Objectives:

Learn how to use fixed-point notation to plot graphs onto the LCD screen. In addition, this lab helped to get used to the Keilv5 environment and to become familiar with the LCD module program provided in the starter files.

Code:

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*ST7735\_XYplotInit\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Specify the X and Y axes for an x-y scatter plot

Draw the title and clear the plot area

Inputs: title ASCII string to label the plot, null-termination

minX smallest X data value allowed, resolution= 0.001

maxX largest X data value allowed, resolution= 0.001

minY smallest Y data value allowed, resolution= 0.001

maxY largest Y data value allowed, resolution= 0.001

Outputs: none

assumes minX < maxX, and miny < maxY

\*/

#define OFFSET 32

int32\_t Xslope, Yslope;

int32\_t Xmin, Xmax, Ymin, Ymax;

void ST7735\_XYplotInit(char \*title, int32\_t minX, int32\_t maxX,

int32\_t minY, int32\_t maxY, uint16\_t bcolor){

// EE445L lab assignment

//clear screen

ST7735\_FillScreen(ST7735\_BLACK);

//clear plot

ST7735\_FillRect(0,32,128,128,bcolor);

//draw the title (0-31)

ST7735\_SetCursor(0,0);

ST7735\_OutString(title);

//private global variables

Xmin = minX;

Xmax = maxX;

Ymin = minY;

Ymax = maxY;

}

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*ST7735\_XYplot\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Plot an array of (x,y) data

Inputs: num number of data points in the two arrays

bufX array of 32-bit fixed-point data, resolution= 0.001

bufY array of 32-bit fixed-point data, resolution= 0.001

Outputs: none

assumes ST7735\_XYplotInit has been previously called

neglect any points outside the minX maxY minY maxY bounds

\*/

void ST7735\_XYplot(uint32\_t num, int32\_t bufX[],

int32\_t bufY[], uint16\_t color){

// EE445L lab assignment

for(int i = 0; i < num; i++){

//ignore point if out of bounds

if(bufX[i] < Xmin || bufX[i] > Xmax || bufY[i] < Ymin || bufY[i] > Ymax){

continue;

}

int32\_t x = (127\*(bufX[i] - Xmin))/(Xmax - Xmin);

int32\_t y = (127\*(Ymax - bufY[i]))/(Ymax - Ymin);

//calculate adjusted coordinates and add offsets for center and label

ST7735\_DrawPixel(x, y + OFFSET, color);

}

}

Analysis and Discussion:

1. You should use fixed-point when floating-point is not supported and when the range of values is known and small. Fixed-point also saves power. Floating-point allows you to represent a much larger range of numbers.
2. An example would be measuring converting temperature from Celsius to Fahrenheit. If the range of values were from 0.000 – 500.000 (resolution of .001), we can use the format F = 32 + (9\*C) >> 12. The normal formula would be F = 32 + (9/5)\*C\*1/1000
3. Yes, floating point is supported on the ARM Cortex M4. The cost is power.