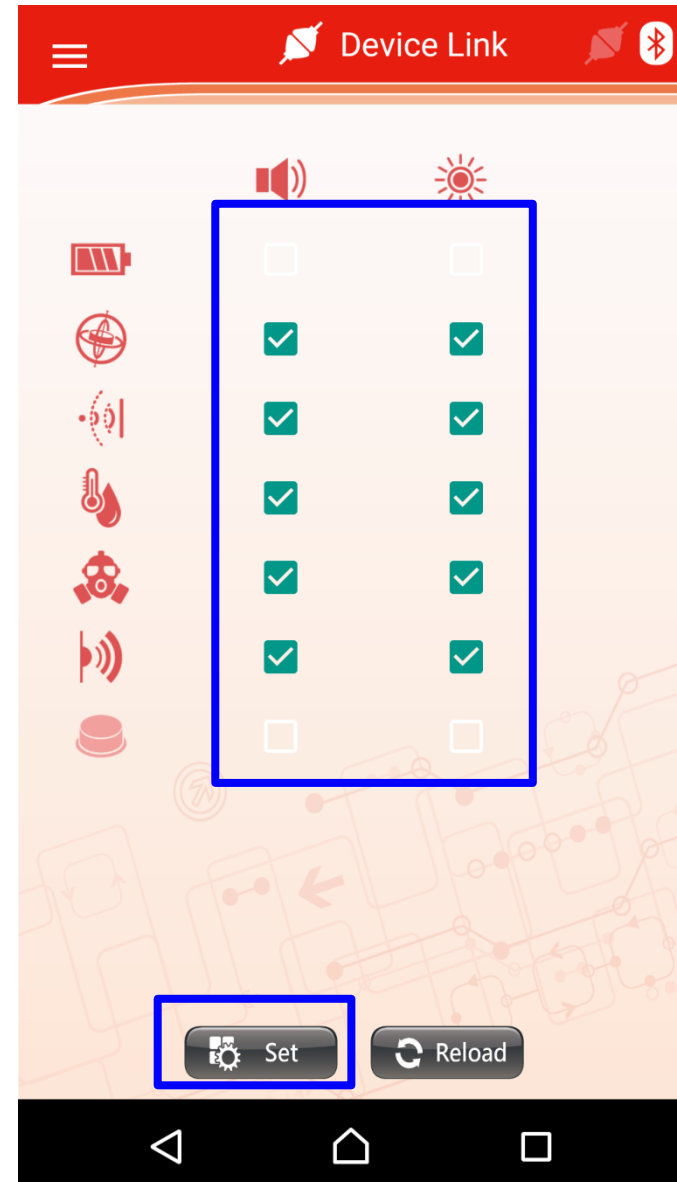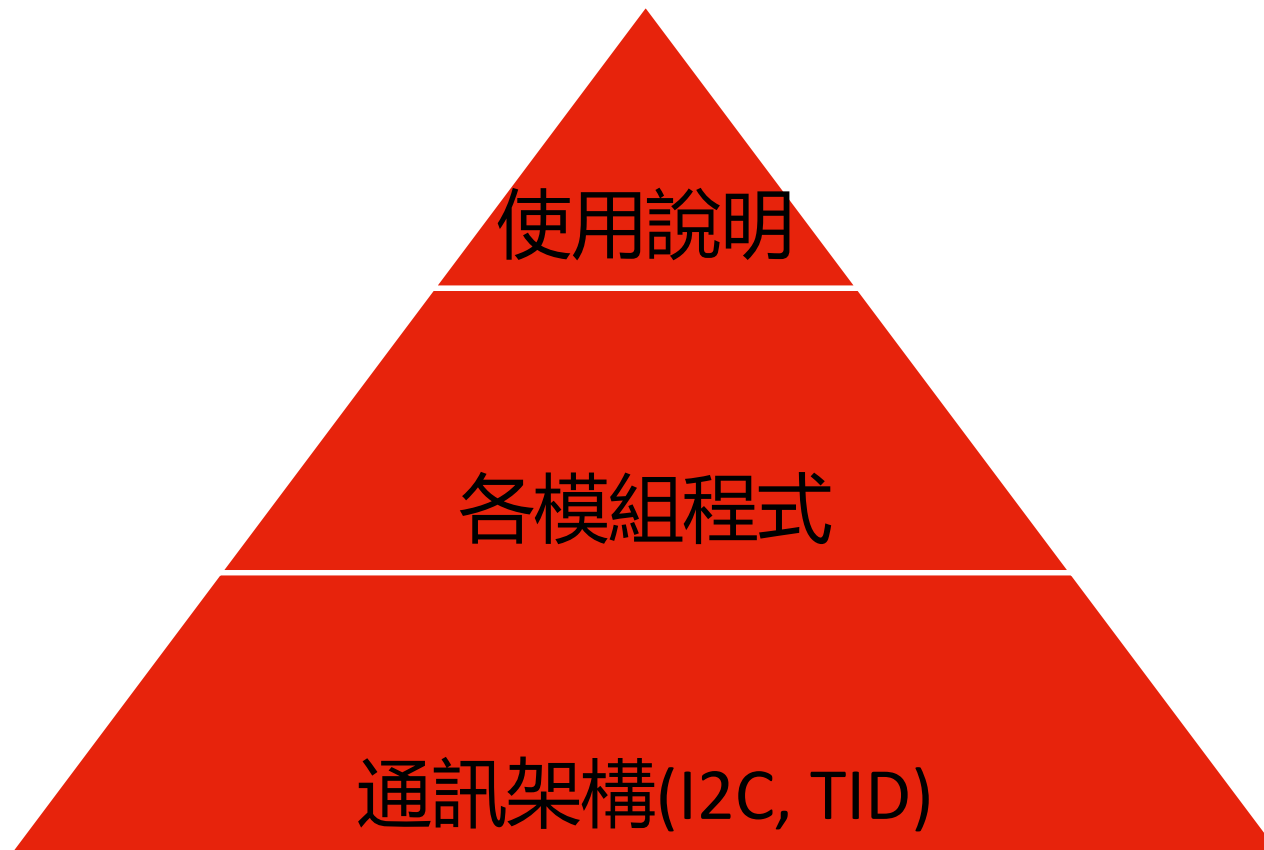
NuMaker Brick平台架構

各模組程式

- 程式分類

各模組程式

- 程式分類

NuBrick ── CMSIS

M451 Core

User

.C檔

Library

基本功能(GPIO, TIMER, PWM)

Include

.H檔

14
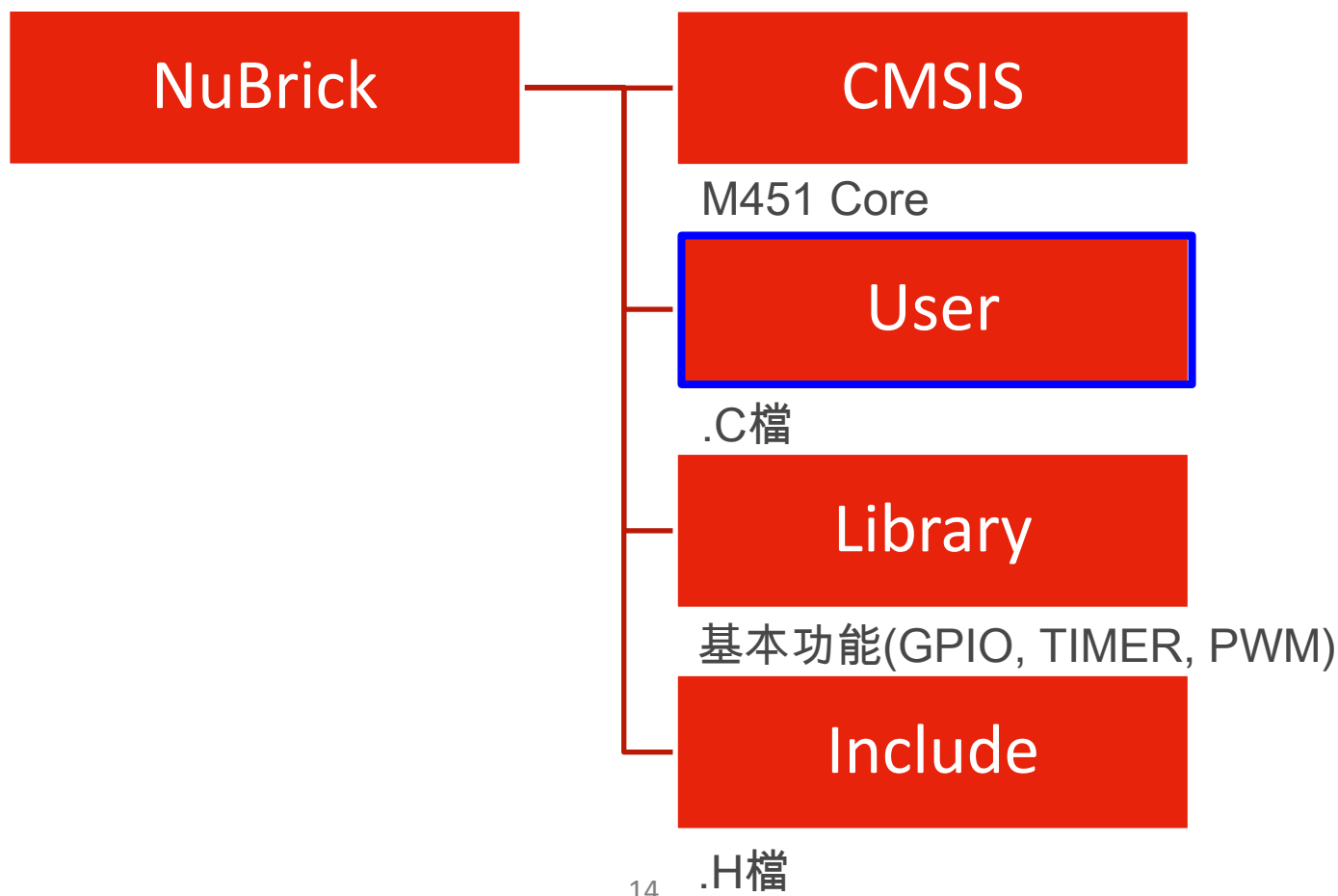
各模組程式

- User

平台架構

- i2c_ms
- i2cdev
- tid
- tidmst
- tiddev
- devCheck
- report
  - report_AP

各模組

- battery
- led
- buzzer
  - music
- gas
- ir
  - PWM0P2
- sonar

各模組-續

- temperature
  - PWM0P0
- AHRS
  - calibrate
  - mpu6050
  - sensors
- KEY
  - GPC_IRQ
  - GPE_IRQ

各模組程式

- 執行架構

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
    /*
    Functions for each device:
    {Initial, Period, Pulling, Report}
    Initial : Init and configure device
    Period  : Process device sensor data or set sensor once per 0.1 seconds.
    Pulling : Process device sensor data or set sensor frequently.
    Report  : Report process data to master
    */

    /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

```
    /* for custom device boards
    fill your four board functions here to specified ID. */
```

					使用者可自定義
{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9	
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10	
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11	
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12	
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13	
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14	

```
};
```

各模組程式

- Battery

各模組程式

Battery

- Battery.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
    /*
    Functions for each device:
    {Initial, Period, Pulling, Report}
    Initial : Init and configure device
    Period  : Process device sensor data or set sensor once per 0.1 seconds.
    Pulling : Process device sensor data or set sensor frequently.
    Report  : Report process data to master
    */

    /* for embedded device boards */
```

Battery程式內容

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

```
    /* for custom device boards
    fill your four board functions here to specified ID. */
```

					使用者可自定義
{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9	
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10	
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11	
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12	
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13	
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14	

```
};
```

Battery

Overview

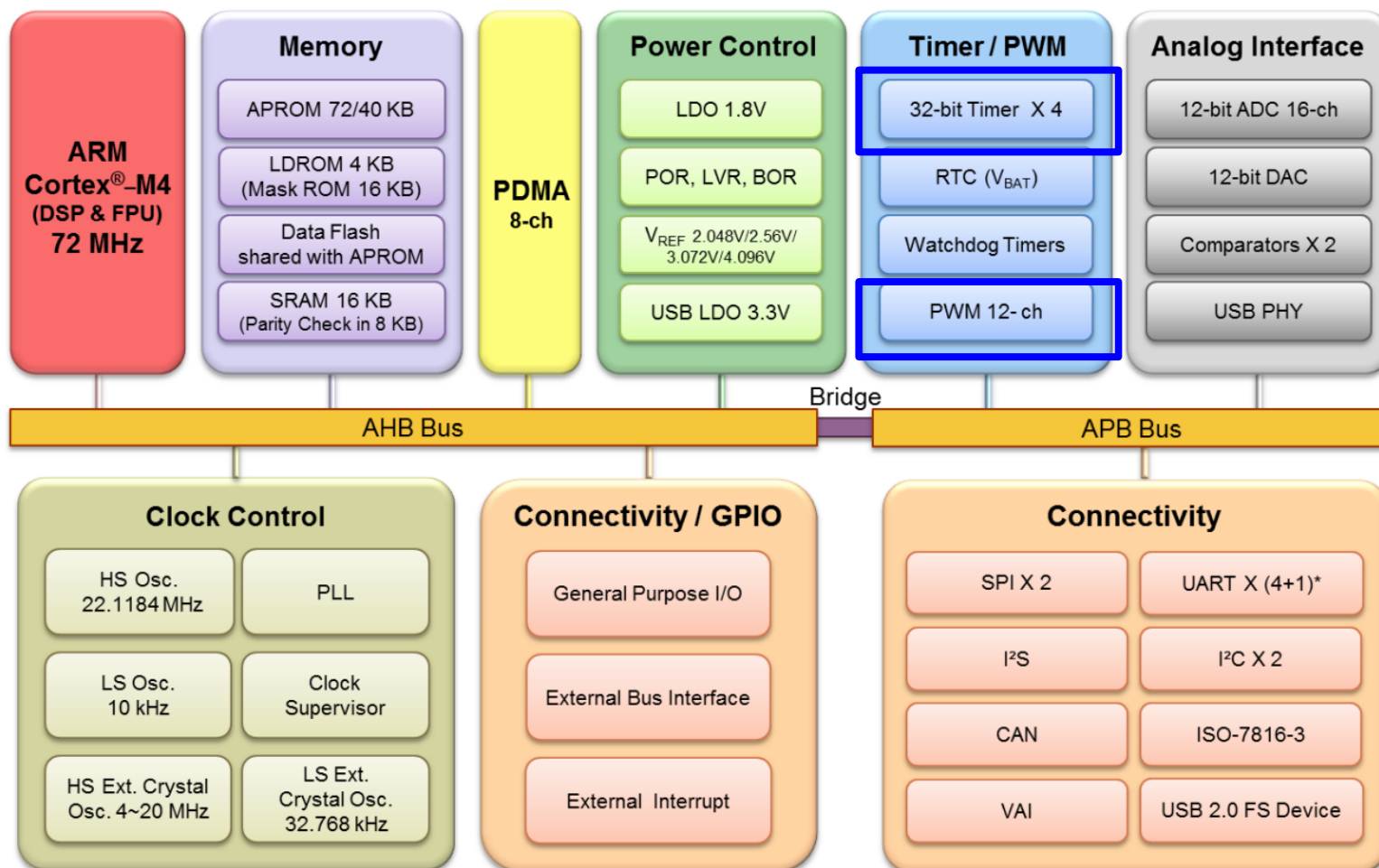- ADC每經過0.1秒(Timer)抓值一次

Battery_init

- 設定ADC
- 設定平台參數

Master control

- 主控端程序

各模組程式

- Buzzer

各模組程式

Buzzer

- buzzer.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
    /*
    Functions for each device:
    {Initial, Period, Pulling, Report}
    Initial : Init and configure device
    Period  : Process device sensor data or set sensor once per 0.1 seconds.
    Pulling : Process device sensor data or set sensor frequently.
    Report  : Report process data to master
    */

    /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

Buzzer程式內容

```
    /* for custom device boards
    fill your four board functions here to specified ID. */
```

{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9	使用者可自定義
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10	
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11	
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12	
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13	
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14	

```
};
```

Battery

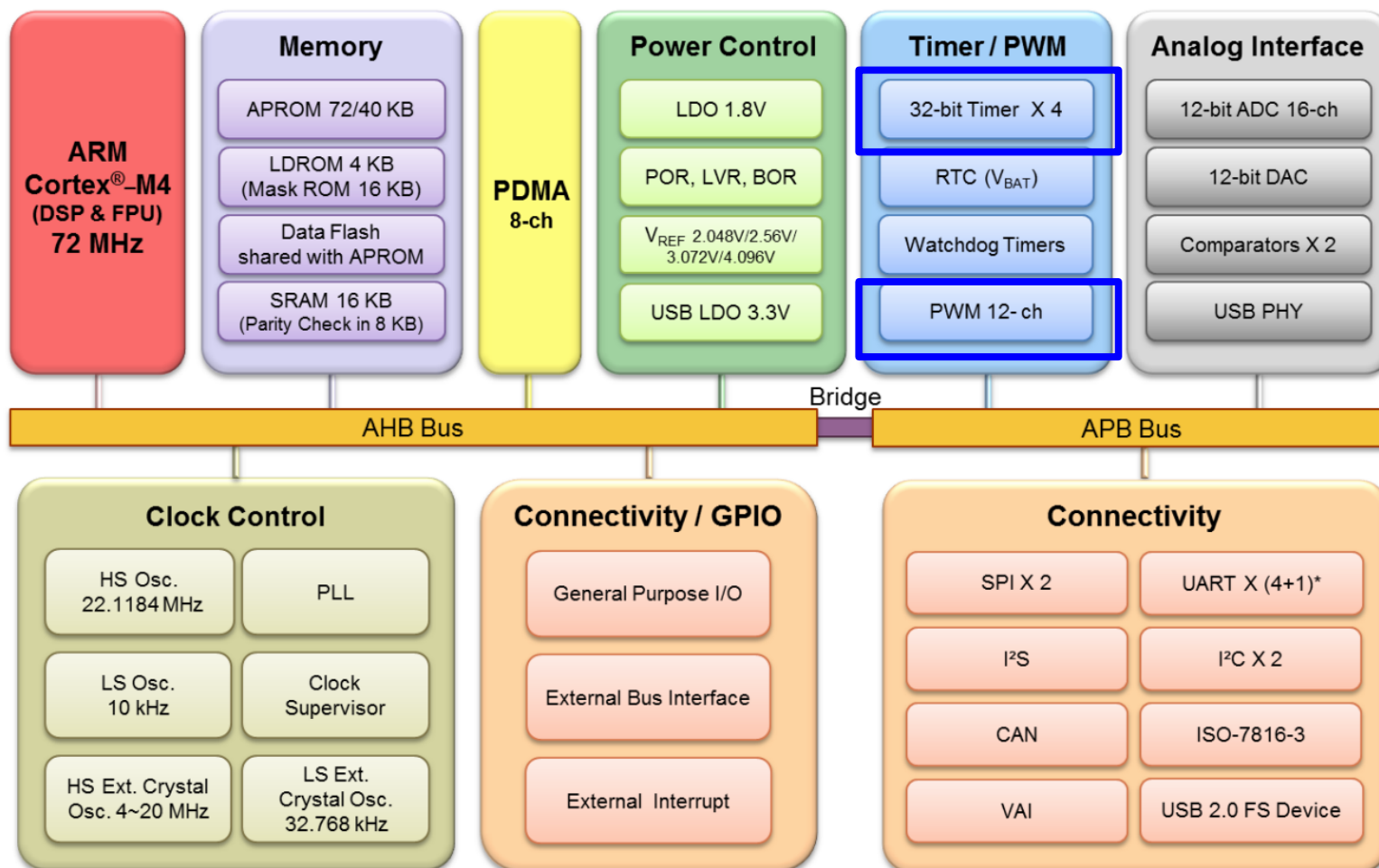## Overview

- Buzzer檢查是否工作

Buzzer_init

- 設定PWM

- 設定平台參數

Buzzer_control

- 持續檢查揚聲器是否發出聲音以及音調

各模組程式

- LED

各模組程式

LED

- led.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
        /*
        Functions for each device:
        {Initial, Period, Pulling, Report}
        Initial : Init and configure device
        Period  : Process device sensor data or set sensor once per 0.1 seconds.
        Pulling : Process device sensor data or set sensor frequently.
        Report  : Report process data to master
        */

        /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

LED程式內容

```
        /* for custom device boards
        fill your four board functions here to specified ID. */
```

					使用者可自定義
{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9	
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10	
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11	
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12	
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13	
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14	

```
};
```
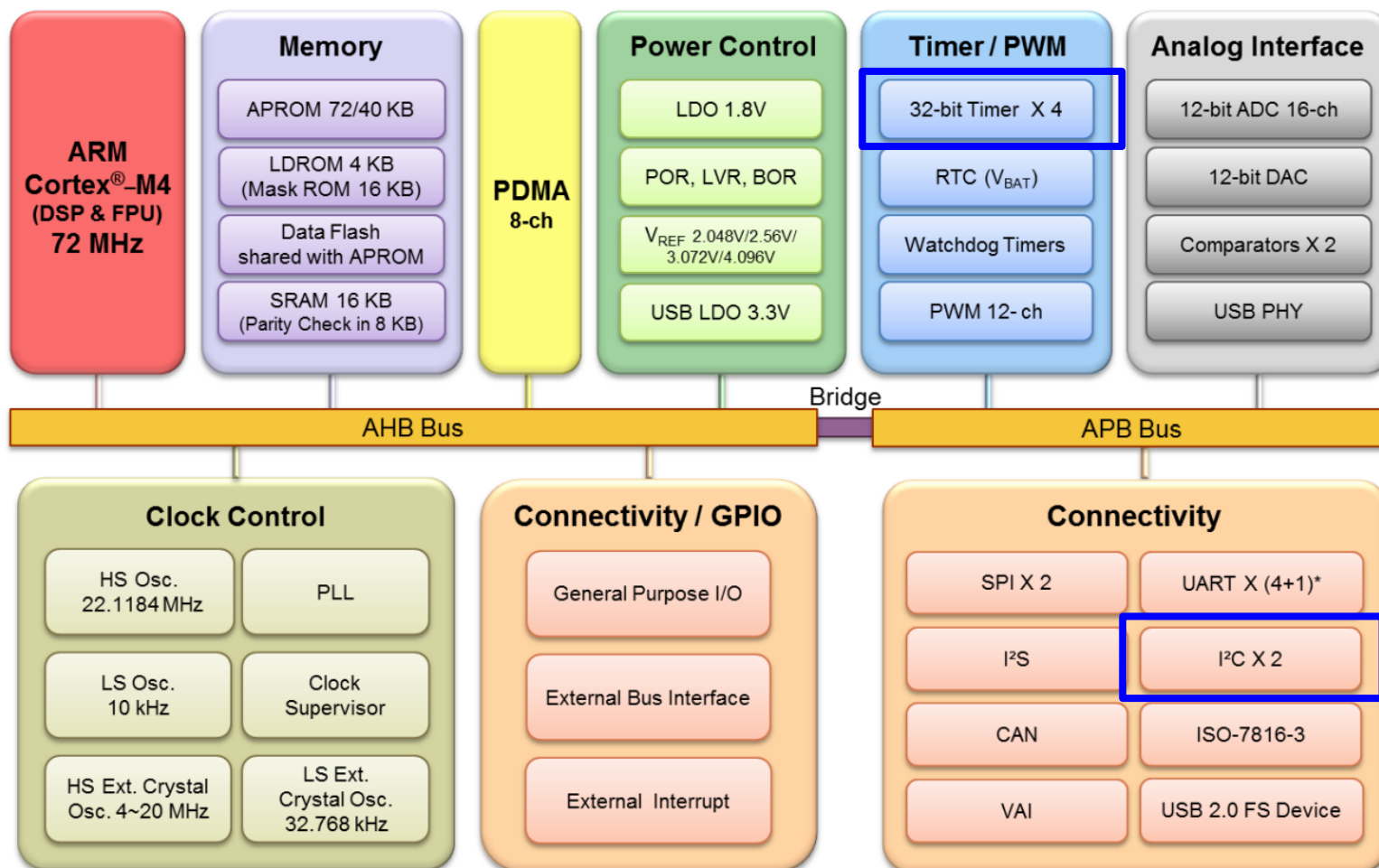
LED

Overview

- LED檢查是否工作

Led_init

- 設定PWM
- 設定平台參數

Led_control

- 持續檢查LED是否發出燈光以及決定顏色

各模組程式

- AHRS

各模組程式

AHRS

- AHRS.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
    /*
    Functions for each device:
    {Initial, Period, Pulling, Report}
    Initial : Init and configure device
    Period  : Process device sensor data or set sensor once per 0.1 seconds.
    Pulling : Process device sensor data or set sensor frequently.
    Report  : Report process data to master
    */

    /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

AHRS程式內容

```
    /* for custom device boards
    fill your four board functions here to specified ID. */
```

{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9	使用者可自定義
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10	
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11	
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12	
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13	
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14	

```
};
```

AHRS

Overview

- 每經過0.1秒(Timer)接收I2C的資料
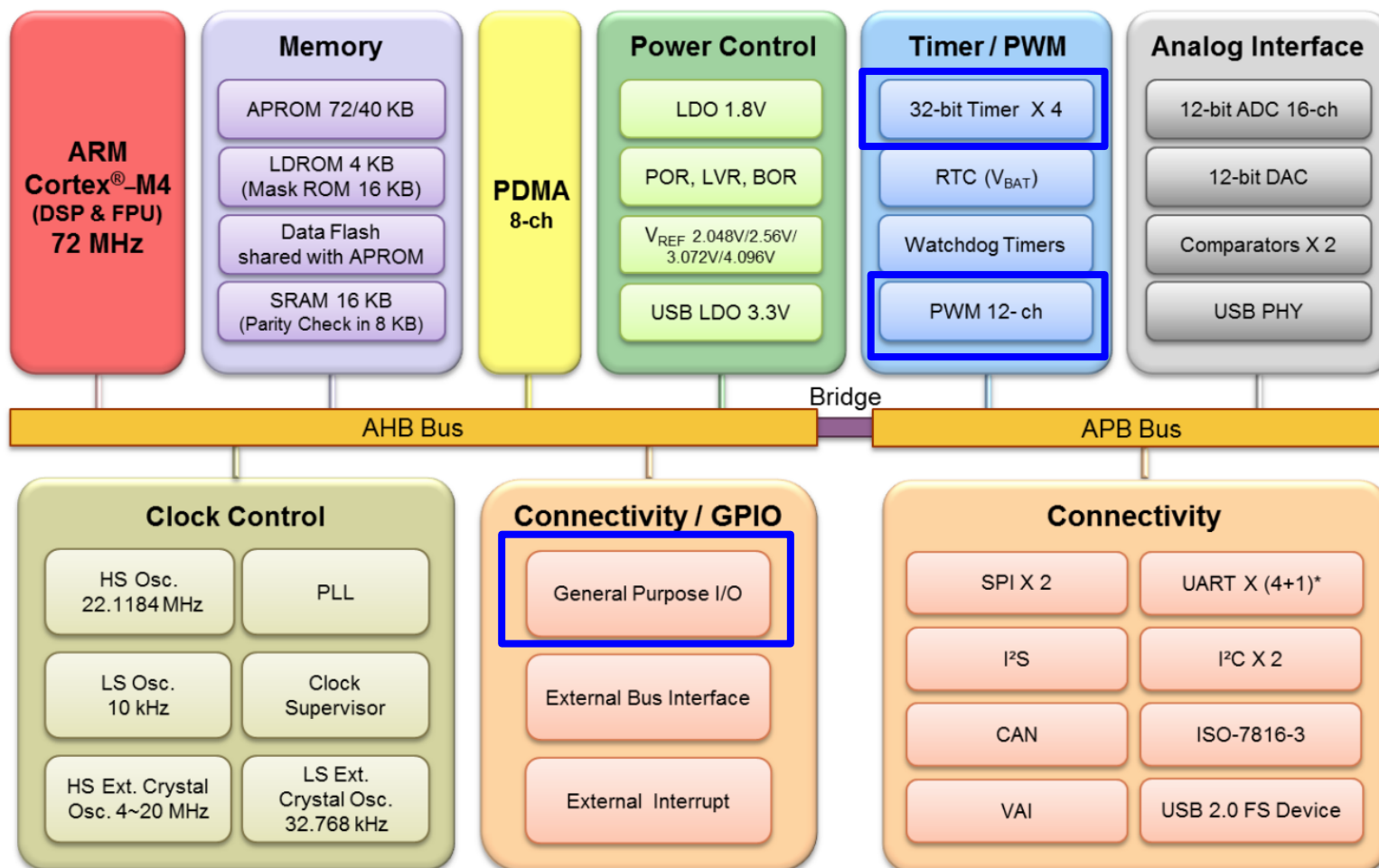
AHRS_init

- 設定I2C

- 設定平台參數

AHRS_control

- 每0.1秒接收I2C的AHRS資料

各模組程式

- SONAR

各模組程式

SONAR

- sonar.c
- PWM0P2_IRQ.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
    /*
    Functions for each device:
    {Initial, Period, Pulling, Report}
    Initial : Init and configure device
    Period  : Process device sensor data or set sensor once per 0.1 seconds.
    Pulling : Process device sensor data or set sensor frequently.
    Report  : Report process data to master
    */

    /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

Sonar程式內容

```
    /* for custom device boards
    fill your four board functions here to specified ID. */
```

					使用者可自定義
{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9	
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10	
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11	
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12	
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13	
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14	

```
};
```

SONAR

Overview

- 每0.1秒(Timer)觸發GPIO並用PWM Capture接收訊號

AHRS_init

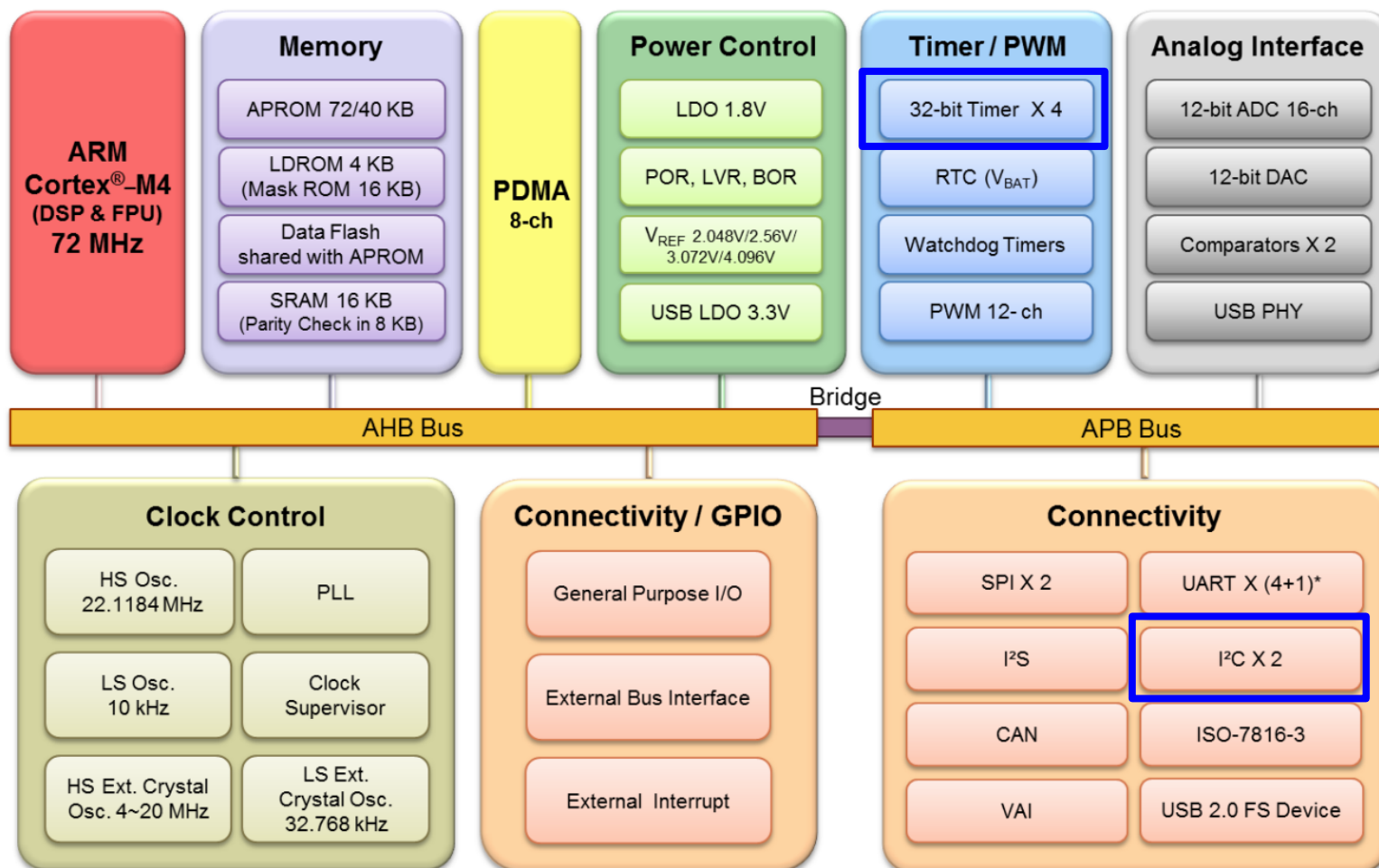- 設定GPIO, PWM
- 設定平台參數

SonarDected

- 每0.1秒觸發GPIO，開始計算時間

SonarTimeOutCheck

- 持續檢查PWM的capture是否有接收到回傳訊號

各模組程式

- 溫度感測器

各模組程式

溫度感測器

- temp_HTU21D.c
- i2c_HTUD.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
    /*
    Functions for each device:
    {Initial, Period, Pulling, Report}
    Initial : Init and configure device
    Period  : Process device sensor data or set sensor once per 0.1 seconds.
    Pulling : Process device sensor data or set sensor frequently.
    Report  : Report process data to master
    */

    /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

溫度感測程式內容

```
    /* for custom device boards
    fill your four board functions here to specified ID. */
```

					使用者可自定義
{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9	
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10	
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11	
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12	
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13	
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14	

```
};
```

溫度感測器

Overview

- 每經過0.1秒(Timer)接收I2C的資料

HTU21D_init

- 設定I2C
- 設定平台參數

WaitHTU21D
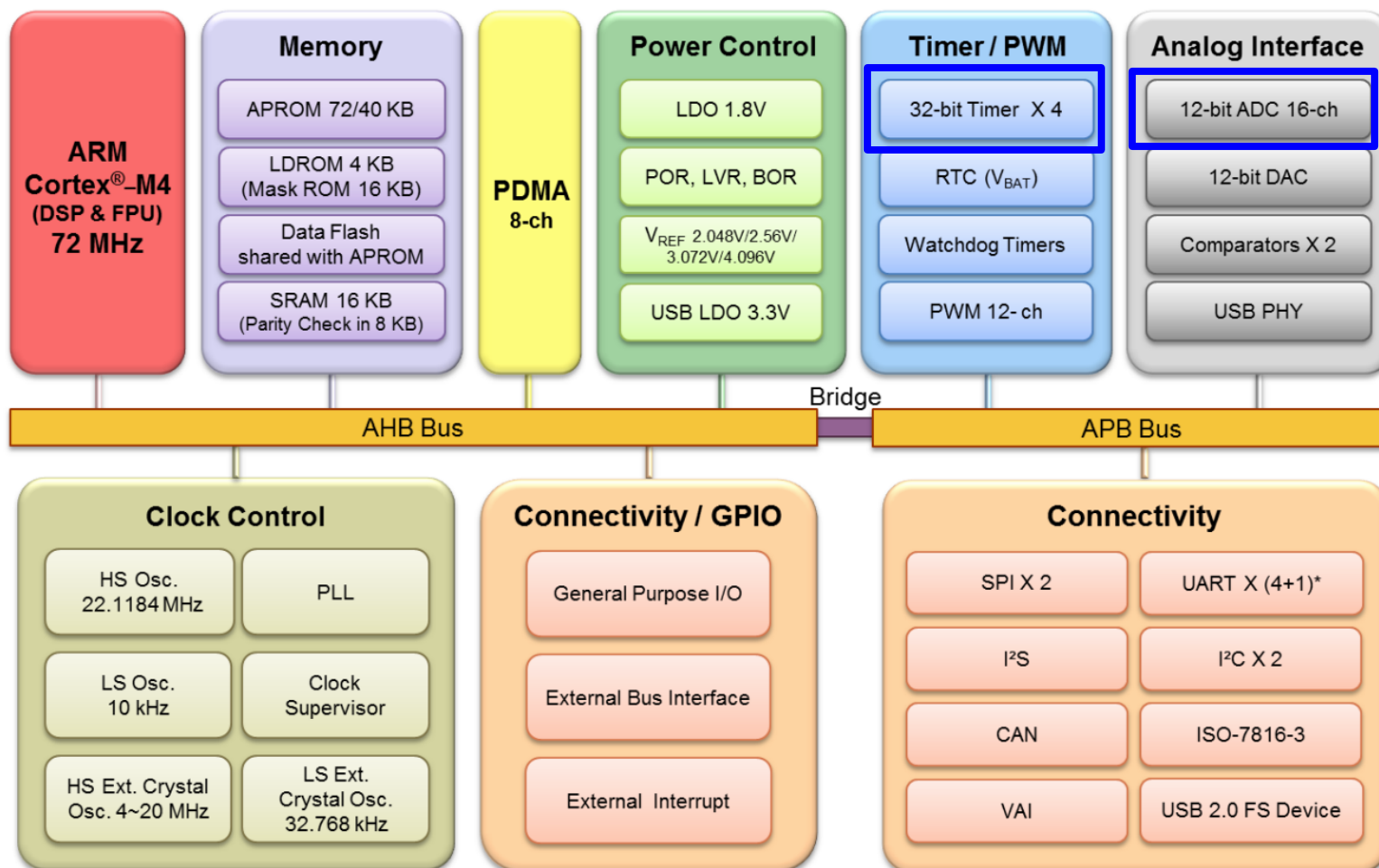
- 每0.1秒開始接收溫度資料

GetHTU21Dtemp

- 持續檢查溫度資料是否傳遞完畢

各模組程式

- 瓦斯感測器

各模組程式

瓦斯感測器

- gas.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
    /*
    Functions for each device:
    {Initial, Period, Pulling, Report}
    Initial : Init and configure device
    Period  : Process device sensor data or set sensor once per 0.1 seconds.
    Pulling : Process device sensor data or set sensor frequently.
    Report  : Report process data to master
    */

    /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

瓦斯感測程式內容

```
    /* for custom device boards
    fill your four board functions here to specified ID. */
```

					使用者可自定義
{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9	
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10	
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11	
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12	
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13	
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14	

```
};
```

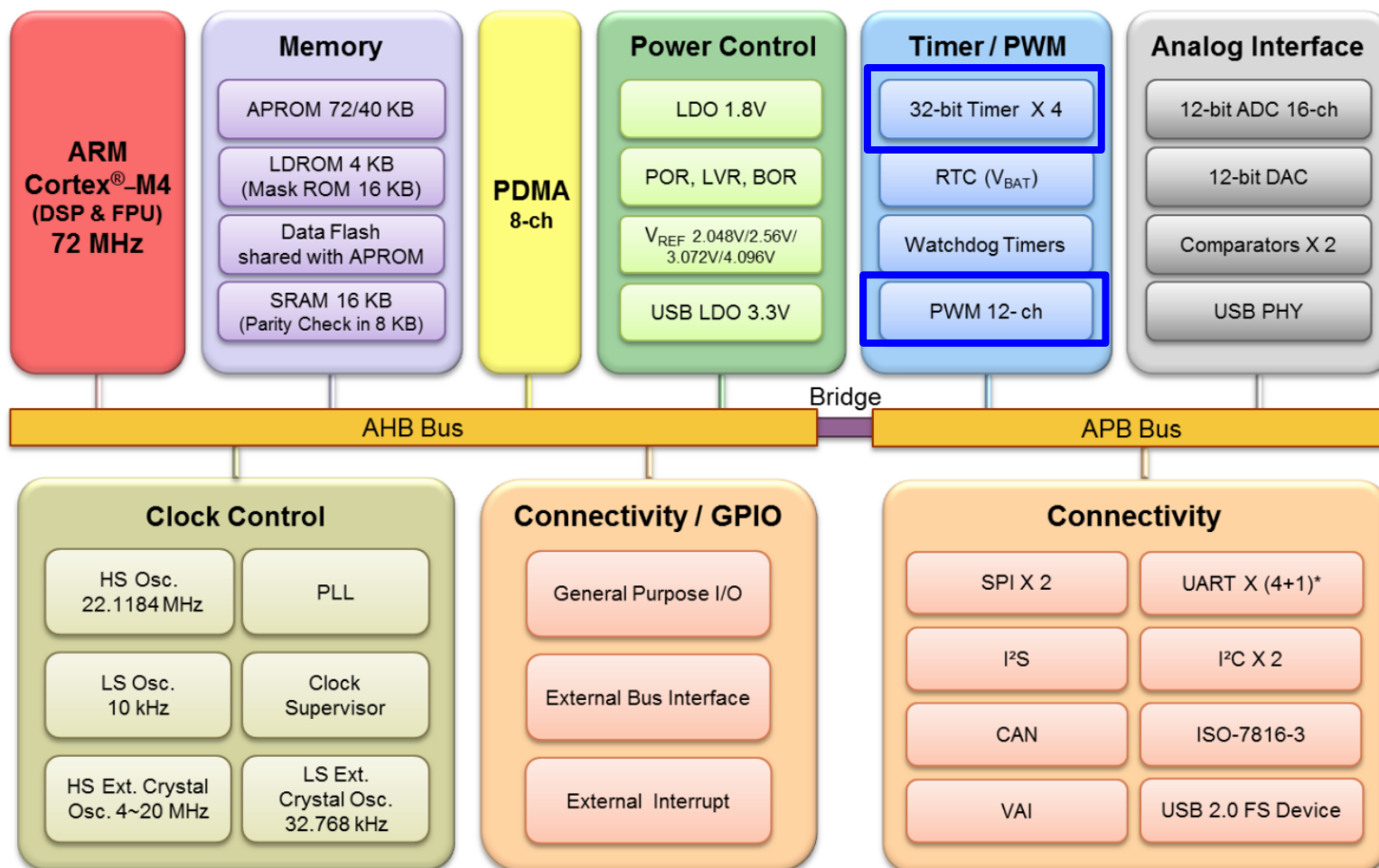# 瓦斯感測器

Overview

- 每經過0.1秒(Timer) ADC 抓值一次

Gas_init

- 設定ADC
- 設定平台參數

GetGas

- ADC抓值

各模組程式

- 紅外線感測器

各模組程式

紅外線發射
接收器

- ir.c
- PWM0P2_IRQ.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
    /*
    Functions for each device:
    {Initial, Period, Pulling, Report}
    Initial : Init and configure device
    Period  : Process device sensor data or set sensor once per 0.1 seconds.
    Pulling : Process device sensor data or set sensor frequently.
    Report  : Report process data to master
    */

    /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

紅外線感測程式內容

```
    /* for custom device boards
    fill your four board functions here to specified ID. */
```

{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14

使用者可自定義

```
};
```

紅外線感測器

Overview

- 用PWM發送紅外線，Capture接收紅外線訊號

IR_init

- 設定ADC
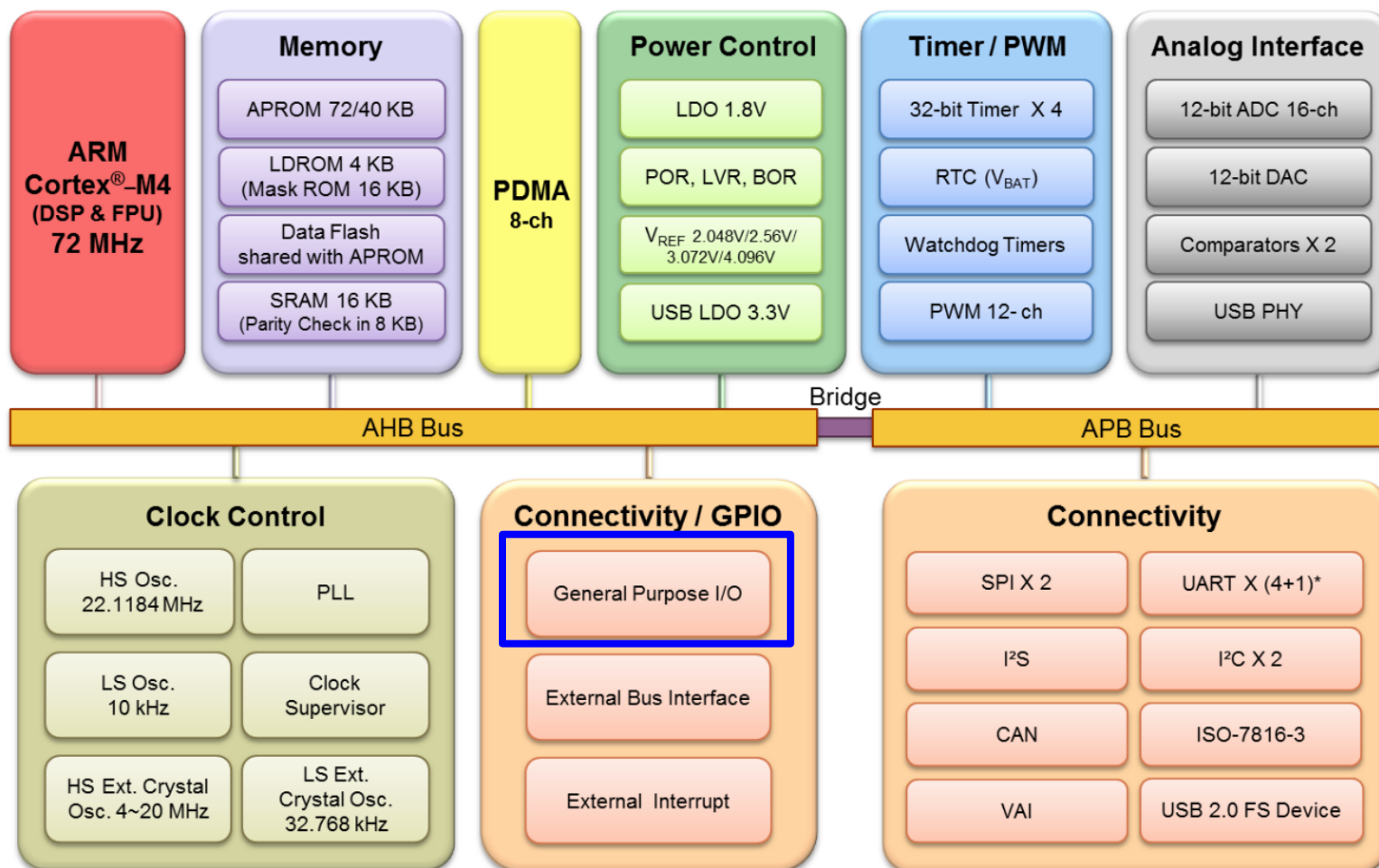- 設定平台參數

IR_control

- 每0.1秒檢查是否要用PWM發送紅外線訊號

IR_Check

- 接收紅外線，持續檢查

各模組程式

- 按鈕感測器

各模組程式

按鈕感測器

- key.c
- GPC_IRQ.c
- GPE_IRQ.c

```
APFN_FUNC_T pfnDevFunc[MAX_TID_DEV] =
{
        /*
        Functions for each device:
        {Initial, Period, Pulling, Report}
        Initial : Init and configure device
        Period  : Process device sensor data or set sensor once per 0.1 seconds.
        Pulling : Process device sensor data or set sensor frequently.
        Report  : Report process data to master
        */

        /* for embedded device boards */
```

模組初始化	模組周期執行程式	模組及時執行程式	
{Battery_Init,	MasterControl,	NULL,	report_battery},
{Buzzer_Init,	NULL,	Buzzer_Control,	report_buzzer},
{Led_Init,	NULL,	Led_Control,	report_led},
{AHRS_Init,	AHRS_Control,	NULL,	report_ahrs},
{SonarInit,	SonarDetect,	SonarTimeOutCheck,	report_sonar},
{HTU21D_Init,	WaitHTU21D,	GetHTU21DTemp,	report_temp},
{Gas_Init,	GetGas,	NULL,	report_gas},
{IR_Init,	IR_Control,	IR_Check,	report_ir},
{key_init,	NULL,	NULL,	report_key},

按鈕感測程式內容

```
        /* for custom device boards
        fill your four board functions here to specified ID. */
```

{Lr_Init,	GetLr,	NULL,	report_resDev9},	// For device ID 9
{NULL,	NULL,	NULL,	report_resDev10},	// For device ID 10
{NULL,	NULL,	NULL,	report_resDev11},	// For device ID 11
{NULL,	NULL,	NULL,	report_resDev12},	// For device ID 12
{NULL,	NULL,	NULL,	report_resDev13},	// For device ID 13
{NULL,	NULL,	NULL,	report_resDev14},	// For device ID 14

使用者可自定義

```
};
```

按鈕感測器

Overview

- 由**GPIO**的中斷檢查按鈕是否被按下

Key_init

- 設定**GPIO**、中斷
- 設定平台參數

...

- ...
  - ...