M487播放SD卡中的AMR文件

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 解码并播放 Micro SD 卡中的 AMR 音频文件。
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 M487 和外部音频编解码器 NAU88L25 解码并播放存储在 Micro SD 卡中的 AMR 音频文件。运行程序前，用户需要将 AMR 文件存储到 Micro SD 卡中，并将 Micro SD 卡插入 NuMaker-PFM-M487 板上的卡槽。

注：已经预先存放一个 AMR 文件 audio.amr 到如下文件路径下，测试时，用户可以将其拷贝到 Micro SD 卡中。

“EC_M487_AMRPlayer_SD_V1.00\SampleCode\ExampleCode\M487_AMRPlayer_SD”

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

1.1 执行结果

执行结果，以及打印数据。

```
+------------------------------------------------------------------------+
|                   AMR Player Example with NAU88L25 Codec               |
+------------------------------------------------------------------------+
 Please put AMR files on SD card
 Please insert SD card...
***** card insert !
====[AMR Info]======
FileSize 282150 bytes
AMR Mode 7
PacketSize 32 bytes
PlayTime 176 s
====================
NAU88L25 Software Reset.
NAU88L25 Configured done.
[NAU88L25] Configure Sampling Rate to 8000
Start AMR playing ...
Start Playing ...
Stop ...
```

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。

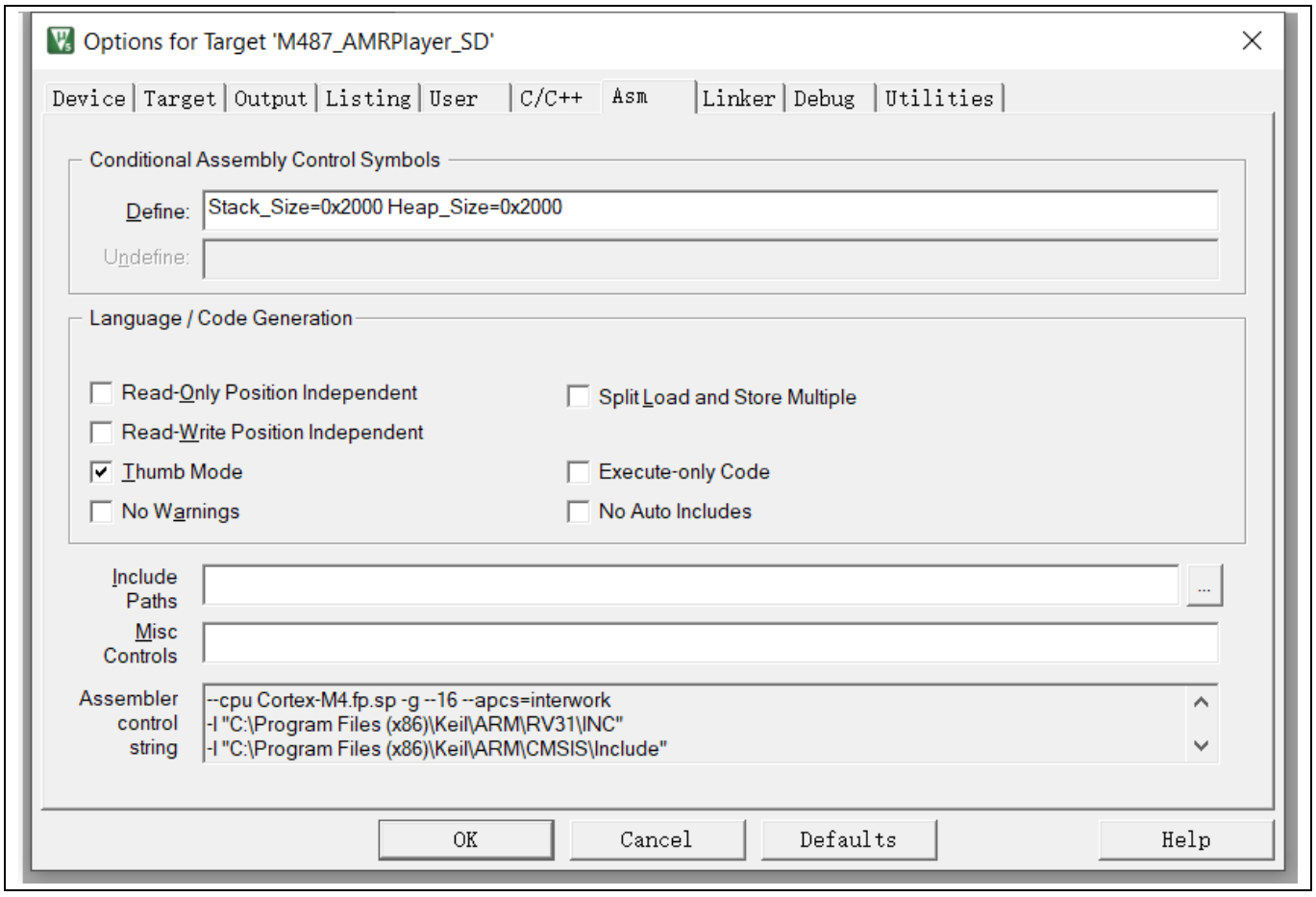

图 2-1 堆栈设置

在main.c中初始化M480。初始化I²C、UART、SDH。然后，调用AMRPlayer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 I2C 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 Player Example with NAU88L25 Codec                 |\n");
    printf("+------------ ----------------------------------------------------------+\n");
    printf(" Please put AMR files on SD card \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);

    /* Set PE.13 low to enable phone jack on NuMaker board. */
    GPIO_SetMode(PE, BIT13, GPIO_MODE_OUTPUT);
    PE13 = 0;
    AMRPlayer();
    while (1);
}
```

解码 AMR 文件并将音频数据复制到两个通道。

```
if (u8StreamPending == FALSE)
{
    if (!f_eof(&amrFileObject))
    {
        f_read(&amrFileObject, u8amr_buf, packet_size, &ReturnSize);

        if (ReturnSize != packet_size)
        {
            // should not happen. clean the packet.
            printf("ERROR: AMR packet error. Ignore it.\n");
            memset(u8amr_buf, 0, packet_size);
        }

        /* Decode AMR file */
        amrDecode(u8amr_buf, (short *)DecodeBuffer);

        u8StreamPending = TRUE;
    }
    else
    {
        break;
    }
}
else
{
    while (g_u8PCMBuffer_Full[u8PCMBufferTargetIdx]);

    /* Duplicate audio data to two channels */
    p = (u8PCMBufferTargetIdx) ? (g_u16PCMBuffer[1]) : (g_u16PCMBuffer[0]);

    for (i = 0; i < AMR_FRAME_SIZE; i++)
    {
        *p++ = DecodeBuffer[i];
        *p++ = DecodeBuffer[i];
    }

    NVIC_DisableIRQ(I2S0_IRQn);
    g_u8PCMBuffer_Full[u8PCMBufferTargetIdx] = 1;
    NVIC_EnableIRQ(I2S0_IRQn);

    u8PCMBufferTargetIdx ^= 1;

    u8StreamPending = FALSE;
}
```

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 耳机
  - Micro SD 卡用于文件存储
- 示意图

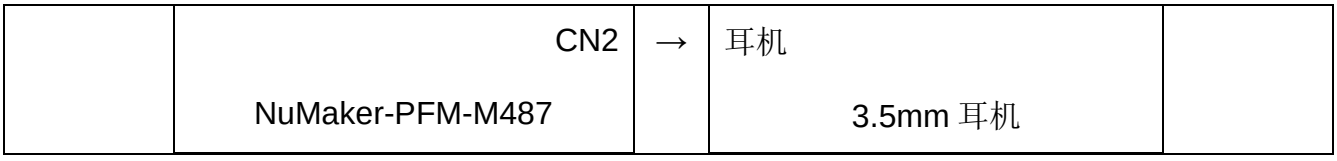

图 3-1 M487 与耳机连接图

4 目录信息

EC_M487_AMRPlayer_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_AMRPlayer_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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