

Interfacing of TFT Display with machines

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Abstract— This paper discusses the interfacing of TFT display with controller, also the tools used for development of GUI for display and various selection parameters used are discussed. We will also be discussing about the two software's used that are STM32cube IDE and touch GFX which will help us to make our application industry ready.

I. INTRODUCTION

Now a days, various machines, automobiles, security systems, use display which displays the functions and certain variables of the systems which gives the user information about the working of system. We have compared different displays and microcontrollers on basis of various properties. In this paper we have discussed various techniques to interface microcontroller with TFT display. After interfacing microcontroller with display, by using touch GFX software we have also used widgets which are used to operate machines. The visual that a TFT LCD display produces is sharper than a CRT monitor. Every pixel in a TFT LCD is active, preventing flickers and distortions. This means that you can get a clearer picture, which is necessary for work. Blurry images on a screen can affect a person's productivity.

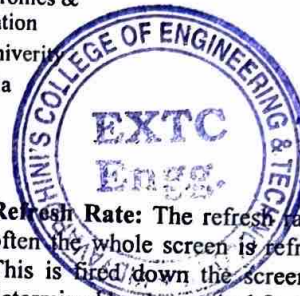
TFT DISPLAY PHYSICAL SIZE: THE SCREEN SIZE IS THE FULL VIEWABLE SIZE OF THE SCREEN. THIS IS MEASURED DIAGONALLY FROM CORNER TO CORNER.

In order to interface we need to understand different interfacing parameters:

Resolution: TFT displays have a certain number of pixels making up their liquid crystal matrix, and so each TFT has a "native resolution" which matches this number. Resolution of the TFT displays is standardized. Based on the application and the clarity of the required image, resolution of Display can be selected.

Aspect Ratio: The aspect ratio of a TFT display describes the ratio of the image in terms of its size. The aspect ratio can be determined by considering the ratio between horizontal and vertical resolution. Here are few examples with aspect ratios.

- 4:3 = Screen with 1600(H) x 1200(V) pixels resolution
- 5:4 = Screen with 1280(H) x 1024(V) pixels resolution
- 16:10 = Screen with 1920(H) x 1200(V) or 1560(H) x 1440(V) pixels resolution



Refresh Rate: The refresh rate of a display relates to how often the whole screen is refreshed by a display controller. This is fired down the screen at a certain speed which is determined by the vertical frequency set in graphics card.

Color Depth: The number of bits required to represent a color is called the 'Color Depth'. For example, a color depth of 16 bits means it requires 16 bits to represent a color, and therefore, we can represent 216 different colors.

Viewing Angles: The angles are related to how the image looks as viewer move away from the central point of view, as it can become darker or lighter, and colors can become distorted as viewer move away from his central field of view. Because of the pixel orientation, the screen may not be viewable as clearly when looking at the screen from an angle, but viewing angles of TFT's vary depending on the panel technology used.

Refresh rate (in Hz): is the number of times per second that the display panel is refreshed. A display must be refreshed minimum 60 times per seconds (60 Hz) since lower refresh rate creates bad visual effects.

565 colour Scheme: In this scheme, there are 5 bits of Red, followed by 6 bits of Green and 5 bits of Blue. Green is given more bits because of the property of the human eye, which can distinguish more shades of Green than Red and Blue.

II. BASIC GRAPHIC CONTENT

This section describes a basic embedded graphic system, the display module categories and the display technologies.

Basic embedded graphic system

A basic embedded graphic system is composed of a microcontroller, a framebuffer, a display controller and a display glass.

Display module categories

The display modules are classified in two main categories, depending on whether they embed or not an internal controller and a GRAM:

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