UNIVERSIDADE da MADEIRA

Evaluation Component P3 (15%) of Computer Architecture

School year: 2020/2021

Delivery and discussion date: 16-06-2021

1. Description of the third practical evaluation component: Control system for the number of entrances in closed spaces

In the third evaluation work, students should develop a program in assembly language and C language for the 8051 processor, capable of controlling the number of entries in closed spaces, where hand hygiene is mandatory.

Requirements for controlling the number of entrances to closed spaces:

B1: at the entrance of the closed space, the user must wash his hands with a solution of alcohol gel. When the user presses the alcohol gel dispenser, button B1 is activated at the same time.

B2: leaving the closed space, as at the entrance, the user is obliged to wash his hands. In this way, the B2 button is activated when the user presses the alcohol gel dispenser at the outlet.

L1 and L2: L1 corresponds to the green light and L2 corresponds to the red light, placed at the entrance to the space. The red light is normally on and the green light is normally off. When button B1 is pressed, the red light is turned off and the green light is turned on, for 3 seconds, to indicate to the user that he can enter the space. At the end of 3 seconds, the green light is switched off and the red light is switched on again. Only one user can enter at a time.

D1: D1 is a 7-segment display that shows the number of entries still allowed at any time. By default, it is considered that the maximum capacity of the space is 9 people at the same time. If a user enters, the space capacity is decreased by one. If a user leaves, the space capacity is increased by one.

L3: L3 corresponds to a yellow signal light, which is normally switched off. If the space is occupied with more than half of the allowed capacity, that is, if the number of users within the space is equal to or greater than 5, this yellow signal light flashes every 1 second (1 second on, 1 second off)). If the number of users within the space is less than 5, L3 is off.

Description of the microcontroller connections:

Figure 1 shows the wiring diagram of the microcontroller that manages the control of the number of entries in closed spaces mentioned above.

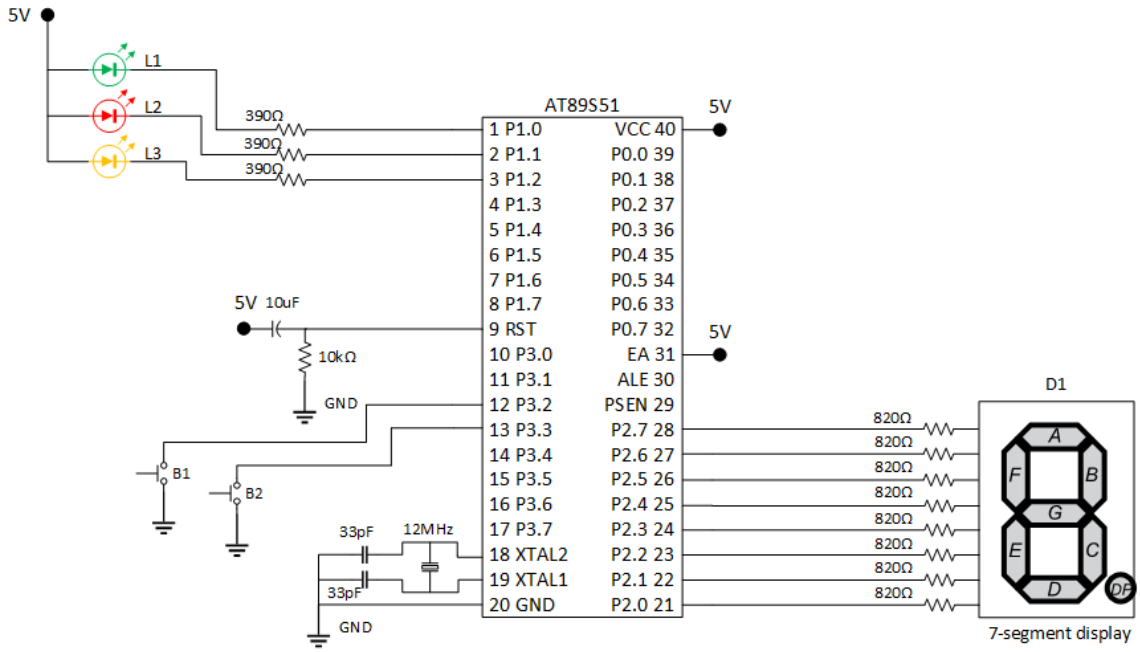

Figure 1 – Diagram of microcontroller connections.

Mapping of the microcontroller pins:

Table 1 shows the mapping of the microcontroller pins.

Table 1 – Mapping of the microcontroller pins.

Object	Microcontroller pin
Lights	
Green (L1)	P1.0
Red (L2)	P1.1
Yellow (L3)	P1.2
Buttons	
Entrance button (B1)	P3.2
Exit button (B2)	P3.3
Display	
Segment A	P2.0
Segment B	P2.1
Segment C	P2.2
Segment D	P2.3
Segment E	P2.4
Segment F	P2.5
Segment G	P2.6
Segment DP	P2.7

7-segment display truth table:

The 7-segment display used is a common anode. Table 2 shows the truth table for the 7-segment display.

Table 2 – Truth table for the 7-segment display.

Segments								Value
A	B	C	D	E	F	G	DP	Decimal
0	0	0	0	0	0	1	1	0
1	0	0	1	1	1	1	1	1
0	0	1	0	0	1	0	1	2
0	0	0	0	1	1	0	1	3
1	0	0	1	1	0	0	1	4
0	1	0	0	1	0	0	1	5
0	1	0	0	0	0	0	1	6
0	0	0	1	1	1	1	1	7
0	0	0	0	0	0	0	1	8
0	0	0	0	1	0	0	1	9

2. Work Plan

The third evaluation work of the course of Computer Architecture is divided into three phases, namely:

- Specification and drawing of the control system for the number of entrances in closed spaces flowcharts;
- Programming in assembly and C languages;
- Implementation, testing, and writing of the report.

- Specification and flowcharts diagrams
    - Drawing of the flowcharts of the main program and the interrupt routines.

- Programming in assembly and C languages
    - Study of the languages for the microcontroller 8051;
    - Study of the configuration and programming of microcontroller interrupts;
    - Programming in assembly and C languages;
    - Simulation of the control system for the number of entrances in closed spaces in the Keil uVision software.

- Implementation, testing and writing of the report
    - Circuit build and verification of the program in Multisim;
    - Elaboration of a report with the description of the work carried out, in a maximum of 5 pages (not counting the annexes, cover and index);
        - Cover with the identification of the discipline, the teachers and the students;
        - Objectives;
        - Description of the solution and analysis of results;
        - Conclusion;
        - Bibliography;
        - Annex A: Flowcharts
        - Annex B: code in assembly and C languages, commented and organized in functions/routines.

3. Evaluation and relevant information

The evaluation work must be done individually or in groups of 2 students. It accounts for 15% of the final grade and has a minimum grade of 8/20.

The report in PDF and the files with the programs should be compressed into a single ZIP/RAR file, which should be sent simultaneously to the Student Support Office ("trabalhos@uma.pt") and to the teacher Pedro Camacho (pedro.camacho@staff.uma.pt) until midnight of the day 16-06-2021. In the e-mail you should indicate: your name and student's number, the course name, the work identification and the teachers names.

Plagiarism of the work implies its annulment.

The discussion of the work (16-06-2021) is individual, being necessary to show the program working correctly, without errors, in Keil uVision and in the Multisim, in at least one of the programming languages.

At a later date to be defined, each student must show the functional project in the laboratory.

GOOD LUCK!