Penn Engineering

Lab 4: Pong

ESE5190: Smart Devices
University of Pennsylvania

In this document, you'll fill out your responses to the questions listed in the Lab 4 Manual. Fill out your name and link your Github repository below to begin. Be sure that your code on the repo is up-to-date before submission!

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GitHub Repository: https://github.com/ESE5190-UPenn-Fall2023/ese5190-lab-4-vbwanere

Interpretation of D/CX State: If D/CX is low: The byte that follows on the MOSI line is considered a command byte.
If D/CX is high (logic level 1):
The byte that follows on the MOSI line is considered a transmission byte (data).

1. **How does the controller differentiate between a command or a data packet?**
   The controller differentiates between a command or a data through the interpretation of D/C pin state:
   a. If D/C is low: The byte that follows on the MOSI line is considered a command byte.
   b. If D/C is high (logic level 1): The byte that follows on the MOSI line is considered a transmission byte (data).

2. **Colors are 16 bits but packet length is 8 bits, how are these sent?**
   The bits are divided as follow: the divided bits are sent over SPI protocol:
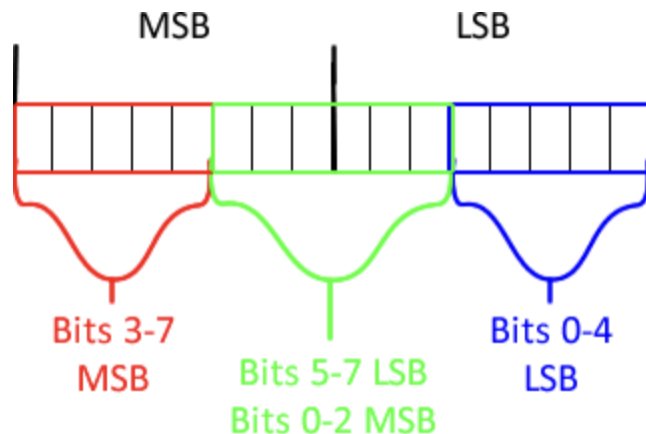
3. **What is the purpose of the LCD_setAddr function? Read about the called command.**
It sets the address window for data writing on the LCD. This function sends a sequence of commands and data to configure the column and page addresses before writing data to the display RAM.
ST7735_CASET: Set the column address.
ST7735_RASET: Set the page (row) address.
ST7735_RAMWR: Command to write data into the display RAM.

4. **rgb565 is a useful function to convert a 24-bit (8-8-8) RGB color value to a 16-bit (5-6-5) value used by the controller. What is the difference between 24 bit RGB and 16 bit RGB? Is information lost during this conversion? If so, is the loss significant?**
   1. 24-bit RGB (8-8-8):
        a. Red Channel: 8 bits
        b. Green Channel: 8 bits
        c. Blue Channel: 8 bits
   2. 16-bit RGB (5-6-5):
        a. Red Channel: 5 bits
        b. Green Channel: 6 bits
        c. Blue Channel: 5 bits
Information loss is significant as the number of colors for 16 bit is 65k and for 24 bit is 16M.

5. **Is debouncing of the "buttons" used to control the paddle needed here?**
No the debouncing is not needed as we are using virtual buttons and there no mechanical noise involved in the system.

   Part B: https://www.youtube.com/shorts/26BzDTve4BM

   Part E: https://www.youtube.com/shorts/N1pH4FHeelA