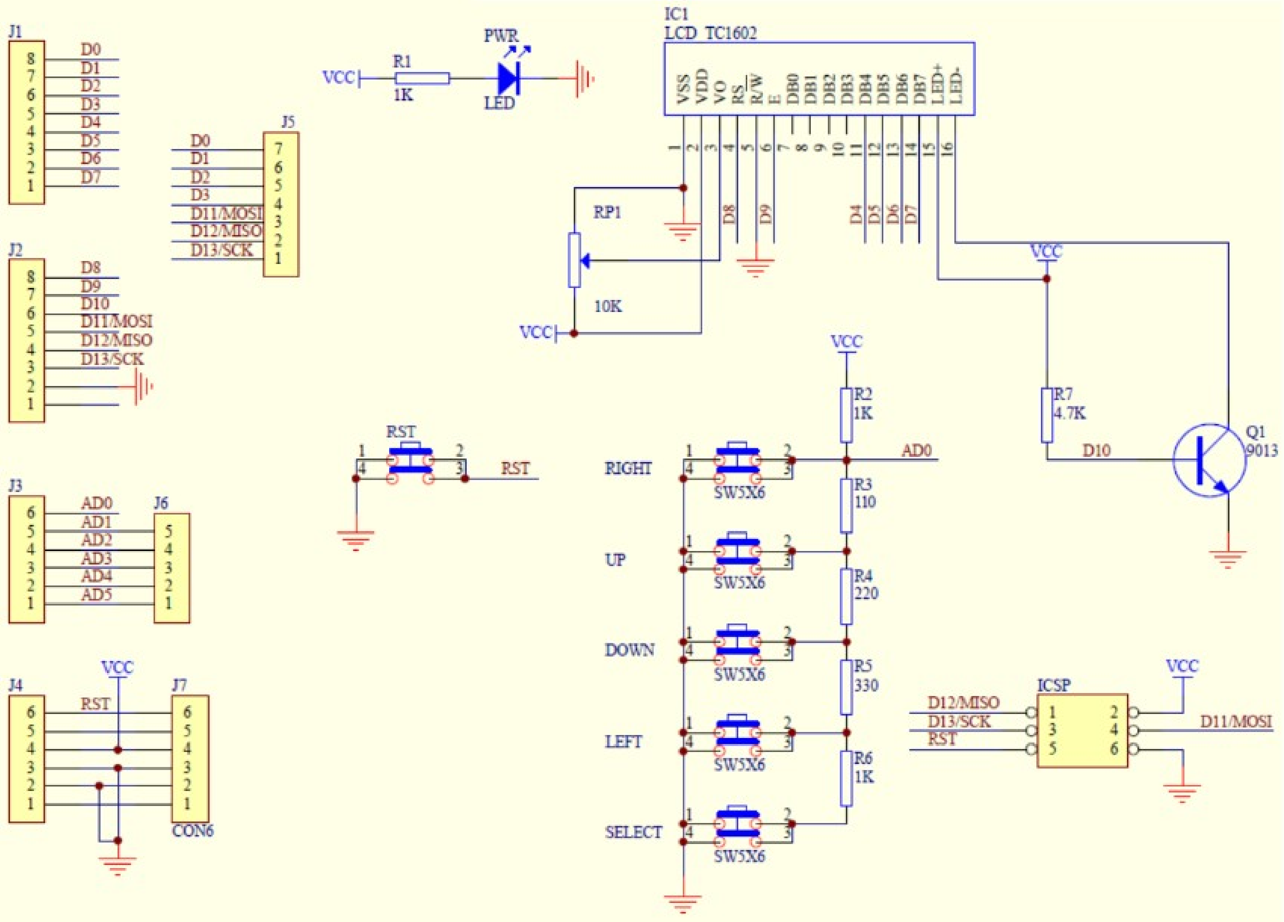
Arduino expansion board 1602

LCD + keyboard

Schematic of the expansion board 1602 with LCD and keyboard is given below.



LCD

Textual LCD display of size 16x2 characters is attached to Arduino and communicates with it using pins 8, 9, 4, 5, 6 and 7. The library which is used with such displays is called *LiquidCrystal.h*. In order to enable the display from the user program, at the beginning it is neccessary to include this library and initialize the display. Initialization assumes assignment of pins which Arduino uses to communicate with the display, as well as the size of textual matrix of the display (number of rows and columns).

Example:

```
#include <LiquidCrystal.h>
// assign pins to be used for communication with the display
LiquidCrystal lcd(8, 9, 4, 5, 6, 7);
void setup() {
      // set number of rows and columns
      // after initialization the cursor is located at (0,0)
      lcd.begin(16, 2);
      // write message
      lcd.print("Happy New");
      // set cursor (X = 0..15, Y = 0..1)
      lcd.setCursor(0, 1);
      lcd.print("Year :)");
}
void loop() {
      //change smiley
      lcd.setCursor(7, 1);
      lcd.print(';');
      delay(1000);
      lcd.setCursor(7, 1);
      lcd.print(':');
      delay(1000);
}
```

Background intensity is determined by PWM duty factor at output pin D10. This value is set using function *analogWrite*():

```
pinMode(10, OUTPUT); // set pin 10 as the output
byte intensity = 100; // set intensity level (min = 0, max = 255)
analogWrite(10, intensity); // set duty factor of PWM on pin 10
```

Keyboard

Keyboard consists of 5 push-buttons (SELECT, LEFT, UP, DOWN, RIGHT). Reading push-button values is done by using the same analog input (AD0). Between the input pin and power suply there is a resistor R_2 with value 1k. This resistor is a part of a voltage divider consisting of pull-down network from resistors R_3-R_6. Depending on the push-button that is pressed, the resistance between the input pin and ground changes, hence the value of input voltage. Input is read by using function analogRead:

```
int input;

input = analogRead(0); // reading analog input 0;

                  // read value will be in the range 0 to 1023
```

Tasks

1) Write a function which returns values depending on the push-button pressed in the following manner:

- none of push-buttons pressed → 0
- SELECT → 1
- LEFT → 2
- UP → 3
- DOWN → 4
- RIGHT → 5

Then write a program which uses a function from above to detect push-button and write corresponding message on LCD (when no push-button is pressed nothing is shown on LCD).

Solution:

```
byte read_key()
{
int tmp = analogRead(0); //key pressed is read through
                       //analog input 0
if (tmp > 635 && tmp < 645) //SELECT
      return 1;
if (tmp > 405 && tmp < 415) //LEFT
      return 2;
if (tmp > 95 && tmp < 105) //UP
      return 3;
if (tmp > 252 && tmp < 262) //DOWN
      return 4;
if (tmp < 5) //RIGHT
      return 5;
return 0; //no key is pressed
}
```

2) Write a program which shown a counter on the display. Counter value is increased after each press of key UP and decreased when key DOWN is pressed. Counter is reset (set to 0) by pressing key SELECT.

3) Write a program in which smiley is shown on the display. By pressing keys LEFT, RIGHT, UP and DOWN the user can move the smiley on a display.