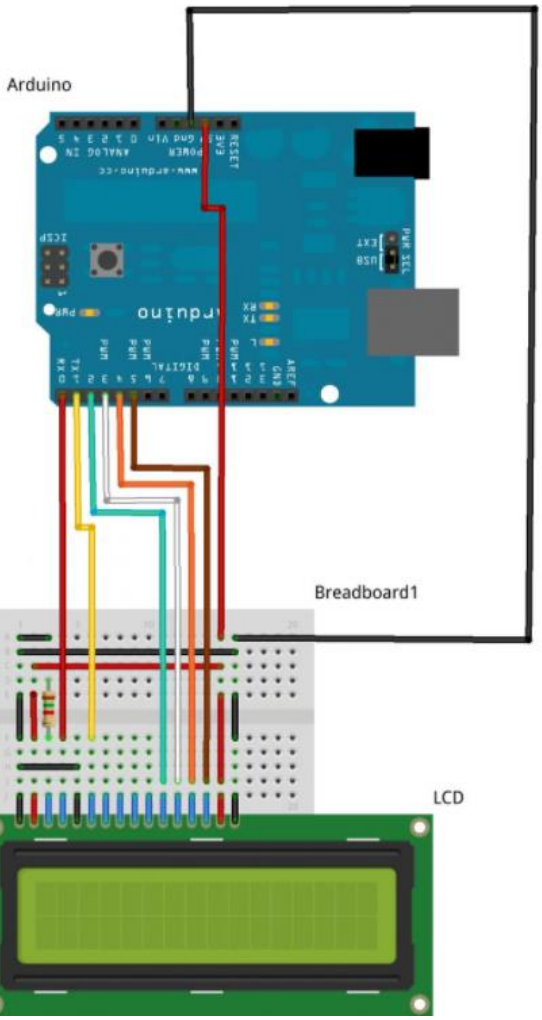
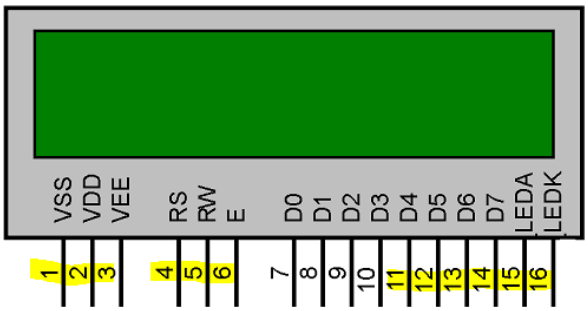
Mechanical and Manufacturing Engineering and Technology
Mobile Robotics LAB 5 (week 6): LCD Characters Display for Embedded and Appl. & programming

Deliverable: Have me check the screens and send me the Arduino file for the (last) task 3
Parts: You need parts as follows

- Standard 16x4 LCD or 16x2 LCD Display
- Resistor (1K-2.2K Ohms)
- A couple of Breadboard & wires w/an Arduino Metro board



LCD 1602 pinout and Interface
The LCD pins are numbered from 1- 16 , look behind the LCD to see the numbering.
The table below explains how to connect the LCD pins to the Arduino.



LCD	Arduino
1 GND	GND
2 VDD	5V
3 Contrast	Resistor to GND
4 RS	PIN 0
5 R/W	GND
6 Enable	PIN 1
7 DB0	Not connected
8 DB1	Not connected

LCD	Arduino
9 DB2	Not connected
10 DB3	Not connected
11 DB4	PIN 2
12 DB5	PIN 3
13 DB6	PIN 4
14 DB7	PIN 5
15 Back LED+	Resistor to 5V
16 Back LED-	GND

Wiring: Follow the above table and circuit diagram in Fig 1, and wire up the LCD using the wires provided.
Color coding: Connect **VCC** and **GND** to Arduino/Metro **5V** and **GND** and others are data lines to LCD.
Code: In this example we use the Arduino pins 0,1,2,3,4 & 5 for connectivity to the LCD pins 4,6, 11,12,13 & 14, respectively (see table 1). Therefore in Arduino code, we initialise the lcd() as follows:

```
LiquidCrystal lcd(0, 1, 2, 3, 4, 5);
```

This code segment tells the Arduino how the LCD is connected to it.
Download this LCD test code and open it in the installed Arduino Development Environment,
This code example will test the LCD and display a message.

Code Example 1: Test LCD for Hello World!
Open a New Arduino window and save it as the name you want to call

My file name is: lcd_liqcrystal_hello

```
// include the library code:
#include <LiquidCrystal.h>

// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(0, 1, 2, 3, 4, 5);


void setup()
{
  // set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  lcd.print("Hello world!");
} //end "setup()"

void loop()
{

} // end loop()
```

Task 2: LCD (Liquid Crystal Display) Clean

hello_lcd_world

```
// include the library code:
#include <LiquidCrystal.h>

// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(0, 1, 2, 3, 4, 5);

void setup()
{
  // put your setup code here, to run once:
  lcd.begin(16,2);  //dimension (16 col, 2 rows or 16x4 LCD --> (16,4)
  lcd.clear();      //clear
  lcd.print("Hello, LCD World");
}

void loop()
{
  // put your main code here, to run repeatedly:

}
```

Task 3: "Custom Character" Coding: Examples from the library Examples/LiquidCrystal/ As usual, add libraries and lcd address

- **Heart, Smiley, Frownie, ArmsDown, ArmsUp characters are written in the code**


```
void setup() {
  // initialize LCD and set up the number of columns and rows:
  lcd.begin(16, 2);

  // create a new character
  lcd.createChar(0, heart);
  // create a new character
  lcd.createChar(1, smiley);
  // create a new character
  lcd.createChar(2, frownie);
  // create a new character
  lcd.createChar(3, armsDown);
  // create a new character
  lcd.createChar(4, armsUp);

  // set the cursor to the top left
  lcd.setCursor(0, 0);

  // Print a message to the lcd.
  lcd.print("I ");
  lcd.write(byte(0)); // when calling lcd.write() '0' must be cast as a byte
  lcd.print(" Arduino Metro! ");
  lcd.write((byte)1);

}
```