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/*****
*                               V 3 2 4 0 C . C                               *
**-----**
* Task                          : Demonstrates programming in 320x400 VGA      *
*                               graphic mode, using 256 colors and four screen  *
*                               pages. This program requires the V3240CA.ASM    *
*                               assembly language module.                      *
**-----**
* Author                        : Michael Tischer                            *
* Developed on                  : 09/04/90                                    *
* Last update                   : 02/26/92                                    *
**-----**
* Memory model                  : SMALL                                        *
**-----**
* (MICROSOFT C)
* Compilation                   : CL /AS /c /W0 V3240C.C                    *
*                               : LINK V3240C V3240CA;                        *
**-----**
* (BORLAND TURBO C)
* Compilation                   : Create a project file using the following:  *
*                               v3240c.c                                       *
*                               v3240ca.asm                                    *
**-----**
* Call                         : v3240c                                       *
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#include <dos.h>
#include <stdarg.h>
#include <stdlib.h>
#include <stdio.h>
#include <conio.h>

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/*-- Type delarations -----*/

typedef unsigned char BYTE;

/*-- External references to the assembler routines -----*/

extern void init320400( void );
extern void setpix( int x, int y, unsigned char pcolor);
extern BYTE getpix( int x, int y );
extern void setpage( BYTE page );
extern void showpage( BYTE page );
extern void far * getfontptr( void );

/*-- Constants -----*/

#define MAXX 319                      /* Maximum X- and Y-coordinates */
#define MAXY 399

/*****
*   IsVga: Determines whether a VGA card is installed.
**-----**
*   Input   : None
*   Output  : 0   If no VGA exists, otherwise < 0
*****/

BYTE IsVga( void )
{
    union REGS Regs;                /* Processor registers for interrupt call */

    Regs.x.ax = 0x1a00;              /* Function 1AH applies to VGA only */
    int86( 0x10, &Regs, &Regs );
    return ( Regs.h.al == 0x1a );    /* Is the function available? */
}

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}

/*****
*   PrintChar : Writes a character to the screen while in graphic mode.*
**-----**
*   Input      :   THECHAR = Character to be written                      *
*                  x, y     = X- and Y-coordinates of upper-left corner  *
*                  FG       = Foreground color                          *
*                  BK       = Background color                          *
*   Info       :   Character is created in an 8x8 matrix, based on the   *
*                  8x8 ROM font.                                         *
*****/

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void PrintChar( char thechar, int x, int y, BYTE FG, BYTE BK )
{
    typedef BYTE FDEF[256][8];                      /* Font definition */
    typedef FDEF far *TPTR;                          /* Pointer to font */

    BYTE          i, k,                               /* Loop counter */
                BMask;                               /* Bit mask for character design */

    static TPTR fptr = (TPTR) 0;                     /* Pointer to font in ROM */

    if ( fptr == (TPTR) 0 )                          /* Pointer to font already set? */
        fptr = getfontptr(); /* No --> Use the assembler function to load */

    /*- Generate character pixel by pixel -----*/

    if ( BK == 255 )                                  /* Drawing transparent characters? */
        for ( i = 0; i < 8; ++i ) /* Yes --> Set foreground pixels only */
        {
            BMask = (*fptr)[thearchar][i];           /* Get bit pattern for one line */

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        for ( k = 0; k < 8; ++k, BMask <= 1 )           /* Execute column */
            if ( BMask & 128 )                           /* Pixel set? */
                setpix( x+k, y+i, FG );                  /* Yes */
    }
else /* No --> Consider background as well */
    for ( i = 0; i < 8; ++i )                            /* Execute lines */
    {
        BMask = (*fptr)[thechar][i];                    /* Get bit pattern for one line */
        for ( k = 0; k < 8; ++k, BMask <= 1 )           /* Execute columns */
            setpix( x+k, y+i, ( BMask & 128 ) ? FG : BK );
    }
}

/*****
* Line: Draws a line based on the Bresenham algorithm. *
**-----**
* Input : X1, Y1 = Starting coordinates (0 - ...) *
*         X2, Y2 = Ending coordinates *
*         LPCOL = Color of line pixels *
*****/

/*-- Function for swapping two integer variables -----*/

void SwapInt( int *i1, int *i2 )
{
    int dummy;

    dummy = *i2;
    *i2 = *i1;
    *i1 = dummy;
}

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/*-- Main part of function -----*/

void Line( int x1, int y1, int x2, int y2, BYTE pcolor )
{
    int d, dx, dy,
        aincr, bincr,
        xincr, yincr,
        x, y;

    if ( abs(x2-x1) < abs(y2-y1) )          /* X- or Y-axis overflow? */
    {                                         /* Check Y-axis */
        if ( y1 > y2 )                      /* y1 > y2? */
        {
            SwapInt( &x1, &x2 );           /* Yes --> Swap X1 with X2 */
            SwapInt( &y1, &y2 );           /* and Y1 with Y2 */
        }

        xincr = ( x2 > x1 ) ? 1 : -1;        /* Set X-axis increment */

        dy = y2 - y1;
        dx = abs( x2-x1 );
        d = 2 * dx - dy;
        aincr = 2 * (dx - dy);
        bincr = 2 * dx;
        x = x1;
        y = y1;

        setpix( x, y, pcolor );             /* Set first pixel */
        for (y=y1+1; y<= y2; ++y )          /* Execute line on Y-axes */
        {
            if ( d >= 0 )
            {

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        x += xincr;
        d += aincr;
    }
    else
        d += bincr;
    setpix(x, y, pcolor);
}
}
else
{
    /* Check X-axes */
    if ( x1 > x2 )
    {
        /* x1 > x2? */
        SwapInt( &x1, &x2 );
        /* Yes --> Swap X1 with X2 */
        SwapInt( &y1, &y2 );
        /* and Y1 with Y2 */
    }

    yincr = ( y2 > y1 ) ? 1 : -1;
    /* Set Y-axis increment */

    dx = x2 - x1;
    dy = abs( y2-y1 );
    d = 2 * dy - dx;
    aincr = 2 * (dy - dx);
    bincr = 2 * dy;
    x = x1;
    y = y1;

    setpix(x, y, pcolor);
    for (x=x1+1; x<=x2; ++x )
    {
        /* Set first pixel */
        /* Execute line on X-axes */
        if ( d >= 0 )
        {
            y += yincr;

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        d += aincr;
    }
    else
        d += bincr;
    setpix(x, y, pcolor);
}
}
}

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/*****
*   GrfxPrintf: Displays a formatted string on the graphic screen.   *
**-----**
*   Input    : X, Y      = Starting coordinates (0 - ...)           *
*              FG        = Foreground color                         *
*              BK        = Background color (255 = transparent)     *
*              STRING    = String with format information           *
*              ...       = Arguments similar to printf              *
*****/

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void GrfxPrintf( int x, int y, BYTE FG, BYTE BK, char * string, ... )
{
    va_list parameter;          /* Parameter list for VA_... macros */
    char stngbuf[255],          /* Buffer for formatted string */
        *cp;

    va_start( parameter, string );          /* Convert parameter */
    vsprintf( stngbuf, string, parameter ); /* Format */
    for ( cp = stngbuf; *cp; ++cp, x+= 8 ) /* Formatted string */
        PrintChar( *cp, x, y, FG, BK );    /* Display using PrintChar */
}

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/*****

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*   ColorBox:  Draws a rectangle and fills it with a line pattern.      *
**-----**
*   Input    :  X1, Y1 = Upper-left coordinates of window              *
*               X2, Y2 = Lower-right coordinates of window              *
*               COLMAX = Greatest color value                            *
*   Info     :  Line colors are selected in a cycle of 0-COLMAX.        *
*****/

void ColorBox( int x1, int y1, int x2, int y2, int colmax )
{
    int x, y,                                /* Loop variables */
        sx, sy;                             /* Exit point for last color loop */

    Line( x1, y1, x1, y2, 15 );              /* Draw border */
    Line( x1, y2, x2, y2, 15 );
    Line( x2, y2, x2, y1, 15 );
    Line( x2, y1, x1, y1, 15 );

    for ( y = y2-1; y > y1; --y )             /* Bottom left to right border */
        Line( x1+1, y2-1, x2-1, y, y % colmax );

    for ( y = y2-1; y > y1; --y )             /* Bottom right to left border */
        Line( x2-1, y2-1, x1+1, y, y % colmax );

    /*-- From center of box to top border -----*/

    for ( x=x1+1, sx=x1+(x2-x1)/2, sy=y1+(y2-y1)/ 2; x < x2; ++x )
        Line( sx, sy, x, y1+1, x % colmax );
}

/*****
*   DrawAxis:  Draws axes from left and top borders on the screen.      *

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**-----**
*   Input   : XSTEP = Increment for X-axis      *
*             YSTEP = Increment for Y-axis      *
*             FG    = Foreground color          *
*             BK    = Background color (255 = transparent) *
*****/

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```

void DrawAxis( int stepx, int stepy, BYTE FG, BYTE BK )
{
    int x, y;                                     /* Loop coordinates */

    Line( 0, 0, MAXX, 0, FG );                   /* Draw X-axis */
    Line( 0, 0, 0, MAXY, FG );                   /* Draw Y-axis */

    for ( x = stepx; x < MAXX; x += stepx )      /* Scale X-axis */
    {
        Line( x, 0, x, 5, FG );
        GrfxPrintf( x < 100 ? x - 8 : x - 12, 8, FG, BK, "%d", x );
    }

    for ( y = stepy; y < MAXY; y += stepy )      /* Scale Y-axis */
    {
        Line( 0, y, 5, y, FG );
        GrfxPrintf( 8, y-4, FG, BK, "%3d", y );
    }
}

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/*****
*   Demo: Demonstrates the functions in this module. *
*****/

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void Demo( void )

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{
#define PAUSE 100000                                /* Pause amount, varies with system */

int x;                                                /* Coordinate counter */
long delay;                                          /* Pause counter */

    ColorBox( 80, 50, 308, 350, 16 );                /* Paint box */
    DrawAxis( 30, 40, 15, 255 );                    /* Draw axes */
    GrfxPrintf( 46, MAXY-10, 15, 255,
        "V3240C - (c) by Michael Tischer");

    setpage( 1 );                                    /* Process page */
    ColorBox( 80, 50, 308, 350, 255 );                /* Paint box */
    DrawAxis( 30, 40, 15, 255 );                    /* Draw axes */
    GrfxPrintf( 46, MAXY-10, 15, 255,
        "V3240C - (c) by Michael Tischer" );

/*-- Display four graphic pages in sequence -----*/

for ( x = 0; x < 50; ++x )                          /* 50 executions */
{
    showpage( x % 2 );                              /* Display page */
    for ( delay = 1; delay < PAUSE; ++delay )        /* Brief pause */
        ;
}

/*****
**          M A I N   P R O G R A M          **
*****/

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```

void main( void )
{
    union REGS regs;

    if ( IsVga() )
    {
        /* VGA card installed? */
        /* Yes --> Go ahead */
        /* Initialize graphic mode */
        init320400();
        Demo();
        getch();
        /* Wait for a key */
        /* Shift into text mode */
        regs.x.ax = 0x0003;
        int86( 0x10, &regs, &regs );
    }
    else
        printf( "V3240C - (c) 1992 by Michael Tischer\n\n"\
               "This program requires a VGA card\n\n" );
}
•

```