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Smart Machine Smart Decision

EASY ACCESS to EMBEDDED AT SIM800(R)

Content

1. Embedded AT Core Conception

2. Embedded AT Functions

3. Example: ADC Detection

1. Embedded AT Core Conception

1.1 Embedded AT Core Conception

1.2 Think from MCU Side

1.3 Programming Style

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1.1 Embedded AT Core Conception

Purpose:

Embedded AT will fully utilize SIM800/H resources, provide interfaces to move external MCU functions inside SIM800/H, so as to save customer's cost.

Programming Idea:

Think from MCU side

Similar MCU programming style

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1.2 Think from MCU Side

What an external MCU do		What EmbeddedAT do
1. Programming to implement functions through serial port by sending/responding AT commands	⟷	1. UART APIs
2. Read/write Flash	⟷	2. Flash APIs
3. Timer	⟷	3. Timer APIs
4. GPIO /Keypad/SPI /ADC configure and interrupt	⟷	4. Periphery APIs

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1.3 Programming Style

MCU Framework

```
void main(void)
{
   Init Hardware();
   Init Variable();
   Start Timer();
   while(TRUE)
   {


      Progress ModemData();
      Progress Timer();
      ....
   }}
```

EMBEDDED-AT Framework

```
void app_main (void)
{  Init RAM and clib();
   Init Hardware();
   Init Variable();
   eat_timer_start(EAT_TIMER_1, 1000);
   while(TRUE)
   {
       eat_get_event(&event);
      switch(event.event)
      {
      case EAT_EVENT_MDM_READY_RD :
          {…}
          case EAT_EVENT_TIMER : {…}
          …
      }}}
```

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2. Embedded AT Functions

2.1 Send and Receive AT Command

2.2 FLASH Operation

2.3 Timer

2.4 GPIO Configuration and Usage

2.5 SPI Interface

2.6 UART Operation

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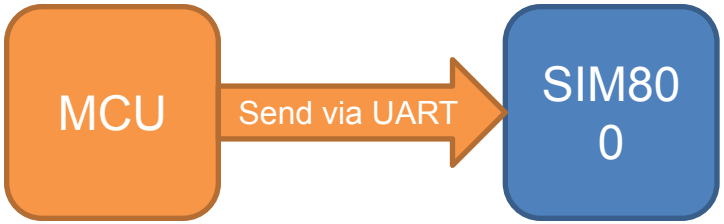
2.1 Send and Receive AT Command

MCU

Send AT Command



Receive AT Command return value

Embedded-AT

Send AT Command

Receive AT Command return value

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Example:

Send “AT+CNETLIGHT=0”when powering on and get response.

```
void app_main(void)
{
  APP_InitRegions();  APP_init_clib(); …
 Eat_modem_write(“AT+CNETLIGHT=0\r”,strlen(“AT+CNETLIGHT=0\r”));
 while(TRUE)
 {
   eat_get_event(&event);
    switch (event.event)
   { case EAT_EVENT_MDM_READY_RD:
     {
        Progress();
     }
      case …
    }}}
```

Send AT command to SIM800 core

Receive AT command response

For more details please refer to the rich examples we provided.

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2.2 FLASH Operation

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2.2.1 Read Data

Step1: Define a global array

u8 Buffer[8*1024]

Step2: Read flash data from flash address

S32 eat_flash_read(Buffer,flash_addr,len)

Return readed data len: Read data from flash successfully, the data are saved in the buffer.

The flash address is between eat_get_app_base_addr() and eat_get_app_base_addr()+eat_get_app_space().

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2.2.2 Write Data

Step1: Define a global array

u8 Buffer[8*1024]

Step2: Fill the data to be saved into Buffer

memcpy(Buffer,string,len)

Step3: Call function, write data

eat_bool eat_flash_write(addr,Buffer, len)

Return EAT_TRUE: Write data to flash successfully.

Note:

It is necessary that erasing the flash block before writing data to flash.

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2.2.3 Other Flash APIs

1. Delete flash data from related address

eat_bool eat_flash_erase(flash_addr, len)

2. Acquire APP Space Size

u32 eat_get_app_space()

3. Get APP base address

u32 eat_get_app_base_addr()

4.Upadte APP

void eat_update_app(*app_code_addr, *app_code_new_addr, len,
pin_wd, pin_led, lcd_bl);

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2.3 Timer

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2.3.2 Start / Stop Timer

Start or stop timer

Soft timer:

Start timer: eat_timer_start(timer_id, expire_ms);

Stop timer: eat_timer_stop(timer_id)

Return EAT_TRUE: Start /stop a timer successfully.

Hardware timer:

eat_gpt_start(expire_61us,loop, gpt_expire_cb_fun);

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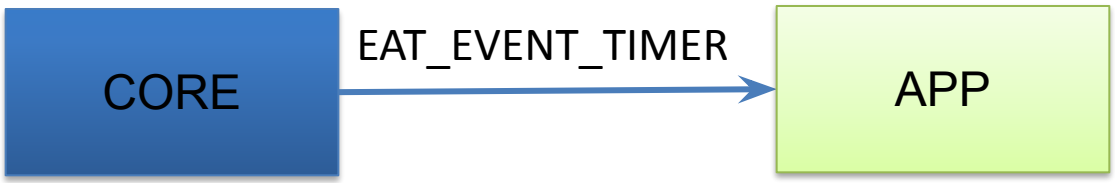
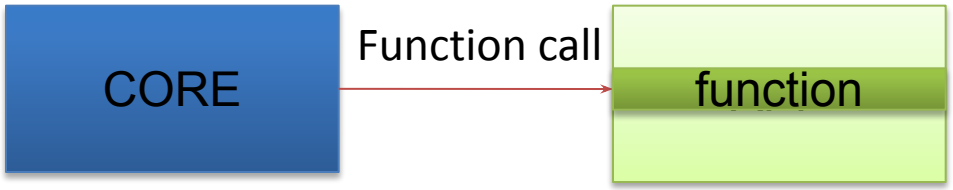
2.3.3 Timer EVENT

When the timer expires, the soft timer will send a event EAT_EVENT_TIMER to APP ,but the hw timer will call function in APP direct.

Soft timer:



Hw timer:



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2.3.4 Get System Time

1. EatRtc_st structure

```
typedef struct {
    unsigned char sec;  /* [0, 59] */
    unsigned char min; /* [0,59]  */
    unsigned char hour; /* [0,23]  */
    unsigned char day;  /* [1,31]  */
    unsigned char mon; /* [1,12] */
    unsigned char wday; /* [1,7] */
    unsigned char year;  /* [0,127] */
} EatRtc_st;
```

2. Get the system time

eat_bool eat_get_rtc (EatRtc_st * datetime)

The current local time will be stored in the datatime structure.

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2.4 Configuration and Usage of GPIO

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2.4.1 Pins for GPIO

1. Available GPIOs in SIM800H

```
typedef enum FlPinNameTag
{
        EAT_PIN3_GPIO1,
        EAT_PIN4_STATUS,
       …
        EAT_PIN74_SCL,
        EAT_PIN75_SDA,
        EAT_PIN_NUM
 } EatPinName_enum;
```

Please refer "eat_peripher.h" for details

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2.4.2 Configure PIN to GPIO and output mode

Step1: Configure the target PIN as GPIO

eat_bool eat_pin_set_mode(PIN, EAT_PIN_MODE_GPIO);

Return EAT_TRUE : Configure status successful

Step2: Configure the target GPIO to be out and high level or low

eat_bool eat_gpio_setup(PIN, EAT_GPIO_DIR_OUTPUT , EAT_GPIO_LEVEL_HIGH)

Return EAT_TRUE : Configuration successful

Back

2.4.3 Configure PIN to GPIO of input mode

Step1: Configure the target PIN as GPIO

eat_bool eat_pin_set_mode(PIN, EAT_PIN_MODE_GPIO);

Return EAT_TRUE : Configure status successful

Step2: Configure the target GPIO to be in

eat_bool eat_gpio_setup(PIN, EAT_GPIO_DIR_INPUT , 0)

Return EAT_TRUE : Configuration successful

Step3: Read PIN status

EatGpioLevel_enum eat_gpio_read(PIN)

Return EAT_GPIO_LEVEL_LOW or EAT_GPIO_LEVEL_HIGH

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2.4.4 Configure PIN to Be Interruptable

1. In SIM800, PINs with interrupt function

EAT_PIN34_SIM_PRE, EAT_PIN35_PWM1, EAT_PIN36_PWM2, EAT_PIN40_ROW4, EAT_PIN47_COL4

2. Interrupt Trigger Type

```
typedef enum {
    EAT_INT_TRIGGER_HIGH_LEVEL,
    EAT_INT_TRIGGER_LOW_LEVEL,
    EAT_INT_TRIGGER_RISING_EDGE,
    EAT_INT_TRIGGER_FALLING_EDGE,
    EAT_INT_TRIGGER_NUM
} EatIntTrigger_enum;
```

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2.4.4 Configure PIN to Be Interruptable

3. Configure the target GPIO to interrupt mode

eat_bool eat_pin_set_mode(PIN35, EAT_PIN_MODE_EINT);

Return EAT_TRUE: Configure status successful

4. Configure PIN24 to rising edge trigger type, 10ms debound

eat_bool eat_int_setup(PIN35, EAT_INT_TRIGGER_RISING_EDGE, 10, NULL);

Return EAT_TRUE : Configuration successful

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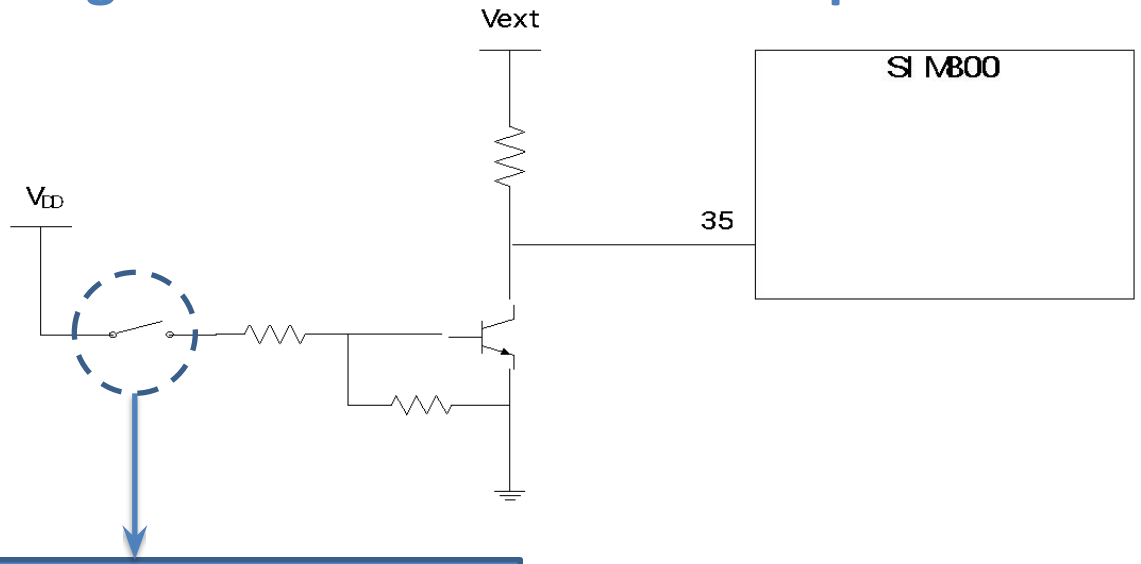
2.4.4 Configure PIN to Be Interruptable

5. Circuit Diagram to Detect GPIO interrupt



When switch is on, it will generate a GPIO interrupt, CORE will report EAT_EVENT_INT to APP

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2.4.5 Configure PIN for Keypad

1. Initializes keypad pins

eat_bool eat_pin_set_mode(pin, EAT_PIN_MODE_KEY);

Note:

If any of the KEYPAD pin is configured as keypad, all KEYPAD pins are KEYPAD;

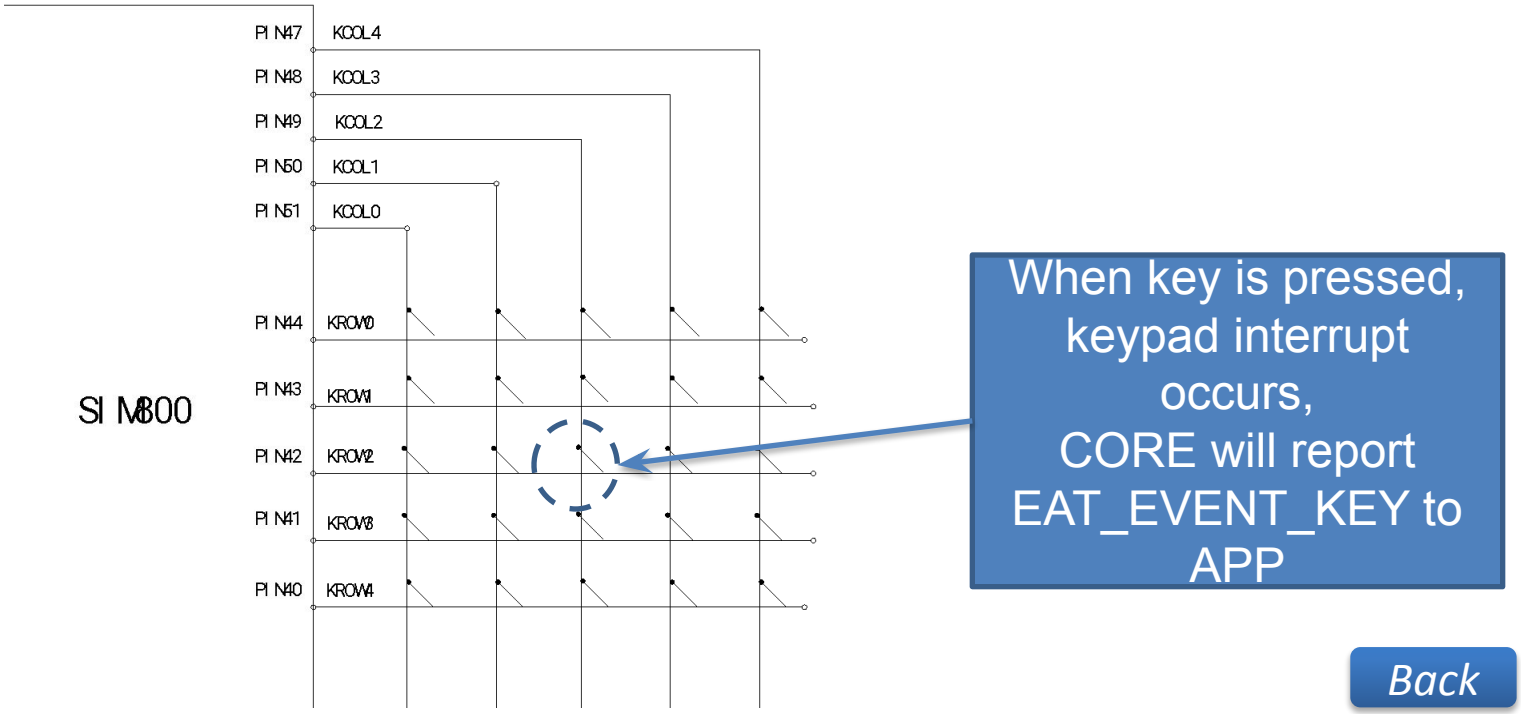
If any of the KEYPAD pin is configured as GPIO, then all KEYPAD pins are GPIO.

2.4.5 Configure PIN for Keypad

2. Following GPIOs can be configured to keypad in SIM800:

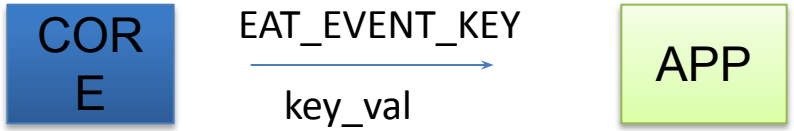
EAT_PIN40_ROW4~ EAT_PIN44_ROW0,

EAT_PIN47_COL4~EAT_PIN51_COL0



2.4.5 Configure PIN for Keypad

3. EAT_EVENT_KEY report to APP



4. The values of each key(key_val) are as following:

```
typedef enum {
    EAT_KEY_C0R0,
    ......
    EAT_KEY_C4R4,
    EAT_KEY_NUM
} EatKey_enum;
```

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2.5 SPI Interface

1. Configure SPI bus, set according to actual situation

eat_bool eat_spi_init(clk, wire, bit, enable_SDI, enable_cs);

2. Write data to SPI bus

eat_bool eat_spi_write(*data, len, is_command);

3. Read single byte from SPI bus

u8 eat_spi_write_read(*wdata, wlen, * rdata, rlen);

Please refer to "eat_periphery.h" for details

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2.6 UART operation

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2.6.1 UART

- **2 UART**
- **1 USB (usb2serial)**

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2.6.2 Configure UART as AT port or DEBUG port

1. AT port

   eat_bool eat_uart_set_at_port(port)

2. Debug mode

   eat_bool eat_uart_set_debug(port)

Note:

a. Only one mode for a port. If UART1 was configured to AT port, then changed to debug mode, the last status of UART1 is debug mode.

b. Above interface are only be available in EatEntry_st-> func_ext1 function at initial stage.

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2.6.3 Configure UART as data mode

1. Open the UART

   eat_bool eat_uart_open(UART)

   If EAT_FALSE given, that means UART is in AT port mode , or debug mode, or parameters error.

2. Configure the UART

   eat_uart_set_config(UART, (EatUartConfig_st*)uart_config)

3. Write the data to UART

   u16 eat_uart_write(UART, *buffer, len)

   If return value is less than “len”, that means uart buffer is full

4. Read the data from UART

   u16 eat_uart_read(UART,*buffer, len)

   “len” is the length for data, the return value is real length.

EAT_EVENT_UART_READY_RD ->read

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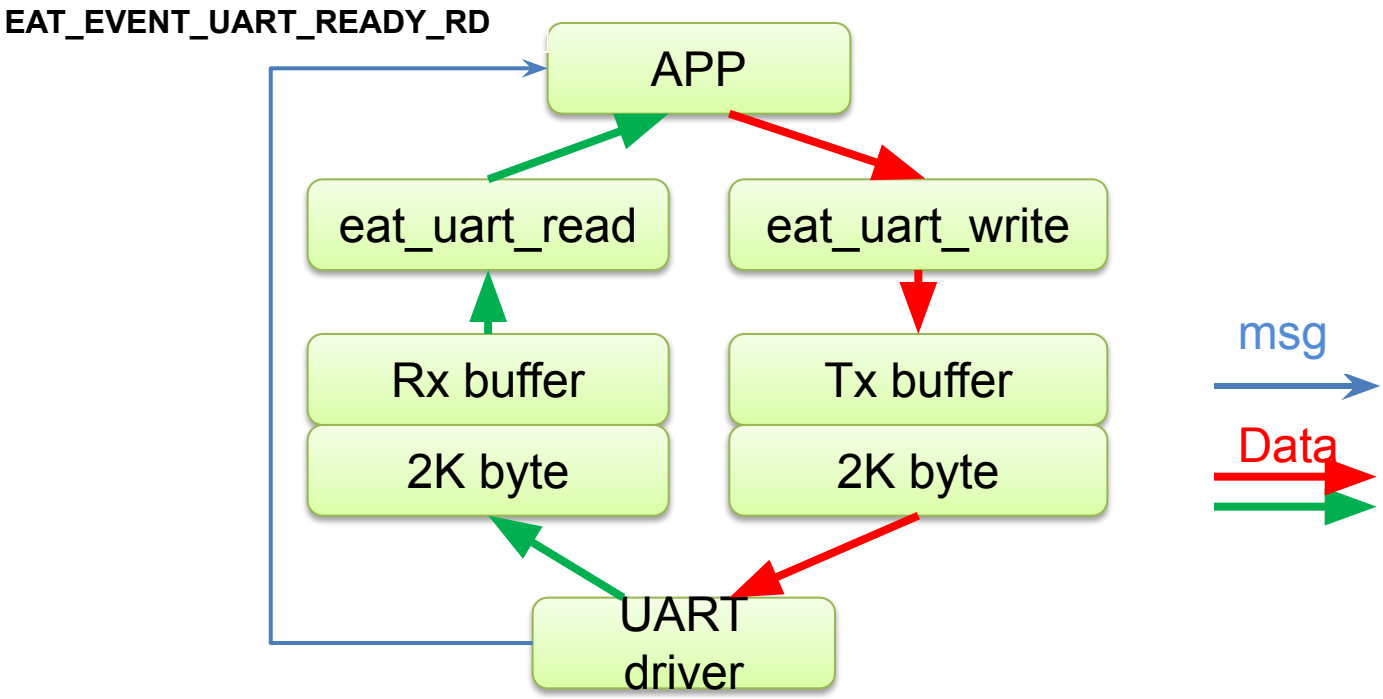
2.6.3 Configure UART as data mode



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3. ADC Detection Example

3.1 Function Description

3.2 Design Flow

3.3 Sample Code

Back

3.1 Function Description

Task Example:

To detect the voltage of ADC pin of SIM800 module periodically.

How does it work?

Once the voltage of ADC pin is lower than a preset value, the alarm pin(PIN37) will be pulled down. If the voltage of ADC pin is higher than a preset value, the alarm pin(PIN37) will be pulled up. This task can be implemented by Embedded AT.

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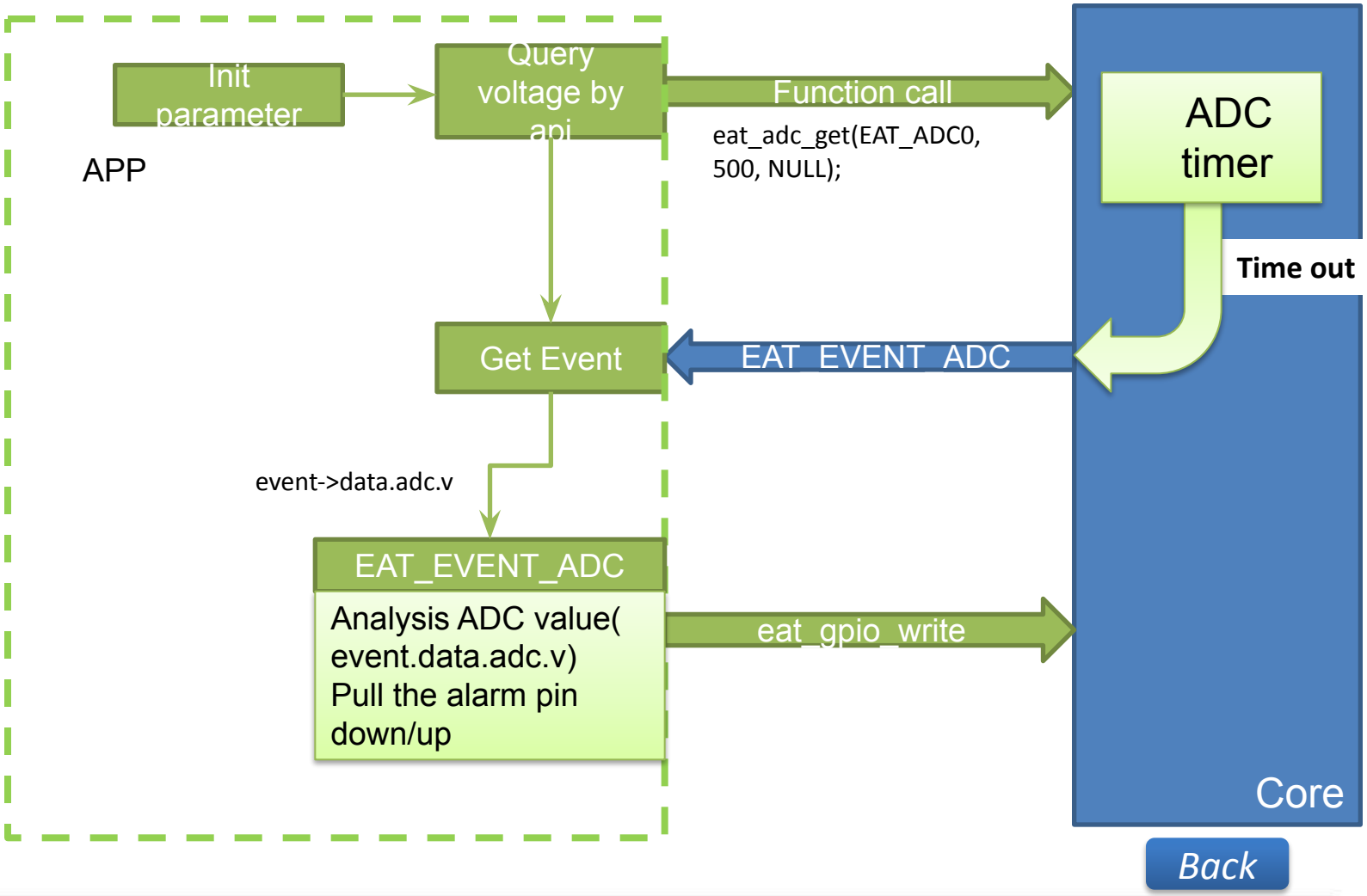
3.2 Design Flow



Thanks!