**Alexandria University**
**Faculty of Engineering**
**Computer and Systems Engineering Department**

**CSE343 Embedded Systems**
**Assigned: Saturday 16/03/2024**
**Due: Saturday 23/03/2024**

# Lab Experiment 04-B

## Objectives

Implement an experiment that displays a digital clock using Arduino and LCD.

## Digital Clock

You are required to implement a software-hardware strategy to support a digital clock using arduino-LCD interfacing. The digital clock should support displaying the time(hours, minutes, and seconds)(24-hour-format), and date. You can assume that the start date and time will be given through the serial monitor upon setup.

**Implementation Details**:

- You should import the LiquidCrystal_I2C and TimerOne libraries(You may need to install them first).
  - LiquidCrystal_I2C documentation: https://tenbaht.github.io/sduino/api/LiquidCrystal_I2C/#api
  - TimerOne documentation: https://www.arduino.cc/reference/en/libraries/timerone/
- The interfacing of LCD to arduino should look like this.

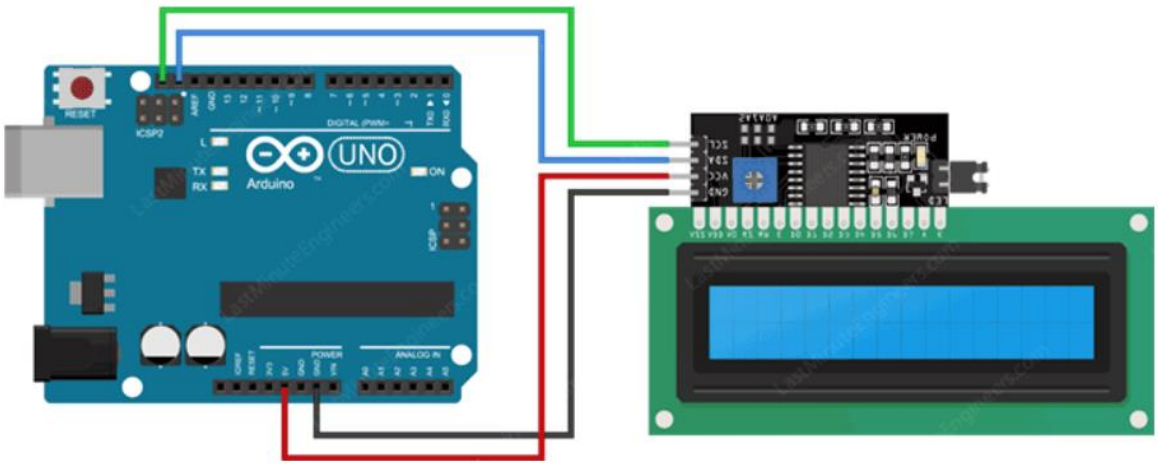


**Figure from**: https://lastminuteengineers.com/i2c-lcd-arduino-tutorial/#:~:text=An%20I2C%20LCD%20has%20only,or%20a%20separate%20power%20supply.

- You should follow the following pseudo sketch for your implementation.

## Global Section

Include the lcd screen i2c library
Include timer one library
Declare constants
Declare variables
Declare necessary functions (interrupt, get initial date and time, update screen, ..)

## Setup Section

Initialize serial speed (for example 9600).
Initialize the LCD screen.
Setup timer interrupt (half a second- 50000).
Get initial date and time from computer using serial monitor.
Send request (for example "enter month").
Receive answer.
Repeat for Year, month, day, day of the week, hour (24 format), minute, second (All numerical values).

## Loop Section

Do Nothing

## Interrupt Function

If complete second (2 interrupts)
***Implement a function to update the digital clock***
Increment seconds variable
If not above max return
Reset seconds variable
Increment minutes
.
.
.
Increment year, no limit check
***Implement a function to update the screen***

## Additional Hints

- Use constant array for limit values
- Use string array for month names, week of the day to display on screen.
- If month is February (2). Then increment using a function to check if it is a leap year (mod (year,4) is zero).
- If the update screen updates only item changed, then you have to use it in setup to display the initial date and time (***implement a function***).
- You should use a constant two dimensional array for the cursor position of each item.
- You should append leading zeros to single digit numbers.

- The lcd print function takes string parameter for printing.
- You can have a deep view over interrupts by checking the examples in the following link: https://www.allaboutcircuits.com/technical-articles/using-interrupts-on-arduino/

## Delivery Policy

- Each group must send a 20-second video for a scenario in which the seconds trigger casing minutes to trigger causing hours to trigger, causing days to trigger, causing months to trigger and then finally years to trigger.
- You should submit a report showing your schematic diagram and the challenges you faced (if any).
- You should submit the sketch source code (.ino file(s)).
- You should cite any additional resources you used.
- Further details for the submission instructions will be posted later on MS Teams.

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## Good Luck