

**T.C.
DOKUZ EYLUL UNIVERSITY**

**FACULTY OF
ENGINEERING**

**DEPARTMENT OF
COMPUTER ENGINEERING**

**2022 – 2023
SPRING SEMESTER**

**CME 3208
PRINCIPLES OF
EMBEDDED SYSTEMS**

**LAB 8:
MOTOR CONTROLLER**

**DUE DATE:
23:55 – 09.05.2023**

In this lab you are asked to create a motor controller using 2 push down buttons, one seven segment display, direct current motor and L293D motor controller. You will use the buttons to change the direction and speed of motor. An example setup is given below.

	DIRECT CURRENT MOTOR	
LEFT BUTTON	SEVEN SEGMENT DISPLAY	RIGHT BUTTON

The left and right button will be used to change the direction of the motor in that direction (right button for clockwise and left button for counter clockwise rotation). The seven segment display will be used to show the current speed of motor. You can arbitrarily divide the speed of motor to 4, 5 or more sections (e.g. 0 is 0% speed, 1 is 25% speed, 2 is 50% speed, 3 is 75% and 4 is %100 speed, the top speed of motor). A global variable to store this motor steps are given below.

```
int MOTOR_STEPS = 4;  
// This variable is used to store how many steps that it would  
require for your engine to reach from 0% to 100% speed. This  
number should be between 1 and 10, including both of them.
```

An example of program execution of this circuit, with 4 step implementation, is given in the table below. You should try to make your code dynamic by being able to work up to 10 step (10% per step) model. This will increase your code quality and enable it to work for different scenarios. To represent step 10 in 7 segment display, use hexadecimal equivalent “A”.

Try to connect a piece of paper or any other object to the motor to make rotation and rotation speed more visible. Because it is usually very hard to see rotation on an empty metal shaft of the motor. Your motor rotation should be easy to see in your video.

In addition, you can put LEDs to both sides, near buttons, to represent current direction of rotation. However this is not required nor it is necessary.

BUTTON PRESS	SEVEN SEGMENT DISPLAY	MOTOR DIRECTION	MOTOR SPEED	EXPLANATION
	0	STOPPED	0%	Initial conditions of the motor. No button press or rotation is happened.
RIGHT	1	CLOCK WISE	25%	We pressed the right button and motor is working in clockwise direction.
RIGHT	2	CLOCK WISE	50%	We pressed the right button and the speed of the motor is increased.
RIGHT	3	CLOCK WISE	75%	We pressed the right button and the speed of the motor is increased.
RIGHT	4	CLOCK WISE	100%	We pressed the right button and the speed of the motor is increased.
RIGHT	4	CLOCK WISE	100%	The right button press does not have any effect in this state due to reaching maximum speed.
LEFT	3	CLOCK WISE	75%	We pressed the left button and the speed of the motor is decreased.
LEFT	2	CLOCK WISE	50%	We pressed the left button and the speed of the motor is decreased.
LEFT	1	CLOCK WISE	25%	We pressed the left button and the speed of the motor is decreased.
LEFT	0	STOPPED	0%	We pressed the left button and the motor is stopped.
LEFT	1	COUNTER CLOCK WISE	25%	We pressed the left button and the speed of the motor is increased.
LEFT	2	COUNTER CLOCK WISE	50%	We pressed the left button and the speed of the motor is increased.
LEFT	3	COUNTER CLOCK WISE	75%	We pressed the left button and the speed of the motor is increased.
LEFT	4	COUNTER CLOCK WISE	100%	We pressed the left button and the speed of the motor is increased.
LEFT	4	COUNTER CLOCK WISE	100%	The left button press does not have any effect in this state due to reaching maximum speed.

UPLOAD REQUIREMENTS:

You are required to upload three different files for this assignment. First is a text file that contains your source code for your circuit. Second is a Tinkercad screenshot showing your circuit after your design is finished. Third is a video file showing your circuit that has been created using lab supplies. Only one of the group members can make an upload, there is no requirement for all members to do a separate upload of same files.

For your video, you are expected to introduce yourself and your teammates, showing your student IDs in video too. If your group are working online rather than meeting in real life, you do not have to show the ID cards of students who are not physically present.

You are also expected to explain your circuit in a brief but complete manner and show its execution. This video should not be too long (a maximum of 3 to 5 minutes is acceptable) and should not be too large otherwise you will not be able to upload to Sakai (check the maximum allowed file size for upload to Sakai). You should also consider choosing resolution 720p over 1080p or larger for smaller file size (make sure your circuit is still visible and understandable over this resolution). You can also change your video format to a more space efficient one.

You should show the effects of changing every global variable that is mentioned above in your video. Again, please do not consider too many different values to make a too detailed video, just show the effect of changing that particular global variable.

If you experience problems with your circuit and cannot make it work, show your design in Tinkercad and your circuit at the same and explain what is the problem and what might be causing it in your opinion.

The naming of your files should follow the format below for 3 person groups. For 2 or 4 person groups just write 2 or 4 student numbers in ascending order. You should write your group numbers with one leading zero if it is between 1 and 9, normally for 10 and above.

The file extension for screenshot (Tinkercad) and video does not have to be “jpg” and “mp4”, you can use other formats as well like “png” or “mkv” or etc. However, make sure you use commonly used image and video formats, if we cannot open it on our computers, you grade related to them will be zero. In addition your source code file extension could be either “c” or “ino”, do not leave it as “txt”.

Do not “zip” or “rar” requested files and upload them. It is not necessary and it makes it harder for us to evaluate your assignments. Please upload 3 files as they are without compressing them to a single file.

You are advised to use serial monitor for debug purposes, it will help you to check your program state more in detail and more freely.

FORMAT:

GROUP_<group_number>_<student_number_1>_<student_number_2>_<student_number_3>_CODE.c

GROUP_<group_number>_<student_number_1>_<student_number_2>_<student_number_3>_TINKERCAD.jpg

GROUP_<group_number>_<student_number_1>_<student_number_2>_<student_number_3>_VIDEO.mp4

EXAMPLE:

GROUP_01_2023510123_2023510124_2023510125_CODE.c

GROUP_01_2023510123_2023510124_2023510125_TINKERCAD.jpg

GROUP_01_2023510123_2023510124_2023510125_VIDEO.mp4

You are expected to write your own code for algorithms instead of using an available method for calculations. If you use such as a method that makes this assignment trivial to code, your grade for coding will be zero.

Your uploaded source codes (as well as your circuit design) will be checked for cheating and plagiarism. If cheating is detected, your entire assignment will be graded zero. If you or other students copy your code from an online source rather than writing it yourself, it will be considered as cheating as well.

Make sure that you upload your correct assignment to correct upload section. If you accidentally upload another assignment (from another class for example) or to an incorrect upload (other section's upload), it will be considered as not turned in and it will be graded as zero. Worst of all, you will only realize it after grades are published and it will be too late to fix it.

If you have any questions or problems regarding this lab paper, you can ask about it in our lab sessions. If you wish, you can also ask it in class forums or assignment page comments. If you send an email and if your question is answered, please share this information with other students to prevent asking of the same question again and again.

Your assignment will be open for upload until 23:55, 10.05.2023. This is done to allow students who may experience extreme problems (no Internet or electricity, computer crash or failure, etc.) and miss the deadline as a result. This one day extension will allow them to upload. If you are still unable to upload, send us an email informing your situation and at the same time, try everything you can to make your assignment upload.

Lastly, please do not forget to click "Submit" button after you upload your assignment files. If you do not, even though your files are uploaded to Sakai, you are labeled as "No Submission" and ignored when we try to download your assignments, making your uploaded files invisible to us, leading us to assume you did not make an assignment submission.

GOOD LUCK TO YOU ALL!