T.C.
DOKUZ EYLUL UNIVERSTY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

2022 – 2023
SPRING SEMESTER

CME 3208
PRINCIPLES OF EMBEDDED SYSTEMS

LAB 2:
LCD CONTROLLER

DUE DATE:
23:55 – 21.03.2023

In this lab session, you are required to create a LCD controller using Arduino and other circuit elements. This controller will be managed by global variables. It will display and control which texts are currently shown in LCD (in both rows), if they are currently scrolling or not, the direction of scrolling and the speed of scrolling. An example of global variables and resulting LCD screen are given below.

```
boolean SCROLL_FLAG      = true;
// This variable is used to turn scrolling on or off.
int     SCROLL_WAIT     = 1000;
// This variable is used to store scrolling wait time before the next scroll operation. 1000 means 1000 milliseconds and this will execute a scrolling operation every 1 second.
char    SCROLL_DIRECTION = 'L';
// This variable is used to store direction of scroll operation. It should be 'L' for LEFT and 'R' for RIGHT. Any other value should not work correctly.

char LCD_ROW_1 [] = "This text is for row 0 and longer than 16 characters.";
// This variable stores the text that will be printed to first line of LCD.
char LCD_ROW_2 [] = "ABCD EFGH";
// This variable stores the text that will be printed to second line of LCD.
```

There will be two problems that you will encounter during this lab session.

First is printing Turkish characters on LCD. If the serial monitor works for non ASCII characters, then try to print them on LCD itself and explain how did you manage to do it on your video. If you were not able to print Turkish characters, explain what methods have you tried to accomplish this on your video, even though you were not successful.

Second is for text shorter than 16 characters. While printing on LCD screen, you should assume it as a text that is 16 characters long and filled with space characters (“ ”). That may make it easier for you to perform scrolling operation.

Please use Tinkercad online simulator to create and test your design before creating the circuit using your Arduino. This will allow you to design your circuit without experiencing connectivity or similar hardware problems.

You are advised to use Tinkercad individually (for every group member) first to design the circuit and code to understand it better and gain experience. Next you should create your circuit as a group by meeting in real life if possible or having an online meeting if it is not possible.

Make sure you use resistors with every connection and circuit with your Arduino board. Otherwise you might burn the port you are using (Digital 10 for example) or even your whole Arduino board. This is also true for circuit elements as well (temperature and humidity sensor for example).

Assuming the global variables that are given above, resulting LCD screen of these variable values are given below.

LCD SCREEN AT TIME 0 (MILLISECONDS):

	00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
00	T	h	i	s		t	e	x	t		i	s		f	o	r
01	A	B	C	D		E	F	G	H							

LCD SCREEN AT TIME 1000 (MILLISECONDS):

	00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
00	h	i	s		t	e	x	t		i	s		f	o	r	
01	B	C	D		E	F	G	H								A

LCD SCREEN AT TIME 2000 (MILLISECONDS):

	00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
00	i	s		t	e	x	t		i	s		f	o	r		r
01	C	D		E	F	G	H								A	B

LCD SCREEN AT TIME 3000 (MILLISECONDS):

	00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
00	s		t	e	x	t		i	s		f	o	r		r	o
01	D		E	F	G	H								A	B	C

LCD SCREEN AT TIME 4000 (MILLISECONDS):

	00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
00		t	e	x	t		i	s		f	o	r		r	o	w
01		E	F	G	H								A	B	C	D

LCD SCREEN AT TIME 5000 (MILLISECONDS):

	00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
00	t	e	x	t		i	s		f	o	r		r	o	w	
01	E	F	G	H								A	B	C	D	

LCD SCREEN AT TIME 6000 (MILLISECONDS):

	00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
00	e	x	t		i	s		f	o	r		r	o	w		0
01	F	G	H								A	B	C	D		E

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.

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 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, 22.03.2023. 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!