FYS4260/FYS9260 2021:

Mandatory lab project task:

Target specifications for my lab project

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| **Student Name:** | Emiliano Staffoli |
| **Lab project name:** | Digital Clock using IC4026 |
| **Specification version/date:** | V2 – 14/02/2021 |

1. Use case description:

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| **Use case (scenario) description** |
| *My purpose is to make a digital clock displaying the time in a 24h format, showing current seconds, minutes and hours. The circuit will be powered through a 5V source provided by a USB charger, so that it can easily be used in a closed space. When the charger will be plugged in, the circuit will start operating, so there’s no need for general switches to turn it on. The current time will be provided through 6 7-segment displays positioned in the above part of the PCB. Two 7-segment displays will be used for the display of the seconds and they will be positioned very close between each other, the same is valid for the couples of 7-segment displays showing respectively the minutes and hours counts. A little space will be left between each couple of 7-segment displays in order to provide more readability for the user. The bottom part of the PCB will host two push buttons to adjust respectively the hour count and the minute count. Each pushbutton will be located exactly below the corresponding couple of 7-segment displays, in order to provide a more intuitive adjusting to the user. The power input will be located on one of the sides of the board, so that the whole package can be hung to a wall.* |

# 2. Specifications:

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| **Functionality** | **Target specification** | **How you will verify that you have reached your target** | **Verification result** |
| Packaging: wall fixing | Ø4mm holes for wall fixing | Inspection |  |
| Packaging: displays | 6 7-segment displays on the above part of the PCB displaying seconds, minutes and hours | Inspection |  |
| Packaging: pushbuttons | Locate pushbuttons for hour and minute adjustment right below the corresponding couple of 7-segment displays. | Inspection |  |
| Power: input pin | Locate the input pin for the power line on the side of the PCB. | Inspection |  |
| Power | 5V DC provided by a USB charger | Demonstration: connecting the cable to the circuit, it will start working. |  |
| Power ON/OFF | The circuit starts working when the cable is plugged in | Demonstration: plug in the cable and the time starts being displayed (from 00:00:00) |  |
| Anti-bouncing system | Avoid multiple steps while adjusting time through pushbuttons. | Testing: adjust the time by pressing the buttons and verify that each push leads to a single step forward of the counter. |  |
| Time regulation | In correspondence of critical hours (e.g. transition between 23:59:59 and 00:00:00), correct transitions occurs, both if naturally occurring or user stimulated through pushbuttons. | Demonstration: check for correct transitions in round hours, both induced by the natural time flow or by pressing pushbuttons for regulating the time. |  |
| Reliability | 24h operating without failures | Testing: plug in the power cable and verify the correct functioning for 24h days |  |
| Precision: constant temperature | The frequency of the clock signal is constant when the PCB is kept in a steady-temperature room | Testing: check the discrepancies with a standard clock in 1h, 6h, 12h after powering up (multiple trials) |  |
| 1Hz signal source | The frequency generated will be in the interval (0.8, 1.2)Hz (main contribution to the error is provided by the uncertainty on the nominal value of a capacitor) | Testing: through an oscilloscope assess the frequency of signal generated by the IC7555 |  |
| Essential components | List | -IC7555: 1Hz clock signal generator  -IC4026: counters and 7-segment display drivers  -Push buttons: employed to set hours and minutes  -74AHCT1G08 AND gates  -ACSA56-41 7-segment displays  -Resistors  -Capacitors  -Diodes |  |

# 3. Physical realisation:

