T.C.
DOKUZ EYLUL UNIVERSTY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

2022 – 2023
SPRING SEMESTER

CME 3208
PRINCIPLES OF EMBEDDED SYSTEMS

LAB 9:
TRAFFIC LIGHT AND MOTOR

DUE DATE:
23:55 – 16.05.2023

In this lab you are asked to create a traffic light simulation with a LED, a light sensor and DC motor. The circuit will start with motor turned on and LED is turned off. The LED will be turned on randomly, simulating a red light on a traffic stop. When the light sensor detects this red light (turned on LED), the motor will be turned off. When the LED is turned off again after a random time interval, the motor will start again. To regulate this random activation of LED, the following global variables will be used.

```
int LED_WAIT_DURATION_MIN = 2000;
int LED_WAIT_DURATION_MAX = 6000;
//The variables above are used to store possible minimum and maximum values for random wait time of LED. They are given in milliseconds (1000 milliseconds is 1 second).

int LED_ON_DURATION_MIN = 2000;
int LED_ON_DURATION_MAX = 6000;
//The variables above are used to store possible minimum and maximum values for random activation time of LED. They are given in milliseconds (1000 milliseconds is 1 second).

int LIGHT_SENSOR_OUTPUT_INTERVAL = 1000;
// The variable above is used to store how frequently the result of light sensor is print out to serial monitor. Currently it is 1000 milliseconds (one second).
```

While the circuit is working, you are also asked to print out the randomly selected values for wait and on time of LED to serial monitor. For this example, the output of light sensor is assumed to be an integer between 0 and 1000. Depending your light sensor and circuit construction, these values might be lower or higher.

```
LED is turned OFF for 2551 milliseconds.

Light sensor output is 101.
Light sensor output is 97.

LED is turned ON  for 3779 milliseconds.

Light sensor output is 951.
Light sensor output is 974.
Light sensor output is 965.

LED is turned OFF for 4111 milliseconds.

Light sensor output is 159.
Light sensor output is 85.
Light sensor output is 124.
Light sensor output is 99.

LED is turned ON  for 5987 milliseconds.

… (This continues until execution stops)
```

In the example above, milliseconds are used for random time durations. However, you can also use just seconds for both serial monitor output and global variables, instead of milliseconds. Even though the random time intervals are increasing in the above example, this might not be the case for every execution of your code and it is not a requirement. You should print out the line related to activation and deactivation of LED at the start of that time interval.

While printing light sensor output in the given example above, we assumed the timer for output interval is reset every time a new LED status is printed to the serial monitor. You do not have to follow this implementation. This has been done to make it consistent with LED activation and deactivation intervals in the given example. Alternatively, you can follow the same time interval from the start of code execution.

Another important point that you should take into consideration is how well light detector will be able to tell if LED is turned on or not. To maximize correct detection, you should use a lower resistance with LED to increase light output, arrange your light detector directly facing the LED and if this still not work effectively, lower the environment light to make it easier to detect by light detector.

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.ino
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.ino
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, 17.05.2023. 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!