



Hacettepe University
Computer Engineering Department
BBM434: Embedded Systems Laboratory
3rd Lab Assignment Report
(2nd Section)

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OBJECTIVE

The purpose of this assignment is to reimplement the 2nd lab. experiment with external circuit components independent from launch pad. Main idea is same with last lab. experiment — lighting up the LED's with specified order&duration and changing that order by pressing a button. However, it's requested to set up this system with non-internal circuit components.

THEORETICAL BACKGROUND FOR THE LAB

First of all, it's needed to mention about the external circuit components used in this experiment and their roles.

LED is a semiconductor diode that emits light when conducting current and is used in different areas about electronics such as displays, indoor and outdoor lighting, etc.

Resistor is electrical component designed to introduce a known value of resistance into a circuit. Resistors are used for regulating the current flows to the LED's and switches.

Solderless breadboard is a circuit board on which electronic components can be easily rearranged or replaced for preliminary design or testing.

This experiment is mainly aimed at connecting the proper ports from the General Input/Output Interface (GPIO) on the launch pad to the LED bulbs assembled on the solderless breadboard together with the resistors to emit light in a specified order from these bulbs and reverse the lighthening order in case of pressing button on that solderless breadboard. Unlike the last experiment, these GPIO ports were constructed as GPIO Port E instead of GPIO Port F which include internal LED's and switches.

In the other hand, the **timing** notion is another significant problem regarding this project. In the last experiment, timing for triggering to enlight a specified LED was implemented with non-efficient way, but in this experiment, it's requested to implement the timing with implicit time module called as **SysTick** timer.

SysTick timer is a simple 24-bit counter that can be used to create time delays and generate periodic interrupts. In this project, it's satisfied to initialize SysTick timer as 0.5 msec for an iteration.

PROCEDURE AND RESULTS

In this lab assignment, external material was used with LaunchPad to achieve the goal. The goal was lighting the LEDs in turn with yellow, red, green and again yellow, red, green and so on. Each time external switch is pressed color order had to reverse.

First, it was decided to use PORTE instead of PORTF. PEO was input, PE1-3 was output. External switch connected to the PEO pin and the LEDs connected to PE1, PE2, PE3 pins respectively. With the aim of providing power to the breadboard, 3.3V pin connected to (+) row of breadboard. And GND pin connected to (-) row of breadboard. After these step, one switch and three LEDs placed to the breadboard. Also four resistors placed, three of them for the LEDs(each resistor is 470Ω), and the last one for the switch(this resistor is $10k\Omega$). Connections with the LaunchPad made according to the picture on the lab sheet of this assignment.

After making connections on the breadboard, related code written. In this code SysTick timer was used to perform delay operation instead of using loops. In addition, switch on the board was implemented as **positive logic** which means if the button is pressed, then the value of GPIO_PORTE_DATA_R value will be true (0x01). When the LaunchPad is powered up the LEDs start to lightning in order Yellow-Red-Green. Every time the switch button is pressed the order of lightning is reversed.

VIDEO OF LAB ASSIGNMENT DEMO

- [BBM 434 - Lab 3](#)