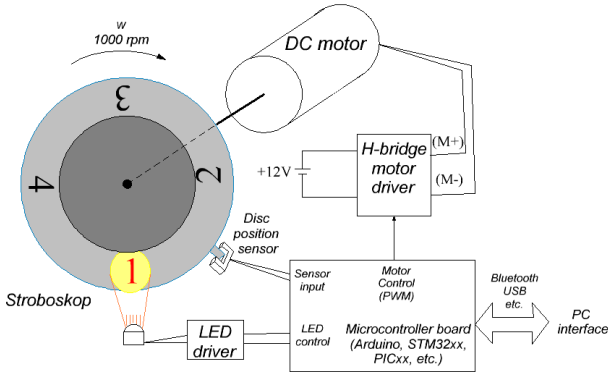
# EE328 - Power Electronics Design Project
## LED Stroboscope

**Objective:**
The objective of this project is to design, simulate and test of a power electronics converter described below.




**Design Problem Statement:**
In this project, a LED stroboscope system capable of highlighting any selected number on the spinning disc will be designed. The system consists of the following components: a power LED and its driver, a PMDC motor and its 4 quadrant speed driver, a paper disc, an optical position sensor (or any other sensor/method) to sense the disc position, and a microcontroller.

**Experimental Part:** Design a stroboscope system according to the design requirements below;

1. All the system should be energized from a single 12V±10% dc voltage source.
2. There is no restriction for the voltage, power or current of the PMDC motor used. The only requirement is that the PMDC motor speed should be adjustable from 120 rpm to 1200 rpm bi-directionally via H-bridge driver.
3. A paper disc which has 4 numbers (1, 2, 3 and 4) placed on it should be attached to the motor shaft.
4. The power of the LED should be selected so that the highlighted number clearly visible under the normal laboratory lighting. If needed, any concentration lens dedicated to power LEDs can be employed for this purpose.
5. The disc position can be sensed by using optical infrared sensors.
6. It is not allowed to use linear circuit topologies, like LM 317. Only switching mode converter topologies, buck, boost, full-bridge etc. are allowed (Except the +5V/3.3V voltage regulator for microcontroller)
7. All the system must be controlled by a single microcontroller, i.e. Arduino xx, STM32xx or similar development card. The microcontroller card must also be powered from the 12V dc source mentioned in (1).

Infrared sensor

8. The microcontroller should have an LCD display. The display should indicate the number to be highlighted on the disc, and also the disc speed in rpm.
9. The number which is highlighted on the disc should be changeable by user using a single push button on the board, or wirelessly by an android device.
10. The maximum average input power of the system from 12V dc source should be lower than **8W** in total.
11. An additional bonus will be awarded if the circuit is assembled on a printed circuit board.
12. The teams which demonstrate the project successfully before 25.04.2018 will be awarded by additional bonus.

**Proposal preparation and final tests:**

- Prepare a proposal for the project which contains brief information about the project, project team, design requirements, work plan, and project time schedule etc.
- Each team should consist of 5 students, and the task of each student should clearly be defined in the project proposal.
- The **project proposals must be submitted via email until 05.03.2018**.
- Demonstrations of all projects will take place at laboratory at 09.05.2018. Each group will have 5 min. to demonstrate their work and answer the questions. All the team members should know all details about the project. Any student who doesn't participate to the demo will get zero grade from the test section.

- Test procedure during the evaluation as follows:

| **Test** | **Test procedure** | **Points** |
|---|---|---|
| Test step #1: Initialize | The circuit will be energized from the 12V laboratory DC voltage source. The disc speed should be 120 rpm and number "1" should be displayed both on the disc and LCD display. | 20p |
| Test step #2: Alternating the number | By clicking a push button, the number highlighted on the disc should increase by "1". When it reached to "4", the next number should be "1" again. No restriction for the disc speed in this test. | 20p |
| Test step #3: Speed variation | While the disc speed is 1000rpm, the number highlighted should count forward by intervals of 1 second automatically. | 20p |
| Test step #4: Reverse direction | While the number "1" is highlighted on the disc, the disc speed is adjusted from 120rpm to 1200 rpm slowly. The highlighted number must be standstill. | 20p |
| Test step #5: Reverse direction | Repeat the step #2 in reverse direction (CCW) of PMDC motor. | 20p |
| Test step #6: Remote control | Is the device able to controlled by an android device wirelessly | +5p Bonus |
| Test step #7: Pcb | Is pcb designed? | +10p Bonus |
| Test step #8: Early finish | Early demonstrate before 10.05.2017 | +10p Bonus |
| | TOTAL: | 100p+25p Bonus |

- The final report must include the followings;
    a. An introduction section which gives brief information about the project
    b. Details about the design requirements
    c. Details about the topology used in the project
    d. Design procedure
    e. Verification of power circuit design by using PSIM simulation
    f. Component selection.
    g. Description and a photograph of the experimental setup.
    h. Comparison of the expected results with experimentally measured values.
    i. Conclusion
- A 2 minute demonstration video of the project should be prepared. This video should introduce the course and team members at first as a slide, and then consist of the test steps above.
- **Project final report + simulation files + demo video** should be submitted via email as zip file (must be below <5Mbyte in size) **until 31.05.2018**.
- IMPORTANT NOTE! Plagiarism will not be tolerated, and results in failure for the project and frequently failing grade for the course.
- Assessment : 100% grade = 50% test + 50% report.

Assoc. Prof. Dr. Mutlu BOZTEPE, 27.02.2018