Hacettepe University
Computer Engineering Department
BBM434: Embedded Systems Laboratory
5th Lab Assignment Report

(2nd Section)

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OBJECTIVE

In this assignment, a basic 'fast finger reaction game' was implemented with using an external LCD screen. The main rule of this game, the player who performs the fastest finger reaction after a certain time will win the game - also the player who performs that reaction within that time will lose.

THEORETICAL BACKGROUND FOR THE LAB

An external Nokia 5110 LCD screen, which displays details of the game in the designed system, was connected to the GPIO_PortA input of the launch pad. The various functions for this screen (initialize, print a string on the screen and clear the screen) were used by importing the Nokia5110.c source file in the Keil directory. On a Nokia 5110 LCD screen with a screen size of 84x48, the pixel corresponding to the point must be activated in order to print a spot.

Figure 1. *A pixel distribution of letter 'B' on LCD screen*

Additionally, there is one more criteria has been defined. Accordingly, from the moment the "PRESS" text is displayed, that is, when a player presses the button within 100 ms from the moment that the players are allowed to press the buttons, the player will lose the game. Various variables are held in implementation for this to happen. The gaming mechanism is provided by looking at these values.

The control of the buttons in the calculation is done by means of interrupts designed for GPIO_PortE. The GPIOPortE_Handler () function allows a button player to lose or win the game by looking at the variables described above when a button is pressed. The timing concepts in the game are defined using the SysTick timer.

PROCEDURE AND RESULTS

The external LCD screen used in this experiment is connected to the GPIO_PortA ports on the launch pad. The necessary initialization on the GPIO_PortA ports is provided by the Nokia5110_Init () function in the Nokia5110.c source file in Keil. After the display interface, this system is based on two main concepts:

Timing Concept

The timing concept for the game is defined by the SysTick timer. In the designed system, response times and game start times can be detected with a counter increasing every 1 ms interval. The start time of the game is determined randomly at the beginning of the game and the game starts by reaching this randomly determined time. The beginning of the game is achieved by taking a non-zero value of an integer variable that is a barrier name; According to which a player loses the game if the barrier variable is zero and the button is hit.

Pushing a Player to the Button

As mentioned above, the control of the buttons is provided by interrupts. When a player presses the button, the PortE handler function is called. This handler function takes the value of the counter at the beginning of the game with that current value and makes it for both players. These values are compared and the player with the smallest difference value is allowed to win the game. Along with the winning player, the difference values (RT1, RT2) of both players are printed on the screen.

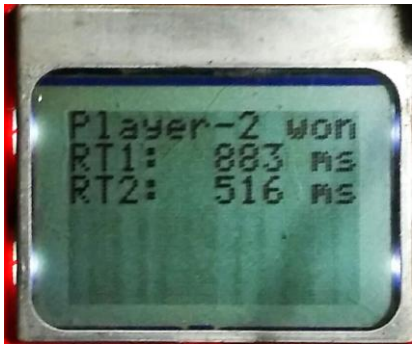

Figure 2. *Display of winning player and reaction times*

In this experiment, the button press of a player in the first 100 milliseconds after the start of the game is interpreted as 'coincidence'. Therefore, the first 100 millisecond reaction was not accepted by the system.

If a player presses a button before the game starts, the system will print an information message ("FALSE START") indicating that an incorrect move has been made.

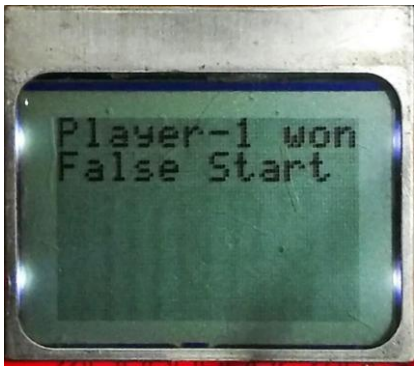

Figure 3. *Display of false starting*

Game continues after a player won the game until during the power is on. It's used a delay function to seperate each phase.

VIDEO OF LABORATORY ASSIGMENT DEMO

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