Laboratory Exercise 04:

Implementation of a smart alarm

In this laboratory exercise, a smart alarm system is implemented, which provides security in the area it operates. The alarm consists of four elements, that serve different functions:

1) A distance calculation sensor, which is an input to the ADC.

2) A timer element.

3) Two switches, which act as a keypad for entering the deactivation code.

4) A PWM pulse that activates the alarm siren.

The alarm consists of two functions, the activation function and the deactivation function. The first function is called in order to activate the alarm and secure the premises. Specifically, when someone enters the predefined four-digit combination via the keypad (two switches of the PORTF), the activation function is called. This four-digit combination is a sequential activation of the two switches SW5 and SW6 of the PORTF in a predetermined sequence. The combination consists of first activating the SW6 switch, then the SW5 switch, then the SW5 switch again and finally the SW6 switch. Once the combination has been correctly entered, a timer (can be simulated with any timer/counter you like) is activated which gives a time period for the occupants of the room to leave the room, locks the doors and activates the second function of the alarm.

The second function, the disable function, is called when it is detected through the distance sensor that someone has entered the guarded area. In particular, when the ADC value falls below a threshold, an LED (LED0) is activated and then the alarm requires the correct input of the entire predefined four-digit combination (the sequence SW6-SW5-SW5-SW5-SW6) within a limited period of time. Therefore, the ADC sets a timer running for a period of time within which the code must be entered with a margin of error of up to three times. If the correct combination is entered within the time limit with less than three attempts, then the alarm is deactivated and its first function is called (it waits for the combination to be entered before it is reactivated). If the time interval expires without entering the correct combination or if the wrong combination has been attempted three times, the siren shall be activated. The siren will be simulated by driving the LED (LED0) through a PWM pulse. On the rising edge of the pulse the LED will be turned on and on the falling edge of the pulse the LED will be turned off (falling edge) of the corresponding pulse will be disabled. To stop the siren and deactivate the alarm (to start its first operation) the correct combination. Finally, note that when an error is made in entering the combination at any stage, the alarm will require the entire combination to be entered again from from the beginning (SW6-SW5-SW5-SW5-SW6).

Laboratory Exercise Questions 4

1) Implement the first function of the alarm function, i.e. the correct combination input waiting system as well as the activation and deactivation of the timer.

2) Implement the second function of the alarm, namely the activation of the ADC, LED0, the timer and the correct combination input control in three attempts within the time frame specified by the timer.

3) Implement the buzzer, i.e. set a PWM pulse to turn LED0 on and off.