AN_258

FT800 Chinese Font Demo Application

Design Note

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This document is to introduce the design flow and note of FT800 Chinese Font Demo Application. It will give the audience the overall picture of the software.
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2 Introduction

FT800 combines display, audio and touch functionality into one single chip, powered by advanced FTDI Chip's EVE technology (Embedded Video Engine). The FT800 device interfaces with a system MCU via either SPI or I²C interface. To help customers easily make Chinese UI with the feature of FT800, a sample application is provided here for tutorial purposes.

In this application, FT800 custom font is created for Chinese UI and applied on widgets, such as toggle, keys, buttons as well as texts.

Note that the code relating to the creation of the screen shots could be reused in different MCU design environments.

To learn more about Arduino platform and its IDE, please check http://www.arduino.cc

2.1 Audience

This document assumes the audience has read the datasheet and programmer guide of the FT800. In addition, familiarity of the C/C++ programming language is necessary to understand the sample application source code. Since the SPI interface is the main interface of FT800, the knowledge of SPI interface is also preferred.

2.2 Scope

The Chinese Font Demo Application mentioned in this document is created with Arduino Pro IDE and Microsoft Windows Visual Studio. It is able to run on VM800P or Windows PC.

2.3 Overview

2.3.1 Hardware

The diagram below gives the basic hardware setup.
2.3.2 Application flow

The diagram below gives the basic flow and structure to configuring the FT800 in an application.

```
CONFIGURE THE SPI MASTER (MODE 0 – MSB)

INITIALISE THE FT800

READ DUMMY DATA AT ADDRESS 0
RESET THE FT800 CORE – WRITE 0x68, 0x00
SET THE CLOCK – WRITE 0x44, 0x00

CONFIGURE THE AUDIO VOLUME
CONFIGURE THE TFT TOUCH SENSE
CREATE DISPLAY LIST
UPDATE (SWAP) DISPLAY LIST

LOAD DUMMY DISPLAY LIST (e.g., blank screen)
ENABLE PCLK

INITIALISE THE TFT DISPLAY

CONFIGURE VSYNC
CONFIGURE HSYNC

Figure 2 Application Flow
```

2.3.3 Architecture

The application is designed to easily port to various platforms with SPI host functionality. Therefore, the application introduces one generic HAL (hardware abstraction layer) which can be used as a guideline for other platforms.
2.4 Hardware requirement

Option A:
- VM800B or VM800C development kit.
  Note that this kit comes with an option for 3 different size displays, 3.5”, 4.3”, or 5.0” (VM800B35A-D, VM800C35A-D, VM800B35A-D, VM800C43A-D, VM800B50A-D, VM800C50A-D, respectively).
- One FTDI MPSSE cable for USB to SPI bridge or VA800A-SPI board.
- Windows PC

Option B:
- VM800P development kit.
- One USB cable with MicroB connector to provide power to the VM800P board and download binary into VM800P.
- Windows PC

2.5 Software requirement

- D2XX driver for FTDI MPSSE cable. Please download and install on the PC.
- Arduino IDE 1.0.5
- FT800 Chinese Font Demo Application release package.

2.5.1 Software package introduction

- “Bin” folder contains the library and run time executables for Windows platform.
- "Docs" folder contains the application note of this application.
• "Hdr" folder contains the header file of windows MSVC project.
• "Src" folder contains the source code of windows MSVC project.
• "Test" folder contains the font file used by application when running up.
• "Project" folder contains both the project files for Windows and Arduino platform.
3 Application design note

This application implements one notepad with simple Chinese Input method enabled. It enables users to input the simplified or traditional Chinese font with SimFang (仿宋) style. All the bitmap information used in this application for Chinese UI are extracted from simfang.ttf, which is part of windows 7 installation. You can find it from "$(WindowsInstallPaths)\windows\fonts\".

When users touches any letter from ‘A’ to ‘Z’, the application gives 10 characters candidates for users to select. Users can choose any characters and constructs one note with up to 10 rows, 16 characters per row including space. After users complete the editing, users can view all the characters in a scrolling window.

![Figure 4 Main UI of Application](image-url)
3.1 Bitmap data information

Out of "A" to "Z", every key maps to 10 Chinese characters. All the fonts is in L4 format. The font style is SimFang (仿宋). The following table describes the bitmap data information in details.

<table>
<thead>
<tr>
<th>Input File</th>
<th>CELL</th>
<th>Handle</th>
<th>Address in RAM_G</th>
<th>Bitmap Source</th>
<th>Raw file size in byte</th>
<th>Format &amp; Style</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-F_ChineseS.txt/A-F_ChineseT.txt</td>
<td>1~60</td>
<td>1</td>
<td>0 (RAM_G)</td>
<td>-328</td>
<td>28708</td>
<td>L4 format Stride 14</td>
<td>60 characters whose pinyin begins with 'A' to 'F'</td>
</tr>
<tr>
<td>G-L_ChineseS.txt/G-L_ChineseT.txt</td>
<td>1~60</td>
<td>2</td>
<td>28708</td>
<td>28380</td>
<td>28708</td>
<td>L4 format Stride 14</td>
<td>60 characters whose pinyin begins with 'G' to 'L'</td>
</tr>
<tr>
<td>M-R_ChineseS.txt/M-R_ChineseT.txt</td>
<td>1~60</td>
<td>3</td>
<td>57416</td>
<td>57088</td>
<td>28708</td>
<td>L4 format Stride 14</td>
<td>60 characters whose pinyin begins with 'M' to 'R'</td>
</tr>
<tr>
<td>S-X_ChineseS.txt/S-X_ChineseT.txt</td>
<td>1~60</td>
<td>4</td>
<td>86124</td>
<td>85796</td>
<td>28708</td>
<td>L4 format Stride 14</td>
<td>60 characters whose pinyin begins with 'S' to 'X'</td>
</tr>
<tr>
<td>Y-Z_ChineseS.txt</td>
<td>1~28</td>
<td>5</td>
<td>114832</td>
<td>114504</td>
<td>13476</td>
<td>L4 format Stride 14</td>
<td>20 characters whose pinyin</td>
</tr>
</tbody>
</table>
3.2 Character code and bitmap handle

The character code is invented to store the code of each character and there is one notepad buffer storing character code: (Max Row: 10, Max Col: 16) in the application. Every character code is 2 byte valid and range from 1 to 270. Application translates the tag value of touching character into character code by following formula and storing it into notepad buffer:

Given Handle and Cell, calculate the character code by:

\[
\text{Character code} = (\text{Handle}-1) \times 60 + \text{CELL} \quad \text{when Handle falls in 1 to 5.}
\]

\[
\text{Character code between 1 to 268}
\]

\[
\text{Character code} = 60 \times 4 + 28 + \text{CELL} \quad \text{when Handle is 6.}
\]

\[
\text{Character code between 269 to 280}
\]

When displaying all the characters stored in notepad buffer, i.e., all the characters selected by users, the character code has to be converted back into handle and cell number by following formula:

Given Character code, calculate the handle and cell by:

If Character code between 269 to 280,

\[
\text{Handle} = 6
\]

\[
\text{Cell} = \text{character code} - 268
\]

If Character code between 1 to 268,

\[
\text{Handle} = \text{character code} / 60 + 1 \quad \text{Cell} = \text{character code} \mod 60
\]

if (character code \mod 60) is not zero

\[
\text{Handle} = \text{character code} / 60 \quad \text{Cell} = 60
\]

if (character code \mod 60) is zero

4 Tag layout

In main interface, tag feature of FT800 is utilized to detect user’s touch. The table below shows the tag value layout in main interface.

<table>
<thead>
<tr>
<th>UI element</th>
<th>Tag value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cmd_keys</td>
<td>65-90</td>
<td>“QWERTYUIOP”</td>
</tr>
<tr>
<td>Cmd_keys</td>
<td></td>
<td>“ASDFGHJKL”</td>
</tr>
</tbody>
</table>
5 Generate the bitmap data and metrics block

There is one font conversion utility from FTDI to export the bitmap information from windows true type font file and form metrics blocks as FT800 specified. Users can easily run the following commands and find the output data at the output folder. For example, for command line 1, the output data is in file "simfang_A-F_ChineseS.txt30\L4\simfang.ttf_30_L4.raw". Its format is in file "simfang_A-F_ChineseS.txt30\L4\simfang.ttf_30_L4.rawh".

About the fnt_cvt details, please refer to its release package.

To generate for Simplified Chinese:

1. fnt_cvt.exe -i simfang.ttf -s 30 -u A-F_ChineseS.txt -d 0
2. fnt_cvt.exe -i simfang.ttf -s 30 -u G-L_ChineseS.txt -d 28708
3. fnt_cvt.exe -i simfang.ttf -s 30 -u M-R_ChineseS.txt -d 57416
4. fnt_cvt.exe -i simfang.ttf -s 30 -u S-X_ChineseS.txt -d 86124
5. fnt_cvt.exe -i simfang.ttf -s 30 -u Y-Z_ChineseS.txt -d 114832
6. fnt_cvt.exe -i simfang.ttf -s 30 -u SC_Note.txt -d 128308

To generate for traditional Chinese:

1. fnt_cvt.exe -i simfang.ttf -s 30 -u A-F_ChineseT.txt -d 0
2. fnt_cvt.exe -i simfang.ttf -s 30 -u G-L_ChineseT.txt -d 28708
3. fnt_cvt.exe -i simfang.ttf -s 30 -u M-R_ChineseT.txt -d 57416
4. fnt_cvt.exe -i simfang.ttf -s 30 -u S-X_ChineseT.txt -d 86124
5. fnt_cvt.exe -i simfang.ttf -s 30 -u Y-Z_ChineseT.txt -d 114832
6. fnt_cvt.exe -i simfang.ttf -s 30 -u SC_Note.txt -d 128308

The resource used in both scenario*:

SC_Note.txt

Simplified Chinese input file*:


Traditional Chinese input file*:
6 Contact Information

Head Office – Glasgow, UK
Future Technology Devices International Limited
Unit 1, 2 Seaward Place, Centurion Business Park
Glasgow G41 1HH
United Kingdom
Tel: +44 (0) 141 429 2777
Fax: +44 (0) 141 429 2758

E-mail (Sales) sales1@ftdichip.com
E-mail (Support) support1@ftdichip.com
E-mail (General Enquiries) admin1@ftdichip.com

Branch Office – Tigard, Oregon, USA
Future Technology Devices International Limited (USA)
7130 SW Fir Loop
Tigard, OR 97223-8160
USA
Tel: +1 (503) 547 0988
Fax: +1 (503) 547 0987

E-Mail (Sales) us.sales@ftdichip.com
E-Mail (Support) us.support@ftdichip.com
E-Mail (General Enquiries) us.admin@ftdichip.com

Branch Office – Taipei, Taiwan
Future Technology Devices International Limited (Taiwan)
2F, No. 516, Sec. 1, NeiHu Road
Taipei 114
Taiwan, R.O.C.
Tel: +886 (0) 2 8791 3570
Fax: +886 (0) 2 8791 3576

E-mail (Sales) tw.sales1@ftdichip.com
E-mail (Support) tw.support1@ftdichip.com
E-mail (General Enquiries) tw.admin1@ftdichip.com

Branch Office – Shanghai, China
Future Technology Devices International Limited (China)
Room 1103, No. 666 West Huaihai Road,
Shanghai, 200052
China
Tel: +86 21 62351596
Fax: +86 21 62351595

E-mail (Sales) cn.sales@ftdichip.com
E-mail (Support) cn.support@ftdichip.com
E-mail (General Enquiries) cn.admin@ftdichip.com

Web Site

http://www.ftdichip.com

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7 Appendix A – References

7.1 Document References

1. datasheet for VM800C
2. datasheet for VM800B
3. datasheet for VM800P
4. FT800 programmer guide FT_000793
5. FT800 Embedded Video Engine Datasheet FT_000792

7.2 Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Terms</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arduino Pro</td>
<td>The open source platform variety based on ATMEL’s ATMEGA chipset</td>
</tr>
<tr>
<td>EVE</td>
<td>Embedded Video Engine</td>
</tr>
<tr>
<td>SPI</td>
<td>Serial Peripheral Interface</td>
</tr>
<tr>
<td>UI</td>
<td>User Interface</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Revision</th>
<th>Changes</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>Initial draft release</td>
<td>2013-03-06</td>
</tr>
<tr>
<td>1.0</td>
<td>Initial release</td>
<td>2014-09-06</td>
</tr>
</tbody>
</table>