Task 3

In our faculty of engineering, building 3000 contains seven floors plus ground. An elevator system is used for this building. It is controlled by a *keypad* inside the elevator that is used by the user to select the target floor. The system should detect the entered floor number and moves a *stepper motor* according to the current floor and the target floor values. Assume that one full motor revolution is required to move the elevator by a single floor. That means a full clockwise revolution moves the elevator one floor up and a full anticlockwise revolution moves the elevator one floor down. In addition, **six** *push switches* are used to call the elevator and **six** *7 Segment BCD* to display the current floor of the elevator (one switch and one 7 segment per floor). The push switch should be pressed for 200 milliseconds at least. Weight sensor is used to avoid overload. It measures the weight from 0 to 100 Kg and outputs a voltage that ranges linearly from 0 to 5 V. It is replaced by an **input voltage source**. If the weight is more than 70 Kg the motor should not move and a **red led** should be turned on. The motor should resume received commands and the red led should be turned off after removing the extra weight (changing the input voltage source).

Any key could be pressed at any time either from the inside key pad or outside switches.

The elevator should respond to any series of requests in the minimum number of rotations. For example, if it is at the start (at the ground floor) and the user pressed 4 at the inside keypad the motor should make four full rotations to reach the fourth floor. While the motor movement, if someone pressed the "Call" switch at the third floor then there are two cases:

1- If the motor rotated three or less full rotations, then it should stop after the third full rotation for one second (assuming it is the time needed for this person to open the door and enter the elevator). Then, it resumes the fourth rotation. In this case, it moved to the third floor then for the fourth floor. The motor makes four rotations.

2- If the motor rotated more than three rotations. Then it currently passed the third floor. Therefore, it should continue its rotations and stops for one second after the fourth rotation. Afterwards, it rotates one anticlockwise rotation. In this case, it moved to the fourth floor then returned back to the third floor. The motor makes five rotations.

Make the hardware and software design of this system using **Arduino Uno**. You can use any desired dimensions of the keypad. You are allowed to use any number of resistors in addition to mentioned devices (written in bold). In addition, you are allowed to use any number of only one type of gates.

This task is graded out of 10 based on the following points (one mark for each point)

1. The motor rotates the minimum number of rotations to fulfill the requests.
2. Red led working correctly (open / close)
3. The motor stop movement correctly with the weight sensor and resume the required orders after removing the weight without losing any order
4. The elevator responds to any pressed push switch more than 200 milliseconds
5. The elevator doesn't responds to any pressed push switch less than 200 milliseconds
6. It discards the repeated key strokes at the internal keypad or any external push switch.
7. All seven segments are working correctly
8. You shouldn't use any type of delay. Use millis
9. You should use at least one interrupt
10. No more than 20% more than the best fully working optimized code size (HEX file size in KB)

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 two files named as

o Task3.ino

o Task3.simu

o If you want to add any comments about your solution, add it as a comment at the begin of Task3.ino file (without putting any personal information)

• The compressed file name MUST be YourCode_YourName_Task3_V1.zip or YourCode_YourName_Task3_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 two files, your code and name should appear only at the compressed file name.

• 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_Task3_V3.zip

or YourCode_YourName_Task3_V3.rar

Penalties:

-20 : for Cheating [Copied designs or codes]

-2 : delivered file in extension other than .rar or .zip

Unmarked because it will be filtered automatically : Compressed file name in any format other than YourCode_YourName_Task3_VX.rar/zip

-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.) – and if you have more than 1 version, I will select one of them randomly

-1 : files inside the compressed file with names other than "Task2.ino" or "Task2.simu"

-1 / hour : for the delayed submission after the deadline

Part 2: Task 2 Review (If you didn't deliver task 2, discard this part. Its mark is part of task 2 grade, not this task)

It is required to review each other solutions of task 2 to check how others think about this task.

Steps:

Open this excel sheet

https://docs.google.com/spreadsheets/d/1JQgD5ZqV1cRw6ih6EZ0NA05eK7ZIMMY2uqPzJKOY8HQ/edit?usp=sharing

you will find three tasks solutions in front of your name. Download these rar files. Each file contains design and code. Run each design with its code then open this link

https://forms.gle/bb15psSEt1h93LCr7

and answer its questions

Note: Ensure that your code is written correctly in the spread sheet file