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H8S/H8SX Families

Using the Graphics API to Implement a Menu System

Introduction

Renesas provides a standard set of functions for creating and manipulating graphics and text on a TFT-LCD panel. These functions are referred to as the Graphics Application Programming Interface or GAPI.

This Application Note is one in a series of application examples which show how to implement interactive graphics on an LCD panel.

This Application Note can be used with any available Direct Drive LCD Demo PCB from Renesas.

Design manuals, software and schematics are also available from www.america.renesas.com/h8lcd.

This application note must be used in conjunction with the REU05b0112_H8SAP application note and code. Please download and install REU05b0112_H8SAP application note first and use the [below instructions](#) to add this source code to the project.

Target Device

H8S2378, H8S2456, H8SX1668R
and Direct Drive LCD Demo Board

Contents

1. Creating Checkboxes with GAPI	2
2. Code	3
3. Touchscreen and Panel Coordinates	7
4. Installation and Source Code Structure.....	8

1. Creating Checkboxes with GAPI

This sample code uses GAPI calls which will access the bitmap in memory and toggle between displaying the checked and un-checked versions.

This code also maps the bitmap to multiple touchable instances based on its size, and specifies which function will be called in the event that the icon is touched.

This code changes the image (and associated state variable) each time it is touched.

Figure 1 shows the bitmap that we will be used as a check box in the sample code:



Figure 1 Checkbox.BMP and ScreenMenu

2. Code

2.1 Setting Up the Icon

The Icons table describes which objects will be placed on the screen. The pBMP_CheckBox image will be placed at three locations on the screen (one for each menu selection) when the “BasicConstructor” processes the “ToggleN” callback function. Note these are “screen relative” coordinates ([see below](#)).

Any number of icons can be placed on the screen; the final entry in the table must be a NULL to terminate the list.

```
static const ICON_type Icons[]=
{
//*****
//BITMAP ADDR          FUNCTION CALL          Y POSITION
//          COLOR SCHEME          X POSITION
//*****
{ &pBMP_ButtonS, T_SchemeBlue, ButtonBack, SX(0.850), SY(0.750) },
{ &pBMP_CheckBox, T_Menu, Toggle0, SX(0.100), SY(0.250) },
{ &pBMP_CheckBox, T_Menu, Toggle1, SX(0.100), SY(0.500) },
{ &pBMP_CheckBox, T_Menu, Toggle2, SX(0.100), SY(0.750) },
{ &pBMP_RightArrow, T_Menu, Checkout, SX(0.850), SY(0.050) },
{ NULL, NULL, 0, 0 },
};

SCREEN_type ScreenHomeData=
{
Constructor, Destructor, Icons
};
```

2.2 Screen Constructor/Destructor

Every screen is started by the framework calling the screen Constructor. In this sample code, the constructor first locates the “checkbox” (BMP), “rightarrow” (BMP) and “FontMenu” (EFNT) files in the pResources structure and assigns these locations to the “pBMP_CheckBox”, “pBMP_RightArrow”, and pfontMenu handles. The state variables associated with each checkbox are also cleared during the screen initialization.

When the “BasicConstructor” is called, it will execute each Icon table callback function (these functions are responsible for placing their own graphic images, in this case the checkboxes and the right arrow).

The “Destructor” function is called on exit from the screen by the framework.

```
static void Constructor(SCREEN_type const *pS)
{
    char text_buffer[16];

    if(pBMP_CheckBox == NULL)
        pBMP_CheckBox = FileFind(pResources, "checkbox");

    if(pBMP_RightArrow == NULL)
        pBMP_RightArrow = FileFind(pResources, "rightarrow");

    if(pfontMenu == NULL)
        pfontMenu = FileFind(pResources, "FontMenu");

    /* clear check boxes */
    toggle_check[0]=0;
    toggle_check[1]=0;
    toggle_check[2]=0;
    ordered = 0;

    // Clear the background
    (void)LCDBMPFillGradient(backFrameBuf, 0, 0, H_DOT_DISPLAY, V_LINES_DISPLAY,
        SCHEME[1].ct , 90);

    // Run default behavior
    BasicConstructor(pS);
}

static void Destructor(SCREEN_type const *pS)
{
    // Run default behavior
    BasicDestructor(pS);
}
```

2.3 Toggle Callback functions

The “ToggleN” functions will be called on every event that the system receives while this sample screen is active. It is the responsibility of this function to decide if it needs to process the event.

The “ToggleN” functions in turn call the “ToggleHandler” function (with an instance argument of 0, 1, or 2).

When “ToggleN” is called by the “BasicConstructor”, it will be passed a message ID of “MSG_DRAW”. The “ToggleHandler” function will let the default behavior of the “IconHandler” framework call draw the checkboxes in the proper state, but to display the menu text, an explicit GAPI “LCDBMPGPutS” call is made.

When “ToggleHandler” is called because of touch events, it use the “IconHandler” to determine if the event was within the boundary of the checkbox and if the event ID was a “MSG_RELEASE”, it will toggle the checkbox image and state.

```
static void ToggleHandler(ICON_type const *pS, EVENT_MSG const *pMsg, uI08 index)
{
    /* draw text if screen draw */
    if(MSG_DRAW == pMsg->id)
    {
        LCDBMPGPutS(list[index], &T_Menu[0].font, backFrameBuf,
                    pS->PosX + BMP_Width(*pS->ppBmp)/2, pS->PosY);
    }

    if((0 != IconHandler(pS, pMsg, toggle_check[index], 0)) && (MSG_RELEASE == pMsg->id))
    {
        //toggle checkbox if touched
        if (++toggle_check[index] >= 2)
            toggle_check[index] = 0;

        //update image
        (void) LCDBMPIndex(*pS->ppBmp, displayFrameBuf, pS->PosX, pS->PosY, toggle_check[index]);
    }
}

static void Toggle0(ICON_type const *pS, EVENT_MSG const *pMsg)
{
    ToggleHandler(pS, pMsg, 0);
}

static void Toggle1(ICON_type const *pS, EVENT_MSG const *pMsg)
{
    ToggleHandler(pS, pMsg, 1);
}

static void Toggle2(ICON_type const *pS, EVENT_MSG const *pMsg)
{
    ToggleHandler(pS, pMsg, 2);
}
```

2.4 Checkout Callback function

The “Checkout” functions will be called on every event that the system receives while this sample screen is active. It is the responsibility of this function to decide if it needs to process the event.

When “Checkout” is called by the “BasicConstructor”, it will be passed a message ID of “MSG_DRAW”. The “Checkout” function will let the default behavior of the “ButtonHandler” draw the bitmap in the proper state.

When “Checkout” is called because of touch events, it use the “ButtonHandler” to determine if the event was within the boundary of the right arrow and if the event ID was a “MSG_RELEASE”, it will display either the “order complete” message or reinitialize the screen (based on the state of the “ordered” variable).

```
static void Checkout(ICON_type const *pS, EVENT_MSG const *pMsg)
{
    /* create font with black fore and white background */
    static const uI08 order_msg[]="Order Complete!";
    static const ColorTable_type order_ct={0x00, 0x00, 0x40, 0x00};
    static sI16 state=0;

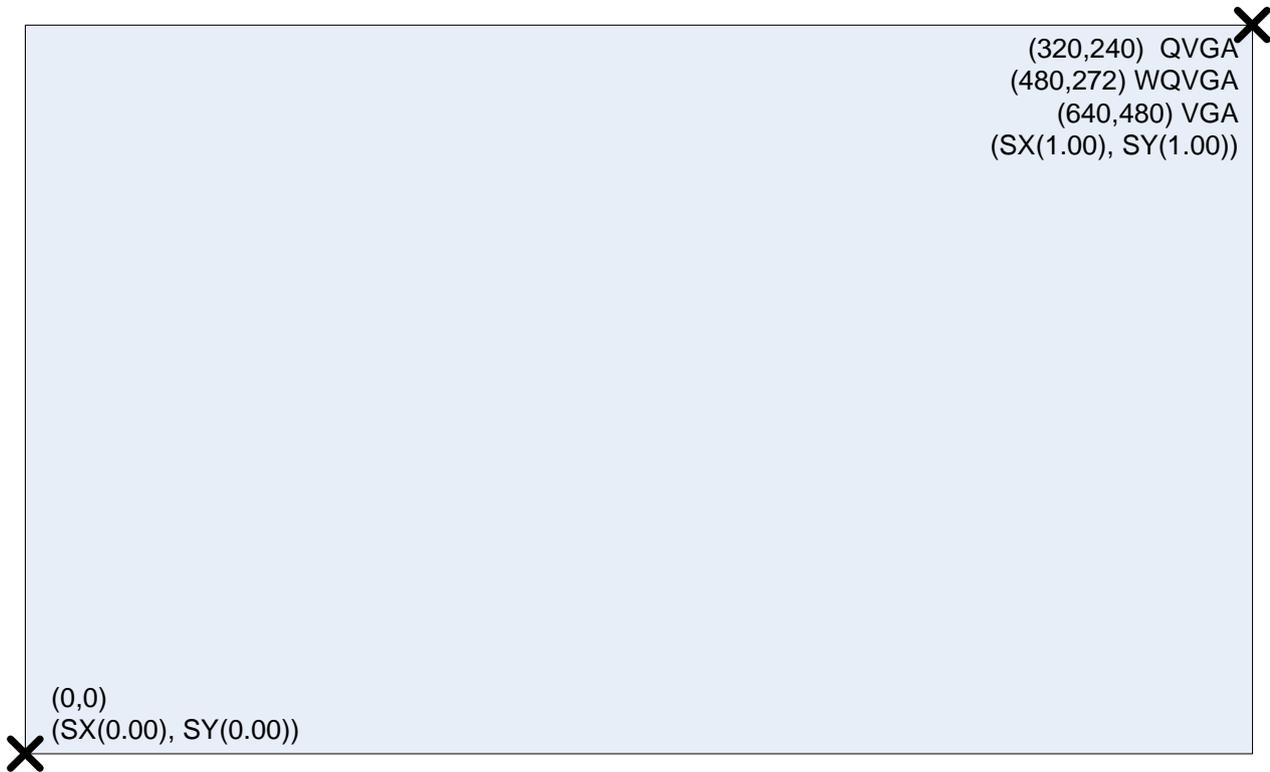
    if(0 != (state = ButtonHandler(pS, pMsg, (uI08 *)"", state)))
    {
        if (MSG_RELEASE == pMsg->id)
        {
            if (0 == ordered)
            {
                sI16 textWidth = LCDBMP_FontWidthString(order_msg,&T_Menu[0].font);
                sI16 textHeight = LCDBMP_FontHeight(&T_Menu[0].font);
                (void)LCDBMPFill(displayFrameBuf, 0, 0, SX(0.800), V_LINES_DISPLAY, &order_ct );
                LCDBMPGPutS(order_msg, &T_Menu[0].font, displayFrameBuf,
                    (SX(0.800)-textWidth)/2, (V_LINES_DISPLAY - textHeight)/2);

                ordered = 1;
            }
            else
            {
                // send a screen change (restart this screen) command to the handler
                msg.type = DISPLAY_TYPE;
                msg.id = MSG_SCREEN_CHANGE;
                msg.param.pS = &ScreenMenuData;
                RLCD_QueueSend(retVal,EventQueue, msg)
            }
        }
    }
}
```

3. Touchscreen and Panel Coordinates

By convention, the sample code uses relative screen coordinates. This is accomplished by use of the “SX” and “SY” macro expansions. These expansions convert normalized coordinates (0.00 to 1.00) to absolute screen coordinates. If desired, the SX/SY macros can not be used and absolute screen coordinates used.

For example SX(0.5), SY(0.5) on a QVGA (320x240) panel would expand to (160,120)



4. Installation and Source Code Structure

The code is contained within one source file called “ScreenMenu.c,” and the bitmap images used are contained in a bitmap files “checkbox.bmp”, “rightarrow.bmp” and the font file in the “FontMenu.efnt”. To install the sample code, double click on the installation executable “REUE05B0108.exe” to bring up the installer. (figure 2) Make sure you click on the browse button in the “Destination Folder” Panel and select your LCD Direct Drive demo project (REU05b0112_H8SAP installation) directory. Then click the next button to copy the new files into your project directory.

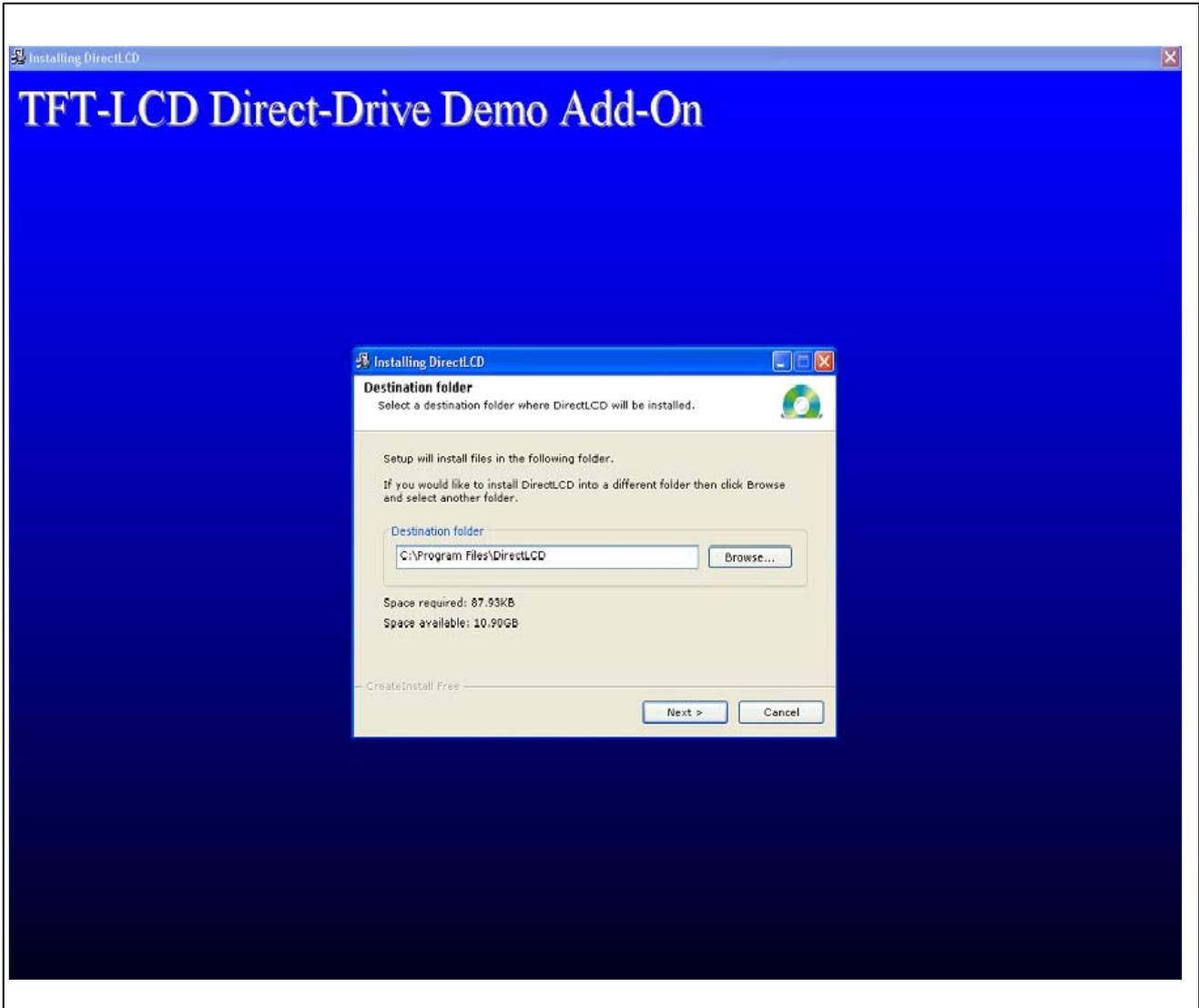


Figure 2: Installation

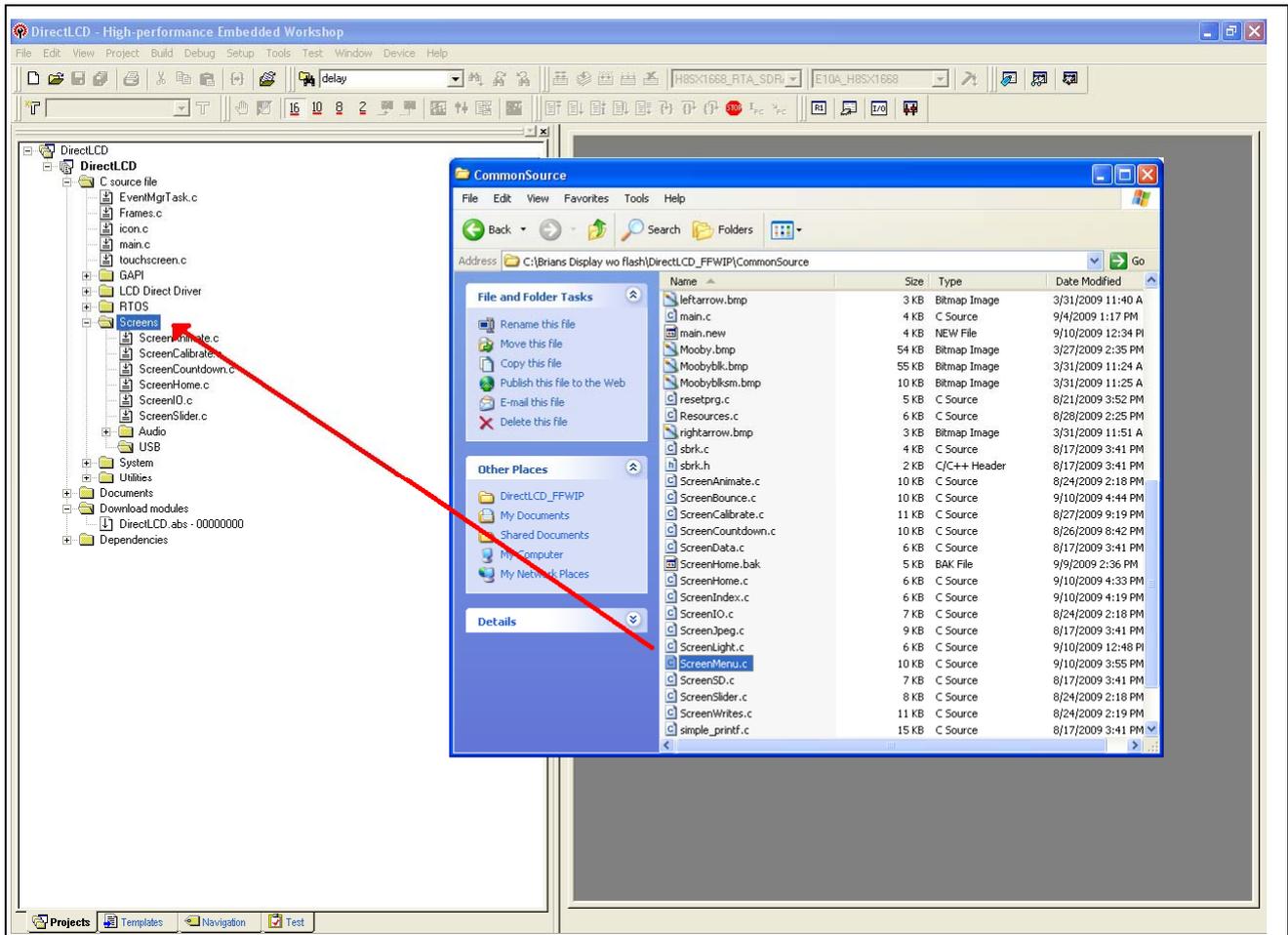


Figure 3: Adding “ScreenMenu.c” to the Direct LCD demo project in HEW

Then, open your LCD Direct Drive demo project in HEW. The ScreenMenu.c file will be located in your CommonSource directory. Add the ScreenMenu.c source file to your project in HEW by dragging the file into the Screens folder of your project. (Figure 3)

The installer places Bitmap Images that are sized for a WQVGA display panel into your resource directory by default. If you are using QVGA or VGA you will need to replace the bitmaps in your resource directory with ones of the appropriate resolution for your display panel. You will find several subdirectories in your resource folder that contain bitmaps of different resolutions. Simply copy all the files from the subdirectories corresponding to your panel resolution and paste them over the files in your resource directory.

Refer to the REU05b0112_H8SAP application note on instructions on how to build and update code resources in the target.

<i>File Name</i>	<i>File Description</i>
CommonSource\ScreenMenu.c	Demo screen code
Resources\checkbox.bmp	Bitmap image
Resources\rightarrow.bmp	Bitmap image
Resources\fontMenu.efnt	Embedded font file

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<http://www.renesas.com/>

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<http://america.renesas.com/h8lcd>

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Rev.	Date	Description	
		Page	Summary
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1.10	January.01.10	—	Converted format to add-in code to REU05b0112

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