Exercise 2

Topic: Graphical LCD display with serial (SPI bus) and parallel interface

1. Laboratory stand

The laboratory stand consists of a PC with Integrated Development Environment Visual Studio and System Workbench for STM32, STM32F429 evaluation board with microcontroller STM32F429ZIT6U and TFT graphic display with parallel interface (Fig. 1), graphic LCD display with PCD8544 controller and serial (SPI) Interface (Fig. 2), set of Male-Male Breadboard Jumper Wires (Fig. 3), and mini USB cable.
2. Laboratory task

1. Refer to the documentation **UM1662: Getting started with the STM32F429 Discovery kit** (Appendix 1).
2. Refer to the documentation **UM1670: Discovery kit for STM32F429/439 lines** (Appendix 2).
3. Refer to the datasheets of **STM32F429xx** ARM Cortex-M4 MPU (Appendix 3).
4. Refer to the datasheets of **PCD8544** and **ILI9341** controllers (Appendix 4 and 5).
5. Connect LCD module (Fig.2) with STM32F429I-DISCO evaluation board according to the table 1.

   **Pay particular attention to the power pins!**

<table>
<thead>
<tr>
<th>Graphic LCD display with PCD8544 controller</th>
<th>STMicroelectronics STM32F429I-DISCO evaluation board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 VCC</td>
<td>+3V</td>
</tr>
<tr>
<td>2 GND</td>
<td>GND</td>
</tr>
<tr>
<td>3 SCE</td>
<td>PE2</td>
</tr>
<tr>
<td>4 RST</td>
<td>PE3</td>
</tr>
<tr>
<td>5 D/C</td>
<td>PE4</td>
</tr>
<tr>
<td>6 DN(MOSI)</td>
<td>PE5</td>
</tr>
<tr>
<td>7 SCLK</td>
<td>PE6</td>
</tr>
<tr>
<td>8 LED optional to +3V or NC</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1!**

All connections should be checked by the teacher before supplying power to STM32F429I-DISCO Evaluation Board!

6. By using the existing project in the folder E:\SW\TRSW\LAB2 perform communication between STM32F429I-DISCO evaluation board and **PCD8544** LCD controller allowing initialization, write data and write command to the display by software SPI port. In this task the prepared function: WriteSPI, PCD8544_WriteCMD, PCD8544_WriteData and PCD8544_Init should be completed according to the information included in appendix 4.

Initialization of the display controller can be done in the following way:

1. Reset on te RST pin (active LOW state).
2. Using the instruction Function Set switch to the extended instruction set.
3. Using the instruction Bias system set value of the bits BS2=1, BS1=0, BS=0.
4. Using the instruction Set VOP adjust the contrast by setting bits Vop (e.g. Vop6=1, Vop5=0, Vop5=0, Vop5=0, Vop5=1, Vop0=0).
5. Using the instruction Function Set switch to the basic instruction set and set horizontal addressing.
6. Using the instruction Set Y address of RAM and Set Z address of RAM reset the addresses.
7. Reset the memory contents by writing 0x00 data to all memory bytes.
7. (optional) Add to the project procedures for communication with the PCD8544 LCD controller procedures which allow to draw a bitmap data stored in MPU memory (eti_logo table in main.c file).

8. Check in Appendix 2 how to connect the TFT display to the processor STM32F429ZIT6U. Note the descriptions of the line of control display and the name of the corresponding pin microcontroller.

9. Perform the possibilities of library prepared by STMicroelectronics (BSP_LCD) and design a simple animation using two layers. In this task refer the contents of stm32f429i_discovery_lcd.c and stm32f429i_discovery_lcd.h files.