Embedded Systems

Exercise 2

Introduction

The first stage of this exercise is to familiarise yourself with the STM32CubeIDE development environment and master the basic functionalities necessary to create a new project, compile the program, run it and debug it using the KAmeleon-STM32L4 evaluation board.

As part of the exercise, you should also familiarise yourself with the structure and functionality of the input/output ports (GPIO) of the STM32L496ZGT6 microcontroller. As part of this exercise, the program developed in exercise 1 should be extended to control the RGB diode using the joystick. A detailed specification of the requirements for the program is given in the other part of the manual.

Tasks

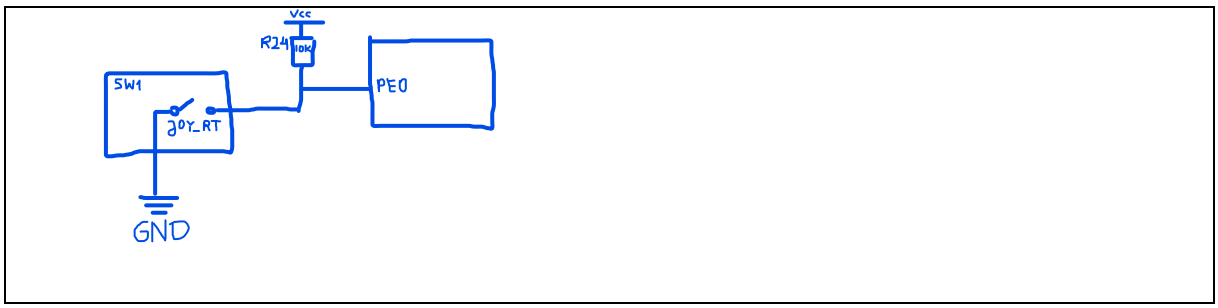
- Analyse the wiring diagrams of the KAmeleon-STM32L4 evaluation board
- Understand how to configure an I/O port to control RGB LED
- Understand how to configure an I/O port to read the button state
- Understand how to control LEDs
- Configure all I/O pins required to implement program logic according to their functionality
- Extend the application from exercise 1 with an algorithm for checking the status of buttons and controlling LEDs
- Compile, run and debug the application

Initial Questions

There are eight single-colour LEDs (D1-D8) and an RGB LED (D9) on the evaluation board. In addition, the board contains five buttons in the form of a joystick. Electrical diagrams showing the connections of individual board components are available on the course website at: https://fiona.dmcs.pl/es/doc_stm/Kameleon_STM32L4-v1-0_Schematics.pdf

As a preparation for writing the program, please answer the following questions:

Draw the connection diagram between the microcontroller and the JOY_RT button, which is part of the joystick (SW1)
Refer to the evaluation board schematics for information.



Based on the evaluation board schematics, please analyse whether the LEDs and buttons are connected to the ground or the supply voltage (+3.3 V), and then answer the following questions:

The D1 diode is connected to pin … of the microcontroller.	PC6
The D9 diode is connected to the pins ... of the microcontroller.	PD12, PD13, PB8
To turn on the D1 LED, set the corresponding pin to the state: (high/low)	High
To turn on the D9_B LED, set the corresponding pin to the state: (high/low)	High

The SW1 JOY_RT button is connected to pin … of the microcontroller.	PE0
The SW1 JOY_LF button is connected to pin … of the microcontroller.	PE1
Pressing the JOY_LF button forces the pin state: (high/low)	low

Requirements for the application

- The LEDs D1-D8 should be controlled in the same way as in exercise 1 (“moving LED” algorithm)
- Additionally, the application should continuously read the status of selected buttons of the SW1 joystick and, on this basis, control the RGB LED in the following way:
    - Each LED colour (R, G, B) corresponds to the selected directional button (e.g. R - left, G - down, B - right)
    - When the selected button is pressed, the corresponding LED turns on
    - When the button is released, the corresponding LED is off
    - Pressing the centre joystick button turns on all the colours
- Both functionalities (LED line implemented with D1-D8 diodes and controlling the RGB diode) should work simultaneously, without visible delays in response to pressing the buttons
- To configure and control input/output ports, the HAL library provided by the manufacturer of the STM microcontroller and available in the STM32CubeIDE environment can be used