Cairo University
Faculty of Engineering
Computer Engineering Department

Microprocessor Systems
Final Assessment
Due Date 2/6/2020

Task 1: Light Panel

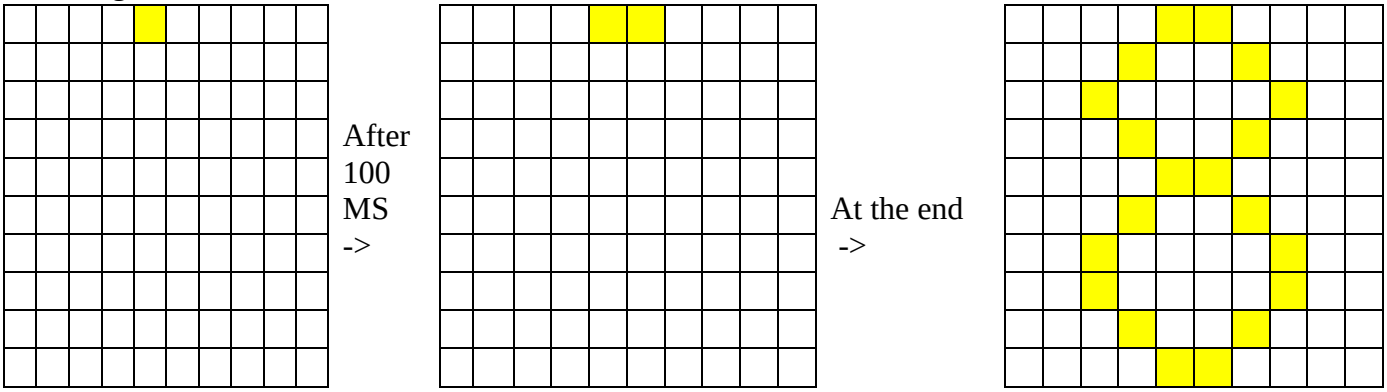
It is required to build a 10*10 LEDs grid. This grid is controlled by a 10 keys keypad. The grid functionality as follows:

The grid has two modes:

1- Numeric mode
2- Emotions mode

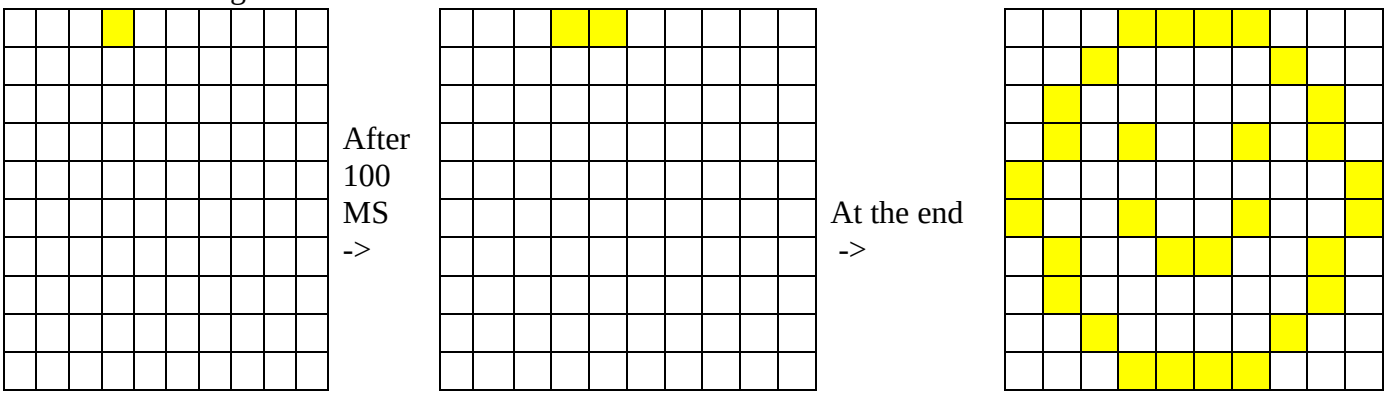
As the system power on, the LEDs grid starts self-testing by turning on the first column while all other columns turned off. The turning on the second column after 200 millisecond and turning off all other columns including the first one. After finishing all columns, the first row is turned on while all other rows are turned off. Then, the second row is turned on while all other rows are turned off including the first row… etc.

After completing self-testing, the grid is working in the numeric mode. In this mode, if the user pressed any key from 0 – 9 the key is drawn on the led grid using LEDs one by one. Meaning that, the first led will open then the second one after 100 milliseconds and so on. For example, if the user entered 8 then the system will do as the following:



If the user entered the password (which is 1234) the system enters the emotions mode. Each key will activate certain emotion of your choice. Therefore, it is required for to select 10 different emotions.

For example, zero will be reserved for 😊 and 1 for ☹. For example, if the user pressed Zero the system will draw the following



If the user entered the reverse of the password (which is 4321) the system returns to the numeric mode.

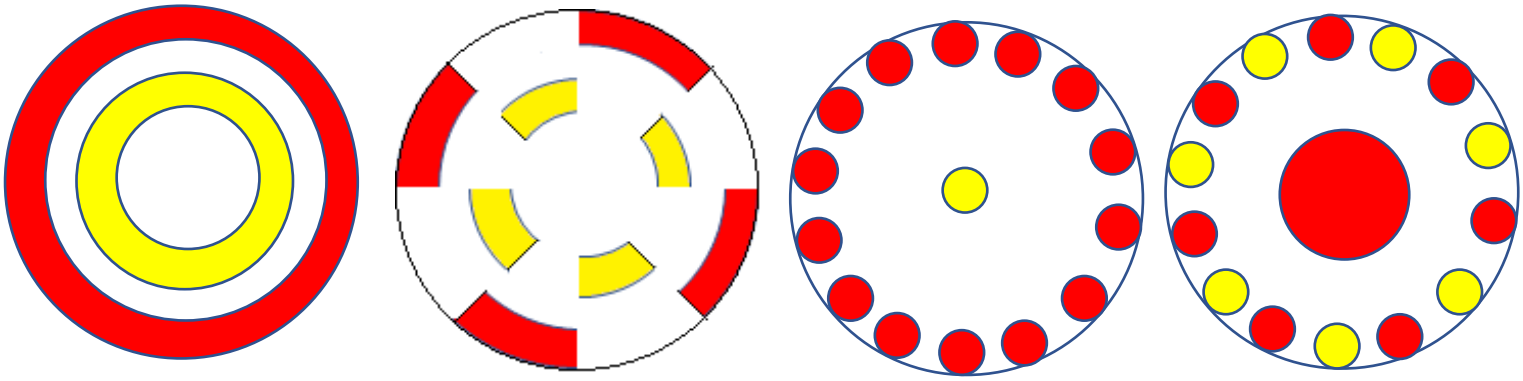
The user is able to change password by entering 1212 followed by four keys. For example, if the user entered 12127891 then the password to change mode from numeric mode to emotions mode is 7891 and the password to change mode from emotions mode to numeric mode is 1987.
An "audio out" sound device is connected to the system. It should make a different sound with each key pressed. And a longer sound if password sequence is detected.
While drawing the number or emotion, if the user pressed any other key (other than the one to be drawn) the system should stop drawing the current number/emotion immediately and start in the new one.
You are allowed to use (AND – OR – NAND – NOR – NOT – XOR – XNOR – Resistors) as you wish with any number of inputs
+ 100 LEDs (LED matrix or LED bar are forbidden)
+1 Keypad or 10 keys
+1 Arduino Uno
+1 audio out
[Optional] voltage source
You are not allowed to use any external library.
All "#include lines" in your code or any non-mentioned devices will be deleted automatically before task evaluation
No restrictions on the code size, number of lines or using delay.

Task 2: Cake Maker / Decorator

It is required to build a cake making / decorator system. This system contains three phases:

1- Making the cake. To make the cake you need to add the following components in the following order
   a. Eggs: open the eggs valve for 500 Milliseconds. All valves are controlled by a servo motor
   b. Start the mixer. The mixer is considered as a stepper motor. The mixer speed is 10 revolutions per second.
   c. After 5 mixer rotations, Open the vanilla valve for 100 milliseconds. And keep rotating the mixer for 4 more rotations. The mixer should not stop while adding the vanilla.
   d. Open the sugar valve for 200 milliseconds.
   e. Make another 10 mixer rotations.
   f. Now, the mixer speed will be reduced to the half. It should be 5 revolutions per second.
   g. Do the following three times
      i. Open the flour valve for 100 milliseconds
      ii. make 4 mixer rotations
2- Baking the cake:
   a. Move the production line using another stepper motor for one full rotation
   b. The cake is now in the oven, open the heater (replaced by a red LED) for 1 second.
   c. Move the production line again for one full rotation
   d. Stop every thing for one second. (The cake needs to cool down)
3- Cake decoration:
   a. There is a mechanical arm used to decorate the cake.
   b. This arm consists of one servo motors to move the arm and two valves (these to valves only are replaced by two LEDs Red and Yellow) to open the raspberry cream or pineapple cream.
   c. The cake stand is rotating using a stepper motor. Therefore, decorating the cake is just like writing data to hard disk. Except that, data is written only to side 0 / platter 0, Review to hard disk lecture to understand the decoration method.
   d. The user is able to select between 4 different very simple decorations using four keys keypad.

e. These four decorations are the following



You are allowed to use (AND – OR – NAND – NOR – NOT – XOR – XNOR – Resistors – LEDs – Motors) as you wish with any number of inputs
+1 Keypad or 4 keys
+1 Arduino Uno
[Optional] voltage source
You are not allowed to use any external library.
All "#include lines" in your code or any non-mentioned devices will be deleted automatically before task evaluation
No restrictions on the code size, number of lines or using delay.

You must submit your task as a one compressed file (.zip or .rar only- No other extensions are accepted)

- This compressed file must contain ONLY four files named as
  - Final1.ino
  - Final2.ino
  - Final1.simu
  - Final2.simu
  - If you want to add any comments about your solution, add it as a comment at the begin of Final1.ino file or Final2.ino file (without putting any personal information)
- The compressed file name MUST be YourCode_YourName_Final_V1.zip or YourCode_YourName_Final_V1.rar
- YourCode starts with "9" for the two semester students and with "1","2","3" or "4" for credit hours students (You login to the faculty site using this code)
- Don't write your name or your code inside any of the four files, your code and name should appear only at the compressed file name.
- Put labels at all devices to describe its functionality
- If you need to re-submit your work, change V1 in the compressed file name to be V2, V3 … etc. For example, if you are resubmitting for the third time, your compressed file name must be YourCode_YourName_Final_V3.zip or YourCode_YourName_Final_V3.rar

Penalties:
Zero for this assignment: for Cheating [Copied designs or codes]
-2 : delivered file in extension other than .rar or .zip
-1 : Compressed file name in the format YourCode-YourName-Final, YourCode_YourName or YourCode-YourName instead of YourCode_YourName_ Final
-2 : incorrect code in the compressed file name
-2 : more than two files in the compressed file
-1 : compressed file name without versioning (V1,V2 .. etc.)
-1 : files inside the compressed file with names other than "Final1.ino" ,"Final1.simu","Final1.ino" or "Final1.simu"
-1 / hour : for the delayed submission after the deadline