M487錄製AMR檔到SD卡中

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

應用簡述	此示例代碼使用 M487 和外部音訊轉碼器 NAU88L25 錄製並編碼成 AMR 音訊檔案，存儲在 Micro SD 卡中。
BSP 版本	M480_BSP_CMSIS_V3.05.003
開發平台	NuMaker-PFM-M487 V3.0

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1 概述

此示例代碼使用外部音訊轉碼器 NAU88L25 從耳機麥克風錄製聲音，通過 AMR 編解碼庫對其進行編碼，存儲到 Micro SD 卡。 默認檔名為“rec.amr”，位於 Micro SD 卡的根目錄下。

錄製的 AMR 檔案支持單聲道模式。 數據長度為 16 比特，取樣速率為 8 kHz。

1.1 執行結果

當示例代碼開始運行時，會從麥克風錄製 20 秒的聲音。 若要播放錄製的檔案，可使用 M487_ AMRPlayer_ SD 示例代碼播放。 演示結果如下所示。

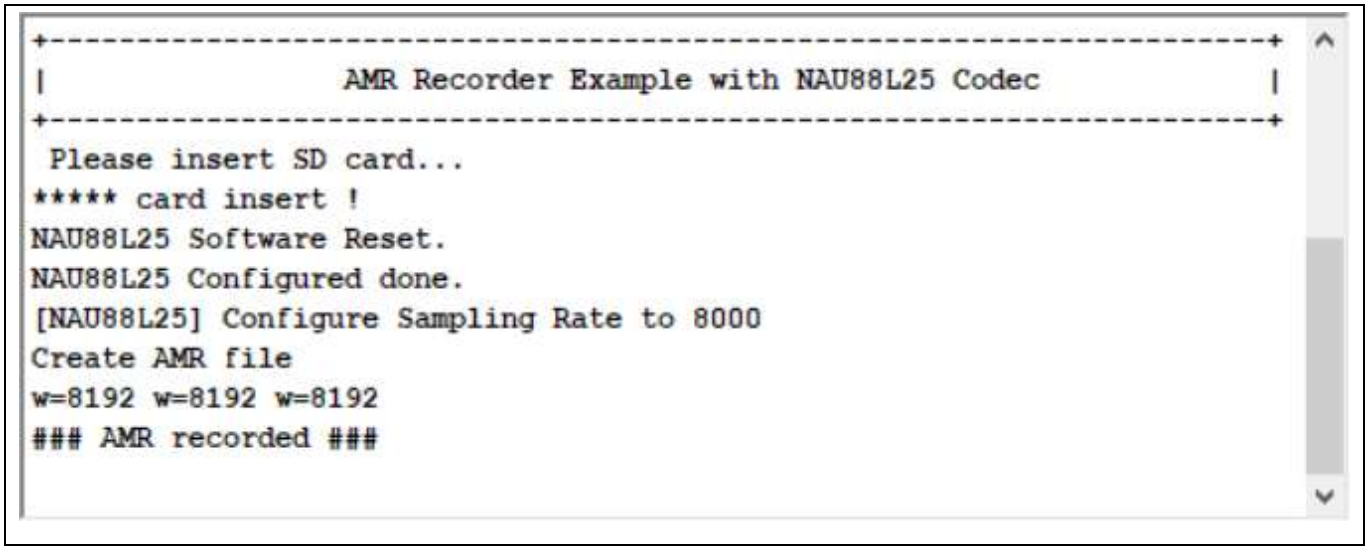

圖 1-1 執行結果

2 代碼介紹

因為 AMR 編解碼庫動態分配記憶體，因此必須為 heap 保留更多記憶體。 項目檔案已經為 heap 設定了 8K 位元組。 如果創建新項目，請記住將以下設定添加到項目中。

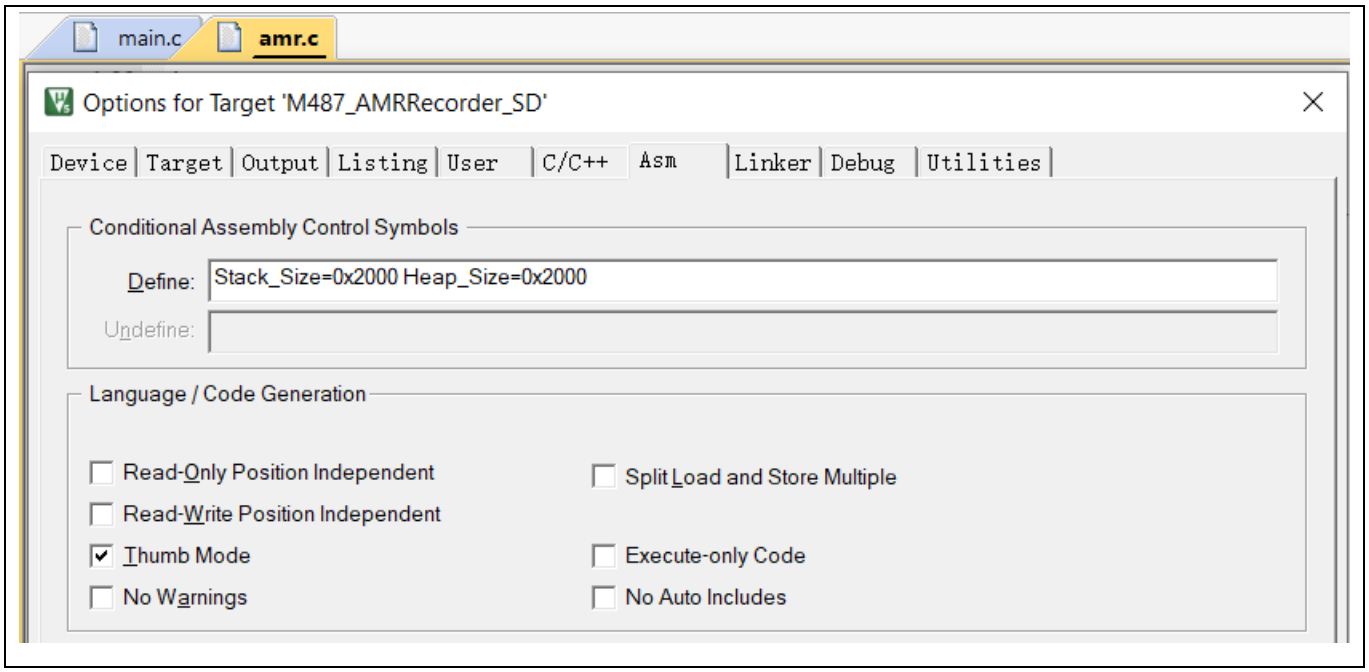

圖 2-1 堆棧設定

首先，在main. c中初始化M487。 初始I²C、SDH、UART。 然後，調用AMRRecoder函數。

```
int32_t main(void)
{
    TCHAR sd_path[] = { '0', ':', 0 };    /* SD drive started from 0 */

    /* Init System, IP clock and multi-function I/O */
    SYS_Init();

    /* Init I2C2 to access WAU88L25 */
    I2C_Init();

    /* Init SD */
    SD_Inits();

    /* Init UART to 115200-8n1 for print message */
    UART_Open(UART0, 115200);

    printf("+-----------------------------------------------------------------------+\n");
    printf("|                 AMR Recorder Example with NAU88L25 Codec              |\n");
    printf("+-----------------------------------------------------------------------+\n");
    printf(" Please insert SD card... \n");

    while (1)
    {
        if (SDH_Open_Disk(SDH0, CardDetect_From_GPIO) == Successful)
        {
            break;
        }
    }

    /* set default path */
    f_chdrive(sd_path);

    while(SD0.IsCardInsert != TRUE);

    /* Recording to AMR format audio */
    AMRRecoder();

    while (1);
}
```

初始化 I²S 和 NAU88L25。創建 AMR 文件，開始錄製 20 秒的聲音。

```
void AMRRecoder(void)
{
    /* Reset NAU88L25 codec */
    NAU88L25_Reset();

    /* Open I2S0 interface and set to slave mode, mono channel, I2S format */
    I2S_Open(I2S0, I2S_MODE_SLAVE, 8000, I2S_DATABIT_16, I2S_ENABLE_MONO, I2S_FORMAT_I2S);
    NVIC_EnableIRQ(I2S0_IRQn);

    /* Set MCLK and enable MCLK */
    I2S_EnableMCLK(I2S0, 12000000);
    I2S0->CTL0 |= I2S_CTL0_ORDER_Msk;

    /* Initialize NAU88L25 codec */
    CLK_SysTickDelay(20000);
    NAU88L25_Setup();

    /* Configure NAU88L25 to specific sample rate */
    NAU88L25_ConfigSampleRate(8000);

    /* Init AMR codec */
    amrInitEncode();

    /* Create AMR file */
    amr_recorder_th(AMR_REC_FILE);

    /* record 20 seconds then close file */
    amr_recorder_bh(20);

    /* Clean AMR codec */
    amrFinishEncode();
}
```

3 軟體與硬體需求

3.1 軟體需求

- BSP 版本
  - M480_BSP_CMSIS_V3.05.003
- IDE 版本
  - Keil uVersion 5.36

3.2 硬體需求

- 電路元件
  - NuMaker-PFM-M487 V3.0
  - 3.5mm 耳機附麥克風
  - Micro SD 卡用於檔存儲

4 目錄資訊

EC_M487_AMRRecorder_SD_V1.00	
Library	Sample code header and source files
CMSIS	Cortex® Microcontroller Software Interface Standard (CMSIS) by Arm® Corp.
Device	CMSIS compliant device header file
StdDriver	All peripheral driver header and source files
SampleCode	
ExampleCode	Source file of example code
ThirdParty	
FatFs	A generic FAT file system module for small embedded systems. Its official website is: http://elm-chan.org/fsw/ff/00index_e.html.
LibAMR	The AMR codec library supports Narrow Band of AMR encode and decode.

圖 4-1 目錄資訊

5 範例程式執行

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 *M487_AMRRecorder_SD*.uvproj。
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
   c. 進入 / 離開除錯模式
3. 進入除錯模式介面
   a. 執行代碼

6 修訂紀錄

Date	Revision	Description
2022.03.15	1.00	1. 初始發布.

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