HOLTEK HT32 Voice Tool User Guide

Contents

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1. Development Environment

1.1 Overall Environment

Combine HT32 Development Board with ESK32-A9A21
Voice Expansion Board, and Connect It to PC

ESK32-A9A21 Voice Expansion Board
+
HT32 Development Board

HT32 Development Board Combined with ESK32-A9A21
Voice Expansion Board Schematic Diagram
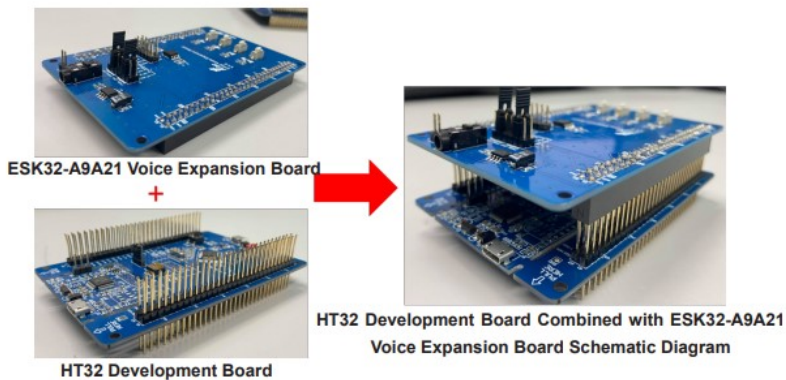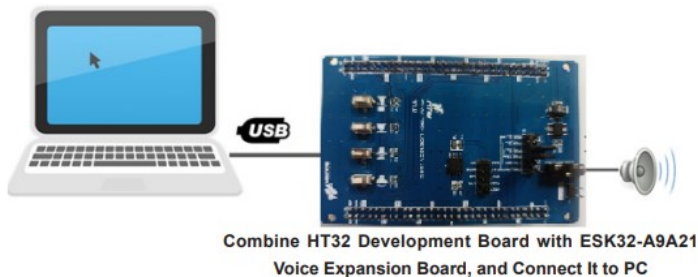
I. HT32 Voice Tool
Development Board Speaker
II. KeilTM MDK-ARM

1.2 Software

This includes the HT32 Voice Tool and the KeilTM MDK-ARM μVision5.

1.2.1 HT32 Voice Tool

- MCU selection, external SPI Flash Memory capacity selection, loading and setting voice WAV, sentence configuration settings.
- MCU program compiling, SPI Flash data compiling and MCU/SPI Flash data downloading function.

1.2.2 KeilTM MDK-ARM μVision5

- The KeilTM MDK-ARM μVision5 is used to set and view the source code, which can be downloaded to the development board.
- The HT32 Voice Tool is required with the KeilTM MDK-ARM μVision5. Ensure that the KeilTM MDK-ARM μVision5 and KeilTM HT32 support packages have been installed before using the HT32 Voice Tool.

1.3 Hardware

The development board is used together with the HT32 Voice Tool for development.
(The following HT32 development board product No. can be used together with HT32 Voice Tool.)
HT32F52341
HT32F52241
HT32F52253
HT32F52354
HT32F52367
HT32F50343
HT32F52352
HT32F50241
HT32F57341
HT32F57352
HT32F0008
HT32F12366
HT32F12345
HT32F12364

1.3.1 Development Board Introduction

HT32 Development Board Introduction
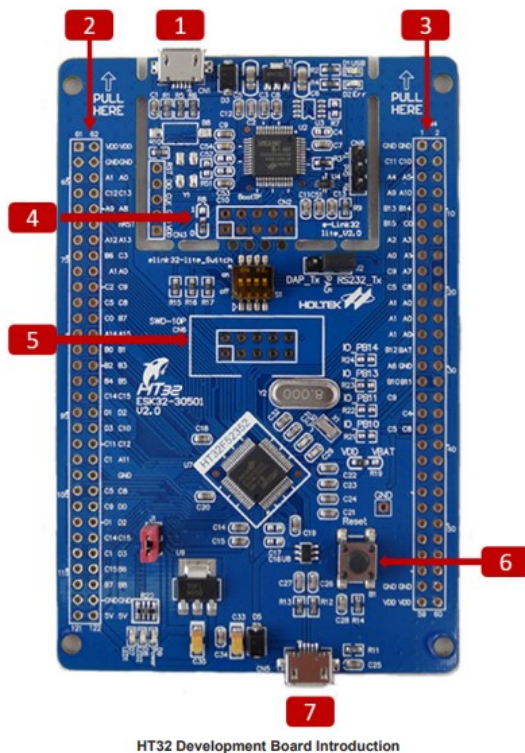
1. USB_B: e-Link32 Lite – for downloading program/data and emulation
2. GPIO / Expansion connector

3. GPIO / Expansion connector

4. Download connector

5. SWD-10P connector

6. Reset key

7. USB_A: HT32F0006 USB interface

Voice Expansion Board Introduction
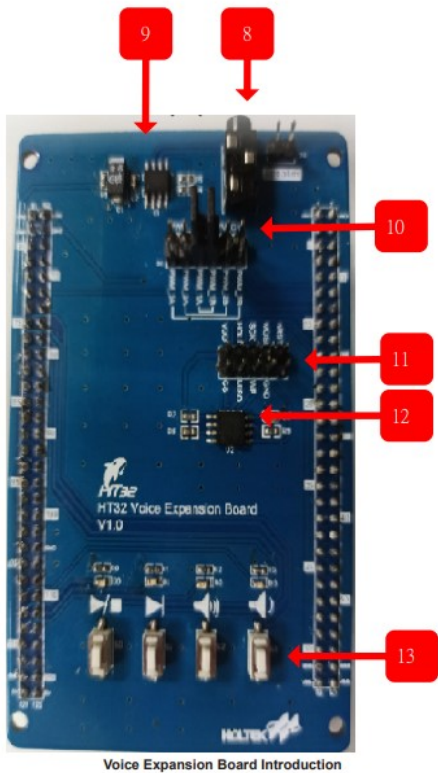
8. Speaker output jack

9. HT82V742 amplifier IC

10. PWM output selection

11. SPI interface

12. SPI Flash

13. Demo function keys

1.3.2 Hardware Output Resources

The MCU product No. based around an M0+ processor core, PWM Timer, PWM I/O and SPI pins are shown in the following table.

	Timer	Supported IC	PWM I/O	SPI (SCK/MOSI/MISO/CS)

M0+	GPTM 0	HT32F52341	PA5/PA7 (PWM 2A/PWM 2B)	PA0/PA1/PA2/ PB9 (Program output signal)
		HT32F52241	A5/A7(PWM B) (PWM 2 A/PWM 2B)	PA0/PA1/PA2/ PB9 (Program output signal)
		HT32F52253	PA2/PA3 (PWM 1A/PWM 1B)	PB3/PB4/PB5/PA7
		HT32F52354	PC4/PC5 (PWM 1A/PWM 1B)	PA0/PA1/PA2/PA7
		HT32F52367	PC4/PC5 (PWM 1A/PWM 1B)	PD11/PD12/PD13/PD5
		HT32F50343	PC4/PA3 (PWM 1A/PWM 1B)	PB3/PB4/PB5/PC5
	GPTM 1	HT32F52352	PA2/PA3 (PWM 1A/PWM 1B)	PC5/PC8/PC9/PA7

	PWM 1	HT32F50241	PC4/PC5 (PWM 1A/PWM 1B)	PB3/PB4/PB5/PA7
		HT32F57341	PD4/PD5 (PWM 1A/PWM 1B)	PC5/PC8/PC9/PC4
		HT32F57352	PD4/PD5 (PWM 1A/PWM 1B)	PC5/PC8/PC9/PD7
		HT32F0008	PC4/PC5 (PWM 1A/PWM 1B)	PA0/PA1/PA2/PA7

The MCU product No. based around an M3 processor core, PWM Timer, PWM I/O and SPI pins are shown in the following table.

	Timer	Supported IC	PWM I/O	SPI (SCK/MOSI/MISO/CS)
M3	MCTM1	HT32F12366	PE1/PE5 (PWM 1A/PWM 1B)	PD10/PD11/PD12/PD6
	GPTM 1	HT32F12345	PA0/PA1 (PWM 3A/PWM 3B)	PC10/PC11/PC12/PC9
	GPTM 0	HT32F12364	PC9/PC10 (PWM 1A/PWM 1B)	PA4/PA5/PA6/PA1

2. HT32 Voice Tool Main Interface

2.1 Software Functions Introduction

1. New project/Open project /Save project
2. Function setting(Voice/Sentence)
3. Generate the corresponding project
4. Download functions: download the generated project to an internal Flash or external SPI Flash
5. Interface language switching: supports three language options which are English, Simplified Chinese and Traditional Chinese
6. "About": Display software version information

3. New Project

3.1 New Project
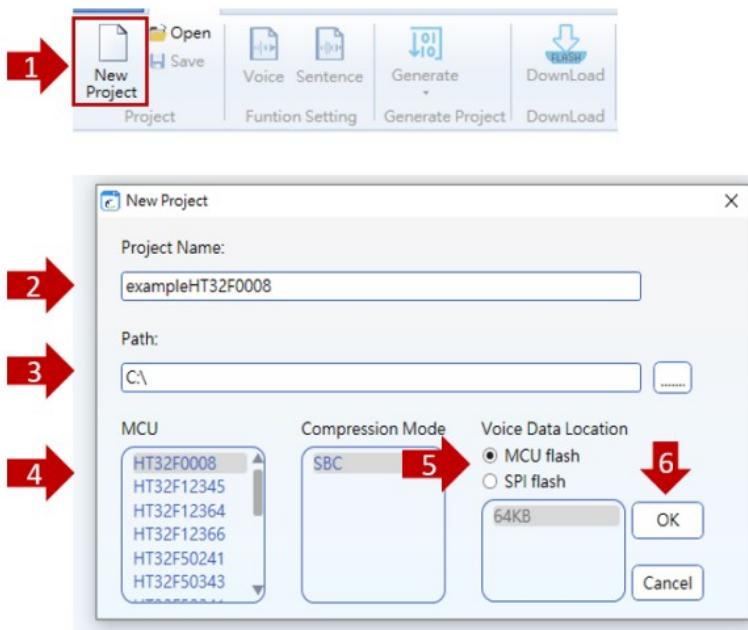
Step 1: Click the "New Project" icon
Step 2: Set the project name
Step 3: Set the project path
Step 4: Select the MCU
Step 5: Select the voice data location
Step 6: Click the "OK" button

3.2 Voice Configuration

3.2.1 Function Introduction

Step 1: Click the "Voice" icon
Step 2: Click the button to delete the WAV
Step 3: Click the button to load the WAV into the project
Step 4: Select the WAV file to add

3.2.2 WAV file sampling rate limitation

HT32F0008 => 6kHz ~ 16kHz
HT32F12345 => 6 kHz ~ 44.1kHz
HT32F12364 => 6kHz ~ 44.1kHz
HT32F12366 => 6kHz ~ 44.1 kHz
HT32F50241 => 6kHz ~ 11.025kHz
HT32F50343 => 6kHz ~ 22.05kHz
HT32F52241 => 6kHz ~ 22.05kHz
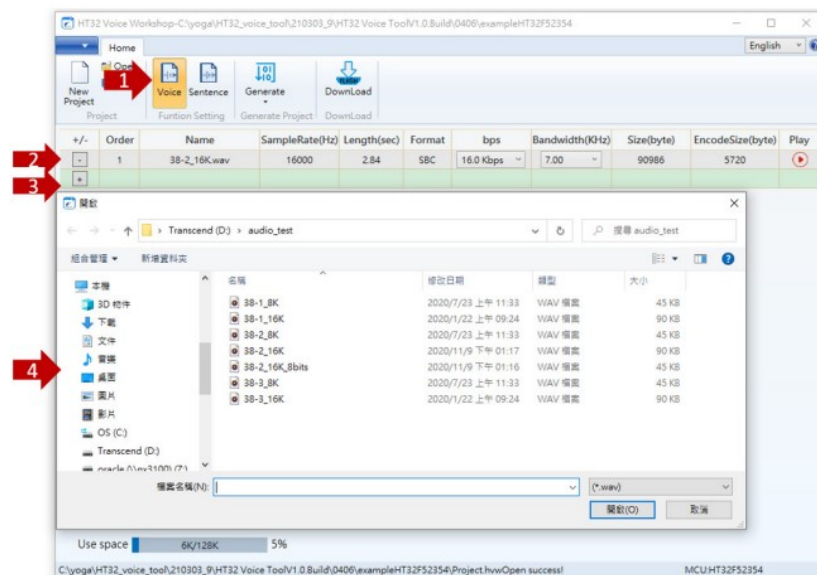HT32F52253 => 6kHz ~ 22.05kHz
HT32F52341 => 6kHz ~ 16kHz
HT32F52352 => 6kHz ~ 32kHz
HT32F52354 => 6kHz ~ 16kHz
HT32F52367 => 6kHz ~ 22.05kHz
HT32F57341 => 6kHz ~ 22.05kHz
HT32F57325 => 6kHz ~ 22.05kHz

When the sampling rate exceeds the limitation, it will be automatically re-sampled to the highest or lowest sampling rate.

3.3 Sentence Configuration

3.3.1 Function Introduction 1

Step 1: Click the "Voice" icon
Step 2: Select the WAV file to add

3.3.2 Function Introduction 2

Step 1: Click the "Sentence" icon
Step 2: Click the button to add a new sentence
Step 3: Click the button to delete the sentence
Step 4: Select the sentence1 to configure the sentence1 content
Step 5: New action
Step 6: Delete an action
Step 7: Set the action and select "Play Voice/Mute"
Step 8: Set the voice/mute time

3.3.3 Function Introduction 3
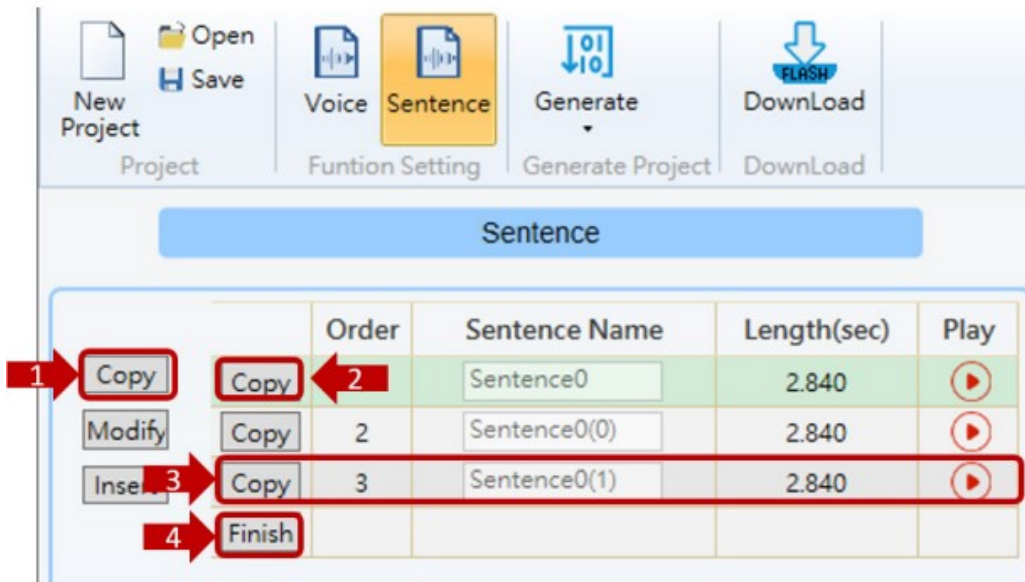
Step 1: Copy sentence function
Step 2: Click the button to copy the Sentence0
Step 3: Automatically insert the copied sentence (Sentence0(1))
Step 4: Click the "Finish" button to finish the settings
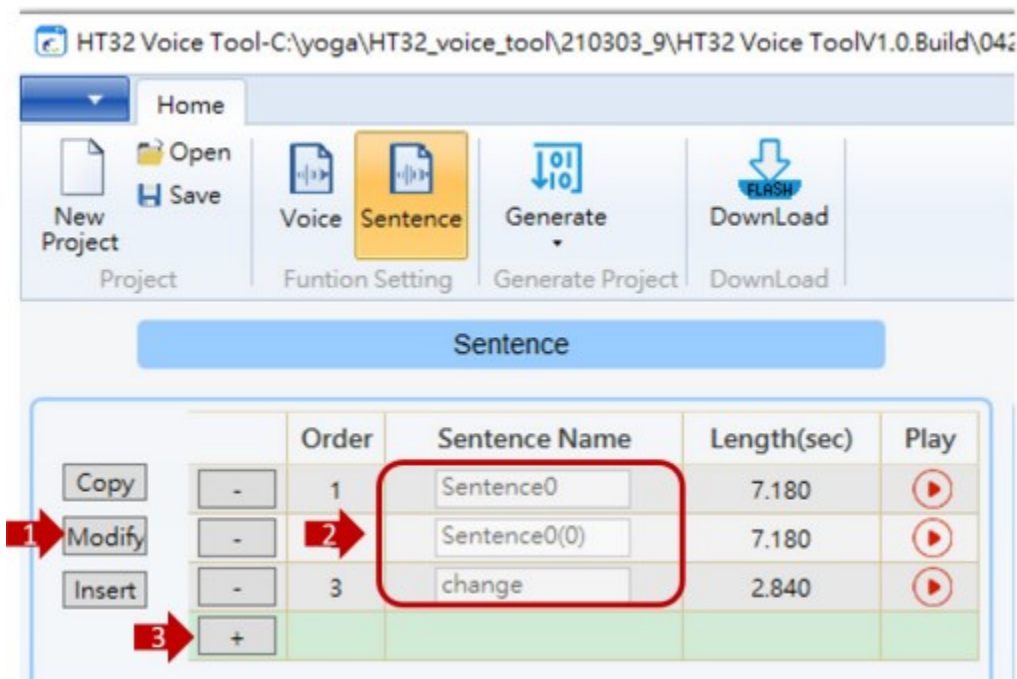
Step 1: Modify the sentence name function
Step 2: Modify the sentence name
Step 3: Click the "Finish" button to finish the settings
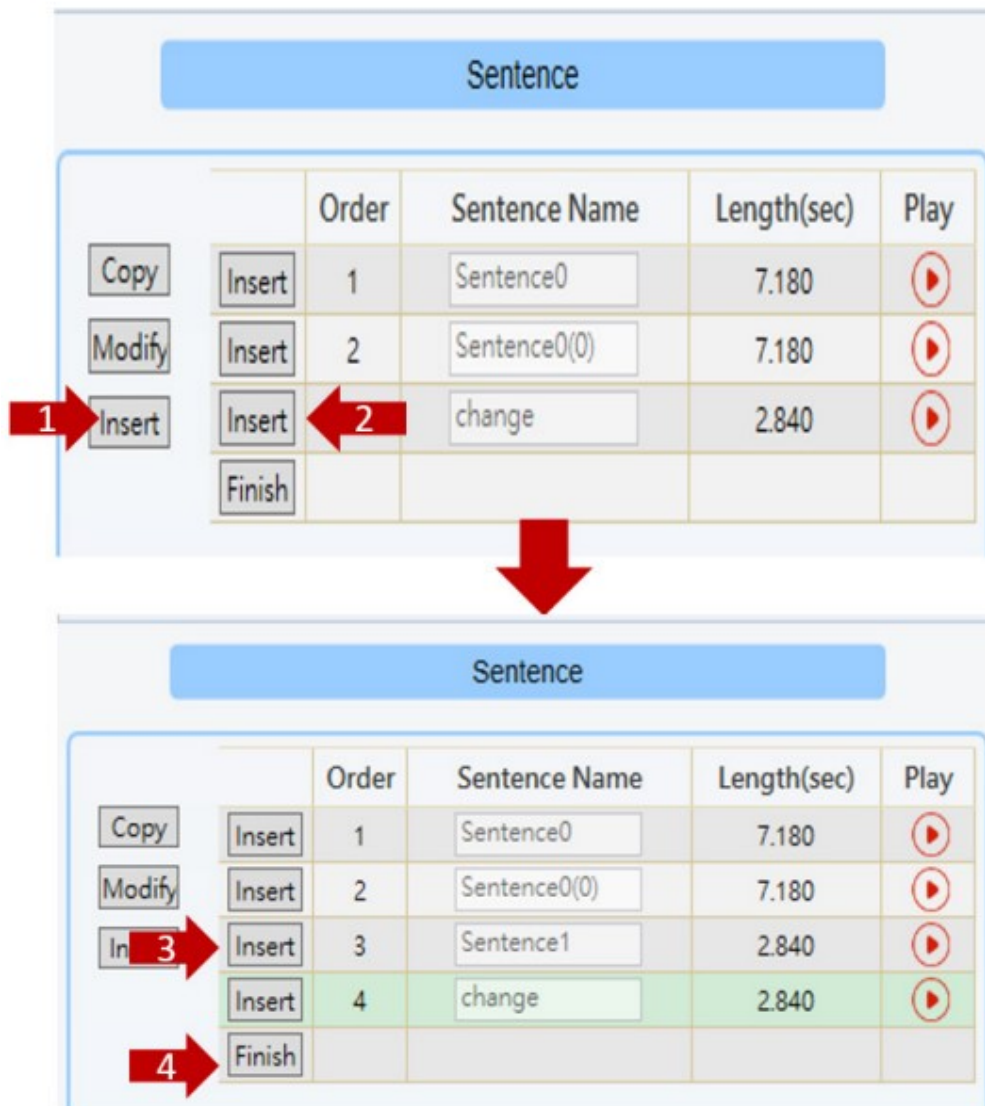
Step 1: Insert sentence function
Step 2: Click the button to insert the sentence
Step 3: Automatically insert a sentence (Sentence1)
Step 4: Click the "Finish" button to finish the settings

3.4 Generate Project and HT32 Voice Data

Step 1: Click the "Generate" icon
Step 2: Select [set keil path].
Step 3: Select the keil path

3.5 Download Function

3.6 Open Project

Users can open or switch to the HT32 Voice project by clicking the "Open" icon.
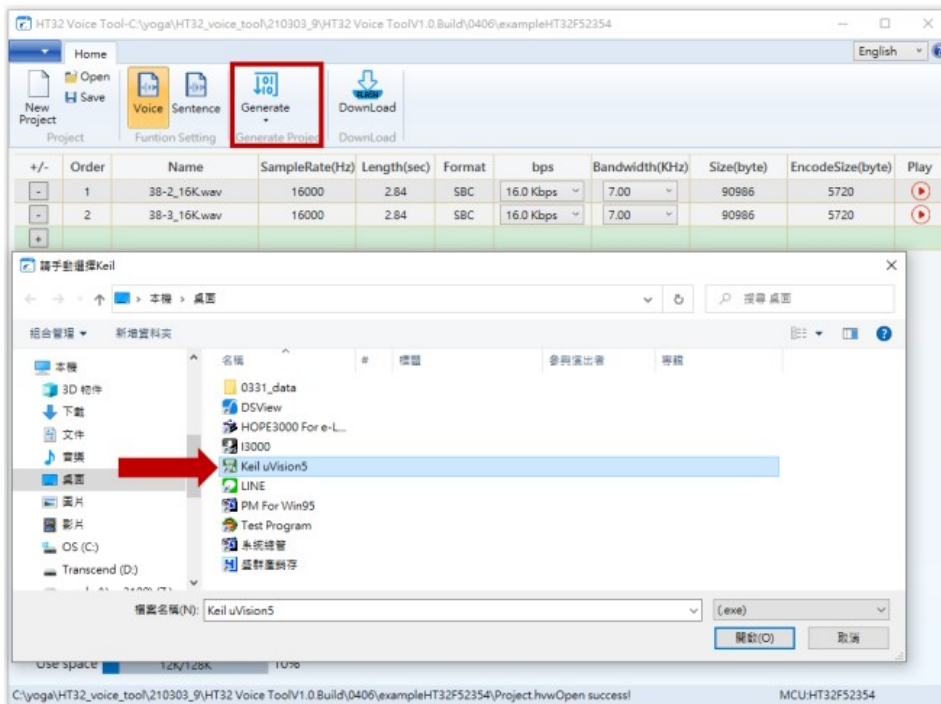
Step 1: Click the "Open" icon
Step 2: Select the project "xxxx.hvw" to open (the last saved project path is used automatically by default), such as Project.hvw
Step 3: Click the "Open" icon to enter the operating interface to complete the open project
Step 4: When opening the project, the project path is shown in the information column below

4. Function Library Description

4.1 Voice Library Description

The voice library contains three files in the following table.

File Name	Description
HT32Voice.lib	Voice library
VOICELib.h	Variables and function declarations used in library functions
typedef.h	Variable type definitions used in the project

4.2 Play Functions

Functions	Description
void VOICE_VolumeDown(void)	The volume turns down a step
void VOICE_VolumeUp(void)	The volume turns up a step
void VOICE_Stop(void)	Stop playing voice
void SENTENCE_Stop(void)	Stop playing sentence
FlagStatus VOICE_Finish(void)	Finish playing voice
void VOICE_Resume(void)	Resume playing voice
void VOICE_Pause(void)	Pause playing voice
void PLAY_SENTENCE(u32 index, u32 volume)	Play sentence
void PLAY_VOICE(u32 index, u32 volume)	Play voice

4.2.1 Play Functions (User Function) void VOICE_VolumeDown(void)

Description: The volume turns down a step void VOICE_VolumeUp(void)
Description: The volume turns up a step void VOICE_Stop(void)
Description: Stop playing voice void SENTENCE_Stop(void)
Description: Stop playing sentence
FlagStatus VOICE_Finish(void)
Description: Determine if the voice has finished playing void VOICE_Resume(void)

Description: Resume playing voice void VOICE_Pause(void)
Description: Pause playing voice void PLAY_SENTENCE(u32 index, u32 volume)
Description: Play sentence
Parameters: u32 index: Which sentence to add when entering a sentence
(HT32 voice tool number starting with 1, the program number starting with 0) u32 volume: The input function volume value (the number ranges from 0 to 88, the minimum voice volume value is 0, and the maximum voice volume value is 88), determine the volume when the sentence is played. void PLAY_VOICE(u32 index, u32 volume)
Description: Play voice Parameters: u32 index: Which voice to add when entering a voice
(HT32 voice tool number starting with 1, the program number starting with 0) u32 volume:
The input function volume value(the number ranges from 0 to 88, the minimum voice volume value is 0, and the maximum voice volume value is 88), determine the volume when the voice is played.

4.3 Other Descriptions

4.3.1 Resource Occupancy

- The voice library is suitable to HT32 MCU. Two points should be noted when selecting an MCU:

  1.Basic frequency: note that if the decoding speed of a frame of voice is less than play speed, a play error will occur. The length of a frame = 320/Sample Rate(s)

  2. Flash: Pay attention to the voice resource capacity and ensure that there is no overflow of internal Flash or selecting external Flash.

	Resource Type	Capacity
Decode	Flash	about 15 KB
	SRAM	about 3.5 KB

4.3.2 Voice Decoding Speed

Taking the HT32F52354 as an example, measure the decoding speed of a frame of 320-bit voice data.
• The decoding speed of a frame of voice is shown in the following table.

Frame-Format	Basic Frequency (48 MHz)	Basic Frequency (40 MHz)	Basic Frequency (20 MHz)
160-bit	4.7 ms	5.7 ms	11.3 ms
240-bit	4.9 ms	5.9 ms	11.8 ms
320-bit	5.0 ms	6.0 ms	12.0 ms
480-bit	5.2 ms	6.3 ms	12.5 ms
640-bit	5.4 ms	6.5 ms	13.0 ms

5. Appendix

5.1 Program Flow

Provide a program flow for reference in the following diagram
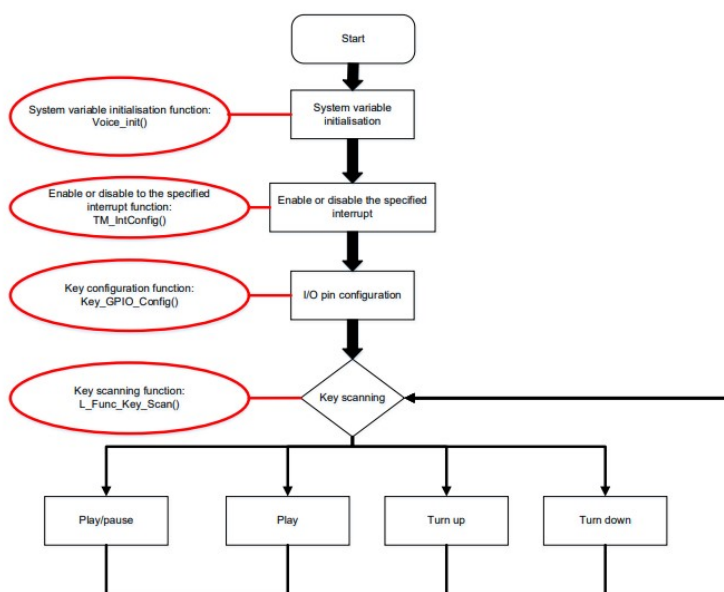
5.2 Development Board Schematic Diagram
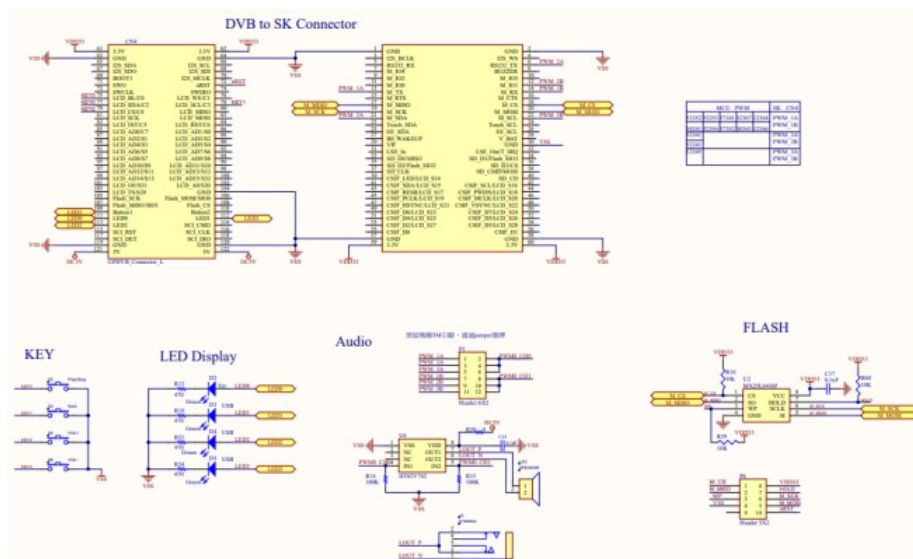
	Supported IC	SK CN4	Pin
	HT32F52341	PWM 2A/PWM 2B	6/12
	HT32F52241	PWM 2A/PWM 2B	6/12
	HT32F52253	PWM 1A/PWM 1B	13/14
	HT32F52354	PWM 1A/PWM 1B	13/14
	HT32F52367	PWM 1A/PWM 1B	13/14
	HT32F50343	PWM 1A/PWM 1B	13/14

M0+			
	HT32F52352	PWM 1A/PWM 1B	13/14
	HT32F50241	PWM 1A/PWM 1B	13/14
	HT32F57341	PWM 1A/PWM 1B	13/14
	HT32F57352	PWM 1A/PWM 1B	13/14
	HT32F0008	PWM 1A/PWM 1B	13/14

	Supported IC	**SK CN4**	**Pin**
M3	HT32F12366	PWM 1A/PWM 1B	13/14
	HT32F12345	PWM 3A/PWM 3B	21/22
	HT32F12364	PWM 1A/PWM 1B	13/14

5.3 Modify Timer Settings for Teaching
5.3.1 Call PWM_CONFIG

- Modify the registers and interrupt settings according to the memory map section in this user manual.

```
]#if defined(HT32F52353)||defined(HT32F52253)||defined(USE_HT32F52353)||defined(USE_HT32F52253)||defined(USE_HT32F52243_53)
    #define Timer_PWM1_GPIO_Type        PWMFROMPA
    #define Timer_PWM1_GPIO_Num         GPIO_PIN_2//GPIO_PIN_0
    #define Timer_PWM1_AF_Type          AFIO_MODE_4
    #define Timer_PWM1_CHx_Type         TM_CH_2
    #define Timer_PWM1_Mode_Type        TM_OM_PWM1
    #define Timer_PWM2_GPIO_Type        PWMFROMPA
    #define Timer_PWM2_GPIO_Num         GPIO_PIN_3 //GPIO_PIN_1
    #define Timer_PWM2_AF_Type          AFIO_MODE_4
    #define Timer_PWM2_CHx_Type         TM_CH_3
    #define Timer_PWM2_Mode_Type        TM_OM_PWM1
    #define Timer_IRQ_Type              GPTM0_IRQn
#define SPI_PORT        (0)
#define SPI_SCK_PORT    (1)
#define SPI_SCK_PIN     (3)
#define SPI_MOSI_PORT   (1)
#define SPI_MOSI_PIN    (4)
#define SPI_MISO_PORT   (1)
#define SPI_MISO_PIN    (5)
#define SPI_SEL_PORT    (0)
#define SPI_SEL_PIN     (7)
#define SPI_CLK_DIV     (2)
#define HT_SPIx                 ((HT_SPI_TypeDef *) HT_SPI0_BASE)
#define Timer_Flag              2
#define Timer_ADDR              0x4006e000
#define Timer_ADDR1             0x4006e000
#define VOICE_TM_IRQHandler     GPTM0_IRQHandler
```
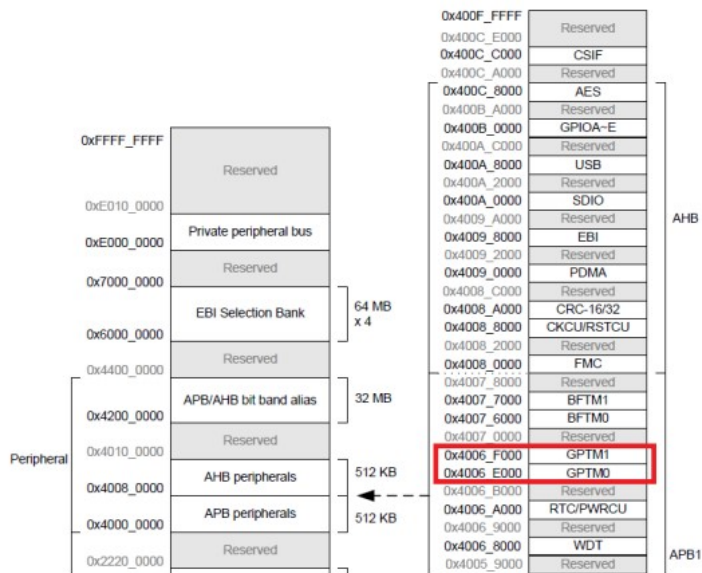
MEMORY MAP

5.3.2 Modify the pin settings according to the pin assignment in datasheet

```
]#if defined(HT32F52353)||defined(HT32F52253)||defined(USE_HT32F52353)||defi
    #define Timer_PWM1_GPIO_Type        PWMFROMPA
    #define Timer_PWM1_GPIO_Num         GPIO_PIN_2//GPIO_PIN_0
    #define Timer_PWM1_AF_Type          AFIO_MODE_4
    #define Timer_PWM1_CHx_Type         TM_CH_2
    #define Timer_PWM1_Mode_Type        TM_OM_PWM1
    #define Timer_PWM2_GPIO_Type        PWMFROMPA
    #define Timer_PWM2_GPIO_Num         GPIO_PIN_3 //GPIO_PIN_1
    #define Timer_PWM2_AF_Type          AFIO_MODE_4
    #define Timer_PWM2_CHx_Type         TM_CH_3
    #define Timer_PWM2_Mode_Type        TM_OM_PWM1
    #define Timer_IRQ_Type              GPTM0_IRQn
#define SPI_PORT        (0)
#define SPI_SCK_PORT    (1)
#define SPI_SCK_PIN     (3)
#define SPI_MOSI_PORT   (1)
#define SPI_MOSI_PIN    (4)
#define SPI_MISO_PORT   (1)
#define SPI_MISO_PIN    (5)
#define SPI_SEL_PORT    (0)
#define SPI_SEL_PIN     (7)
#define SPI_CLK_DIV     (2)
#define HT_SPIx                 ((HT_SPI_TypeDef *) HT_SPI0_BASE)
#define Timer_Flag              2
#define Timer_ADDR              0x4006e000
#define Timer_ADDR1             0x4006e000
#define VOICE_TM_IRQHandler     GPTM0_IRQHandler
```

Table 3. HT32F57331/HT32F57341 Pin Assignment

Package			System Default	\ 					Alternate Function Mapping									
64 LQFP	48 LQFP	46 QFN		AF0 GPIO	AF1 ADC	AF2 N/A	AF3 GPTM	AF4 SPI	AF5 USART /UART	AF6 I²C	AF7 SCI	AF8 N/A	AF9 N/A	AF10 N/A	AF11 N/A	AF12 PWM	AF13 LCD	AF14 System Other
1	1	46	PA0		ADC_IN0		GT_CH0	SPI1_SCK	USR_RTS	I2C1_SCL	SCI_CLK							VREF
2	2	1	PA1		ADC_IN1		GT_CH1	SPI1_MOSI	USR_CTS	I2C1_SDA	SCI_DIO							
3	3	2	PA2		ADC_IN2		GT_CH2	SPI1_MISO	USR_TX									
4	4	3	PA3		ADC_IN3		GT_CH3	SPI1_SEL	USR_RX									
5	5	4	PA4		ADC_IN4		GT_CH0	SPI0_SCK	USR_TX	I2C0_SCL	SCI_CLK							
6	6	5	PA5		ADC_IN5		GT_CH1	SPI0_MOSI	USR_RX	I2C0_SDA	SCI_DIO							
7	7		PA6		ADC_IN6		GT_CH2	SPI0_MISO	USR_RTS		SCI_DET							
8	8		PA7		ADC_IN7		GT_CH3	SPI0_SEL	USR_CTS									
9			PD4		ADC_IN8				UR1_TX							PWM1_CH0		
10			PD5		ADC_IN9				UR1_RX							PWM1_CH1		
11	9	6	PC4				GT_CH0	SPI1_SEL	USR_TX	I2C1_SCL							SEG11	
12	10	7	PC5				GT_CH1	SPI1_SCK	USR_RX	I2C1_SDA							SEG12	
13			PC8				GT_CH2	SPI1_MOSI	UR1_TX								SEG13	
14			PC9				GT_CH3	SPI1_MISO	UR1_RX								SEG14	
15	11	8	PC6						UR0_TX	I2C0_SCL								

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