Using M487 to Record AMR File to MicroSD Card

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	This example code uses the M487 microcontroller and external audio codec NAU88L25 to record sound in AMR format into a MicroSD card.
BSP Version	M480_BSP_CMSIS_V3.05.003
Hardware	NuMaker-PFM-M487 V3.0

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1 Overview

This example code uses external audio codec NAU88L25 to record sound from headphone mic, encode it by an AMR codec library, and store it in a MicroSD card. The default file name “rec.amr” is located at a root directory of MicroSD card.

The recorder AMR file supports mono mode. The data length is 16 bits and sampling rate is 8 kHz.

1.1 Demo Result

When the example code is started, it records 20 seconds sound from mic. To play the recorded file, use the M487_AMRPlayer_SD example code to play it. The demo result is shown below.

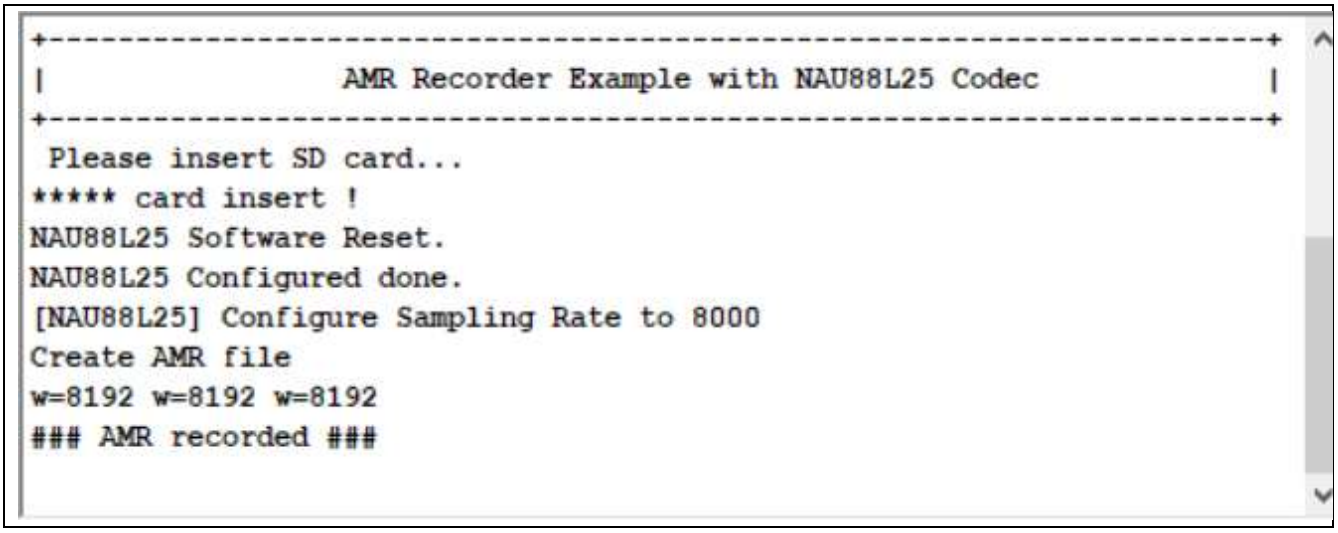

Figure 1-1 Demo Result

2 Code Description

Because the AMR Codec library allocates memory dynamically, it has to reserve more memory for heap. The project file has been set as 8 Kbytes for heap. If you create a new project, remember to add the following setting to your project.

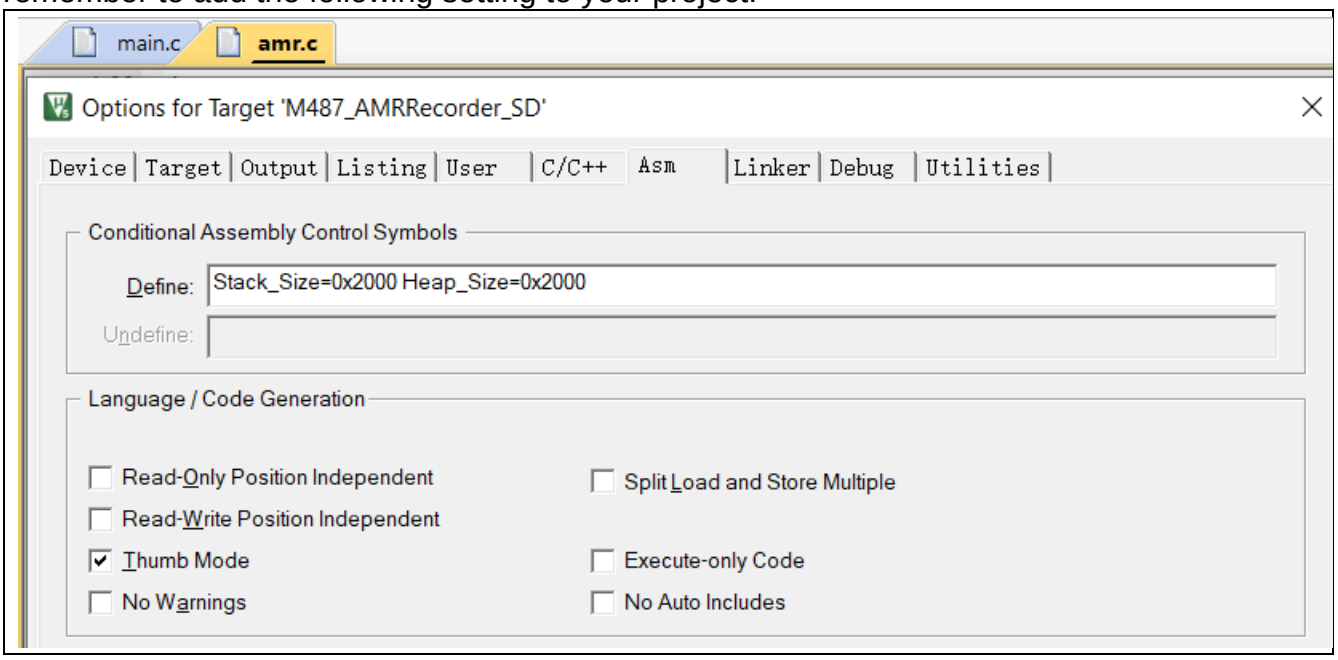

Figure 2-1 Heap Size Settings

Initialize the M487 in main.c, and initialize I²C, SDH, and UART. Then, call AMRRecoder function.

```
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 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);
}
```

Next, initialize I²S and NAU88L25. Create an AMR file, and start recording 20 seconds sound.

```
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 Software and Hardware Requirements

3.1 Software Requirements

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

3.2 Hardware Requirements

- Circuit components
  - NuMaker-PFM-M487 V3.0
  - 3.5mm Headphones with mic
  - A MicroSD card used for file storage

4 Directory Information

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.

Figure 4-1 Directory Structure

5 Example Code Execution

1. Browse the ExampleCode folder as described in the Directory Information section and double-click *M487_AMRRecorder_SD.uvproj*.
2. Enter Keil compile mode.
   - Build
   - Download
   - Start/Stop debug session
3. Enter debug mode.
   - Run

6 Revision History

Date	Revision	Description
2022.03.15	1.00	1. Initially issued.

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