M487录制AMR文件到SD卡

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

应用简述	此示例代码使用 M487 和外部音频编解码器 NAU88L25 录制并编码成 AMR 音频文件存储在 Micro SD 卡中。
BSP 版本	M480_BSP_CMSIS_V3.05.003
开发平台	NuMaker-PFM-M487 V3.0

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1 概述

此示例代码使用外部音频编解码器 NAU88L25 从耳机麦克风录制声音，通过 AMR 编解码库对其进行编码，存储到 Micro SD 卡。默认文件名为“rec.amr”，位于 Micro SD 卡的根目录下。

录制的 AMR 文件支持单声道模式。数据长度为 16 位，采样率为 8 kHz。

1.1 执行结果

当示例代码开始运行时，会从麦克风录制 20 秒的声音。若要播放录制的文件，可使用 M487_AMRPlayer_SD 示例代码播放。演示结果如下所示。

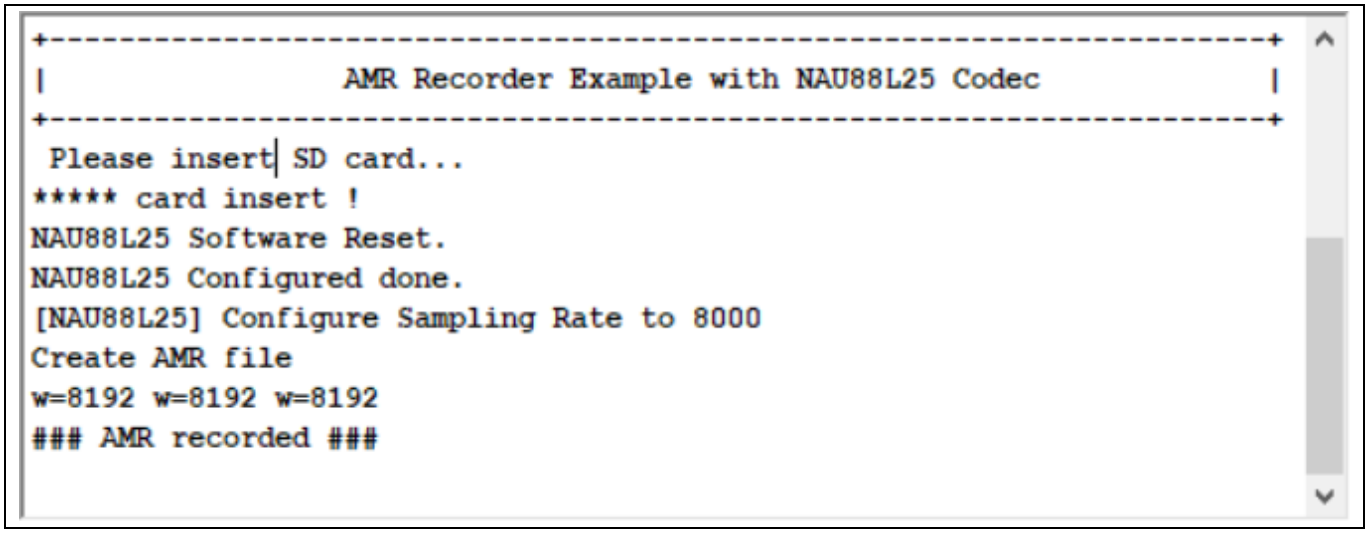

图 1-1 执行结果

2 代码介绍

因为 AMR 编解码库动态分配内存，所以必须为 heap 保留更多内存。项目文件已经为 heap 设置了 8K 字节。如果创建新项目，请记住将以下设置添加到项目中。

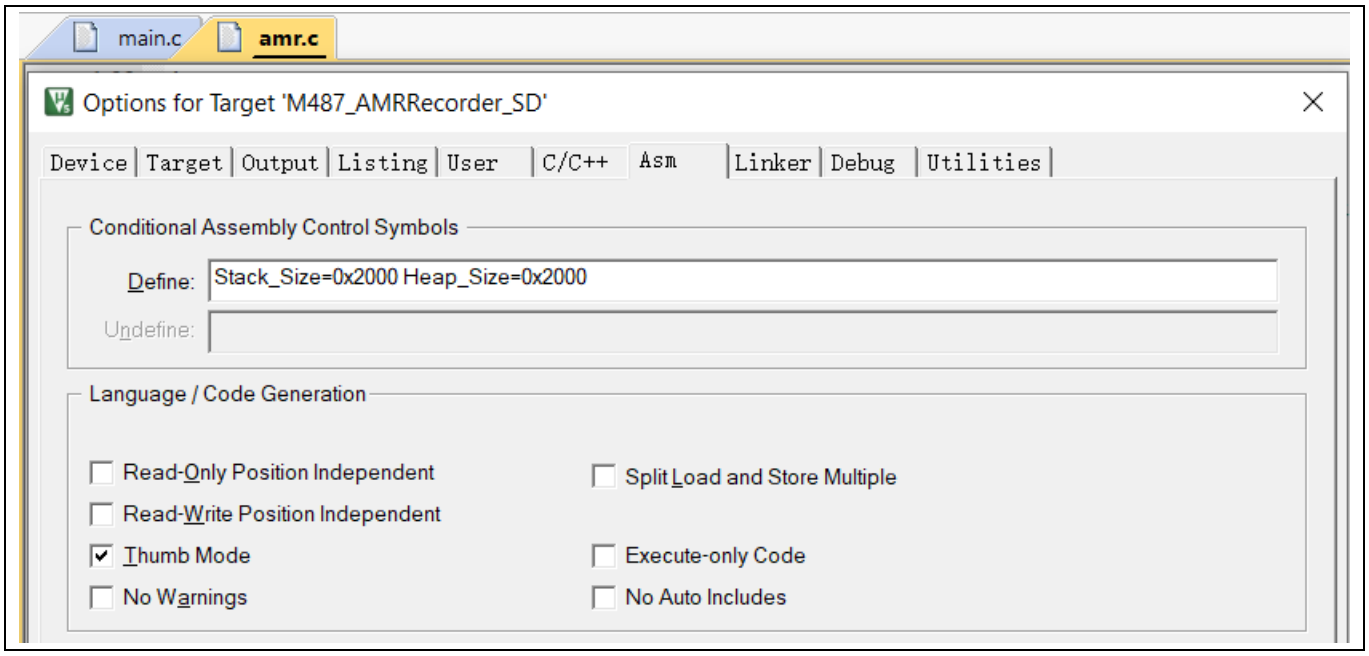

图 2-1 堆栈设置

首先，在 main.c 中初始化 M487。 初始 I²C、SDH、UART。然后，调用 AMRRecoder 函数。

```
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 I²S 和 NAU88L25。创建 AMR 文件，开始录制 20 秒的声音。

```
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 软件与硬件需求

3.1 软件需求

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

3.2 硬件需求

- 电路组件
  - NuMaker-PFM-M487 V3.0
  - 3.5mm 带麦克风的耳机
  - Micro SD 卡用于文件存储

4 目录信息

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.

图 4-1 目录信息

5 范例程序执行

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，双击 *M487_AMRRecorder_SD*.uvproj。
2. 进入编译模式界面
   a. 编译
   b. 下载代码至内存
   c. 进入 / 离开仿真模式
3. 进入仿真模式界面
   a. 执行代码

6 修订纪录

Date	Revision	Description
2022.03.15	1.00	1. 初始发布.

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