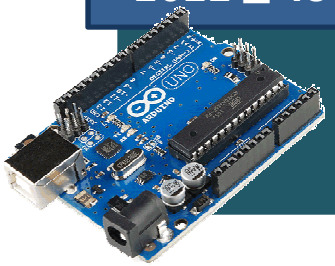
2022년 IoT기반 스마트 솔루션 개발자 양성과정



Firmware [펌웨어]

9-I2C LCD

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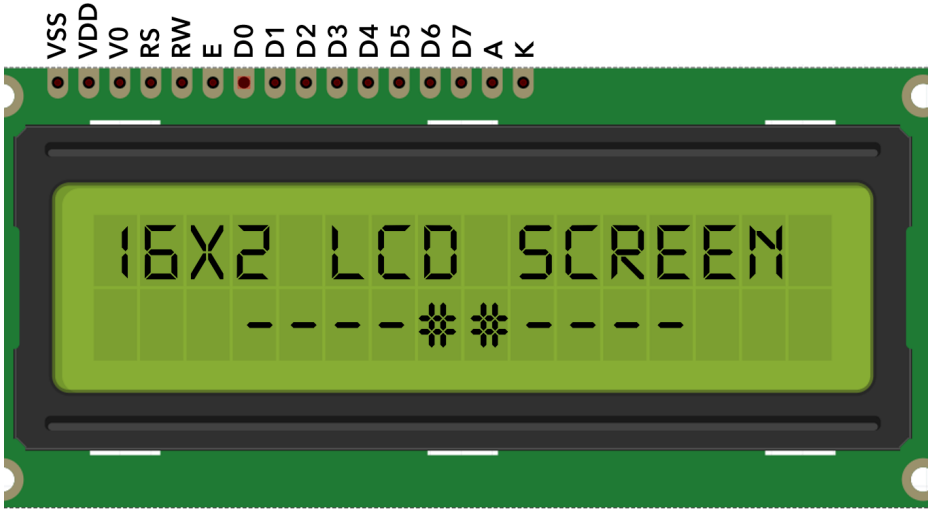
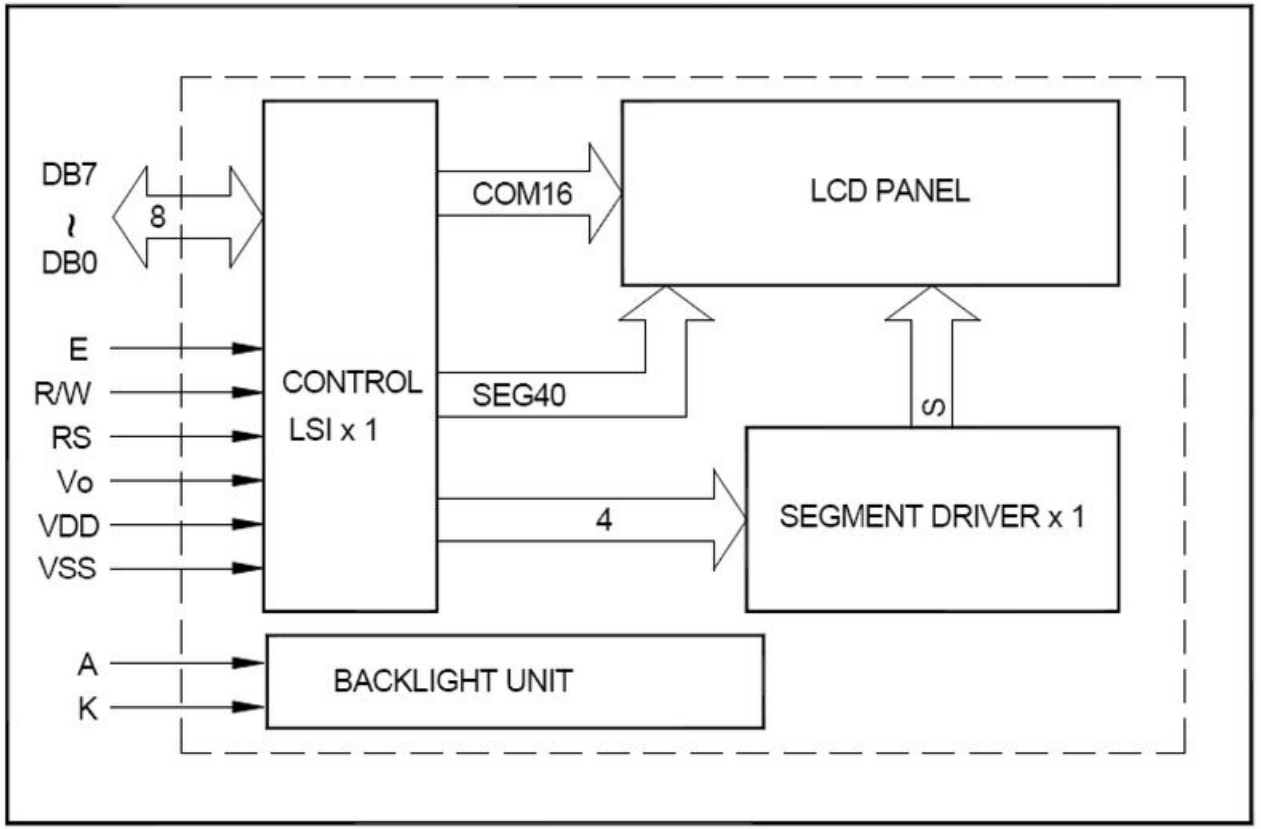
LCD(Liquid Crysal Display)

- LCD (Liquid Crystal Display) is an electronic display module.
- A 16x2 LCD is very commonly used in various device sand circuits.
- A16x2 LCDmeans it has 16 columns and 2 rows for displaying information.
- A command is given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc.
- The data sent to the LCD is in parallel combination i.e. by using D0 to D7 pins.

Parallel - LCD



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	VO	RS	RW	E	D0	D1	D2	D3	D4	D5	D6	D7	A	K
Power		**Bright**	Control			Data								BackLight	

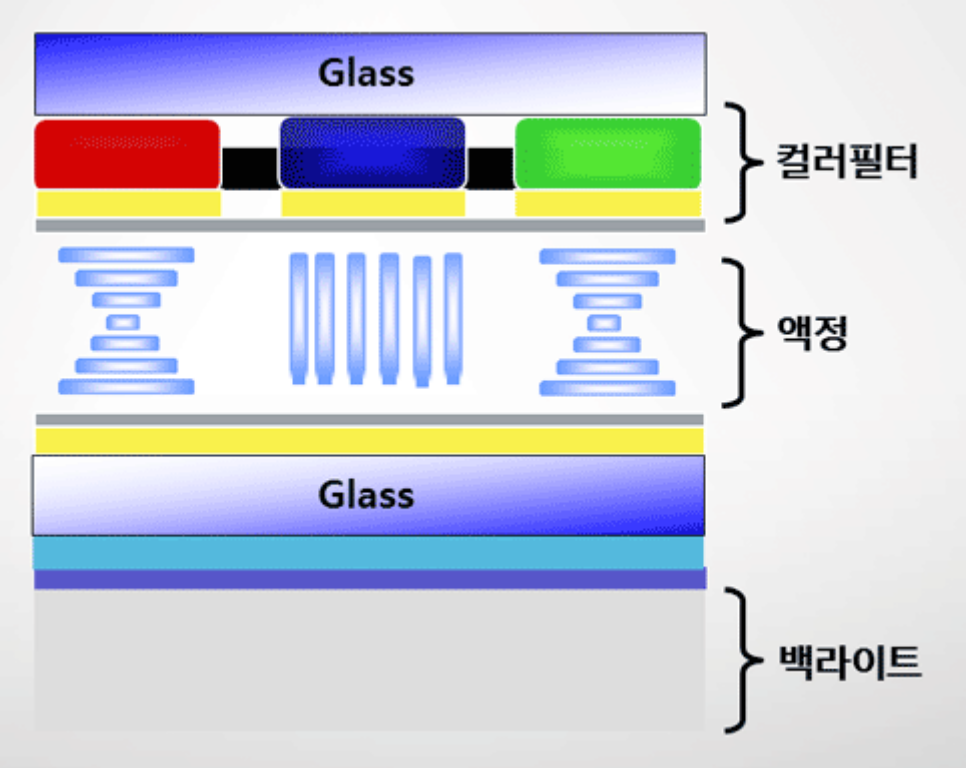

DB7
~
DB0
8
E
R/W
RS
Vo
VDD
VSS
A
K
CONTROL
LSI x 1
COM16
SEG40
4
LCD PANEL
S
SEGMENT DRIVER x 1
BACKLIGHT UNIT

Parallel lcd display(4bit)

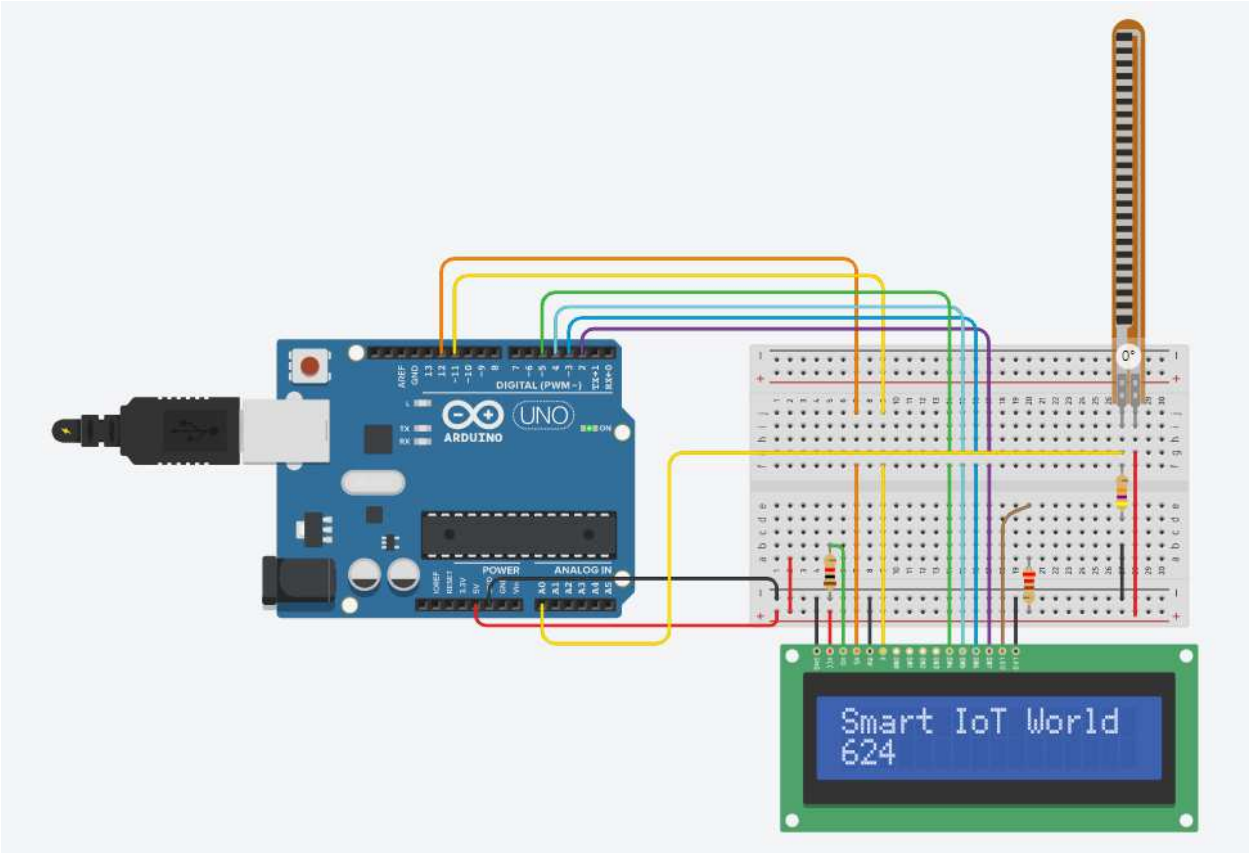
* 4-bit LCD 구동하기 핀맵

LCD Pin NO	Arduino Pin	LCD Pin
1	GND	Vss
2	5V	VCC
3	Contrast(가변 저항에 연결)	V0
4	D12	RS(Register Select)
5	GND	R / W(Read / Write)
6	D11	Enable
7	NC(연결 없음)	Data Bit 0
8	NC(연결 없음)	Data Bit 1
9	NC(연결 없음)	Data Bit 2
10	NC(연결 없음)	Data Bit 3
11	D5	Data Bit 4
12	D4	Data Bit 5
13	D3	Data Bit 6
14	D2	Data Bit 7

LCD Structure



Flex_Sensor

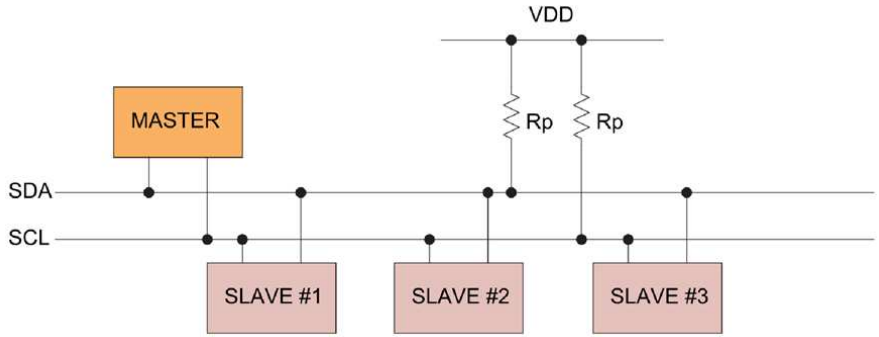

DIGITAL (PWM~)
UNO
ARDUINO
POWER
ANALOG IN
0°
Smart IoT World
624

A9-0 : Flex Sensor

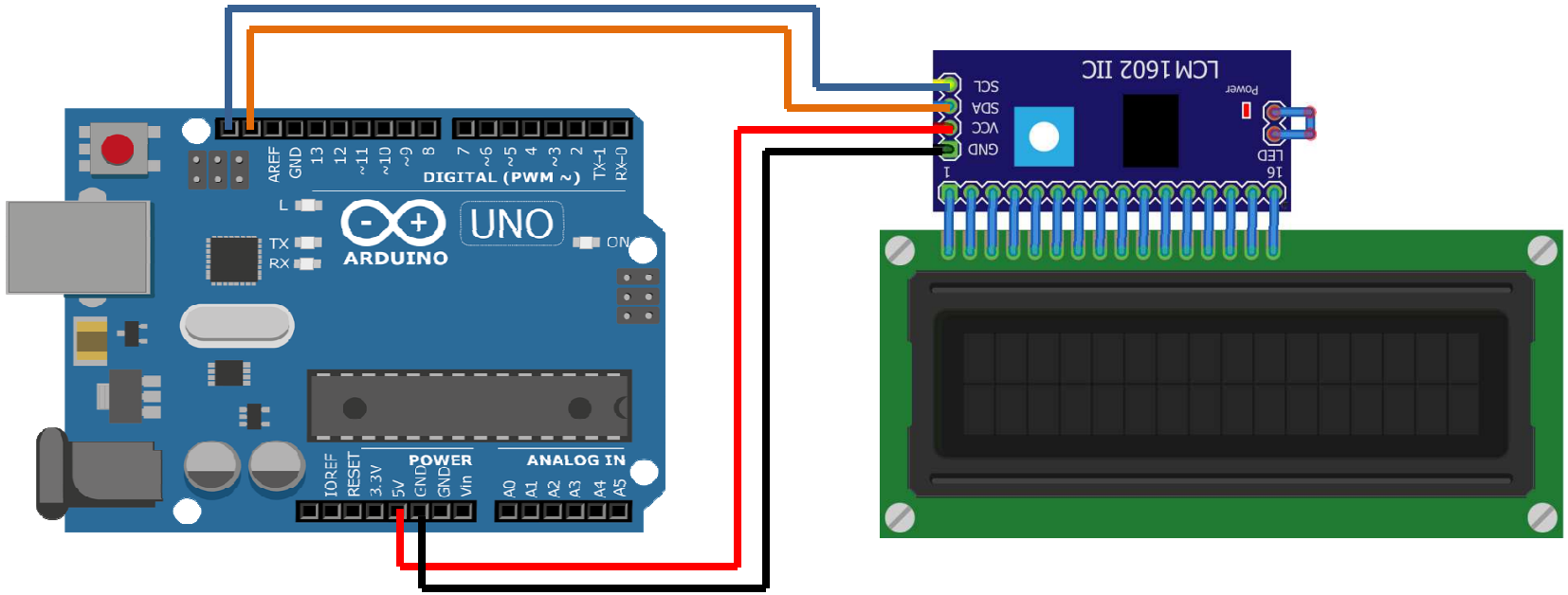
```
#include <LiquidCrystal.h>

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup() {
  lcd.begin(16, 2);
  lcd.print("Smart IoT World!");
}

void loop() {

  lcd.setCursor(0, 1);
  lcd.print(analogRead(A0));
  delay(50);
```

I2C LCD

- I2C (IIC) : Inter-Integrated Circuit
  - 저속의 주변기기들과 연결을 위한 직렬 통신 방식
  - SCL (Serial Clock)
  - SDA (Serial Data)
- I2C Address : 0x20,0x27,0x3F ….

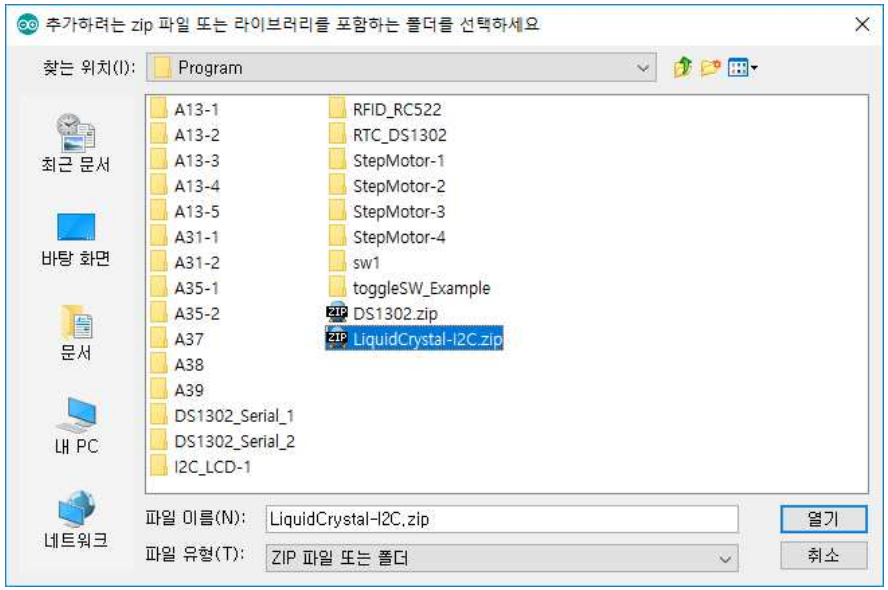


Wiring

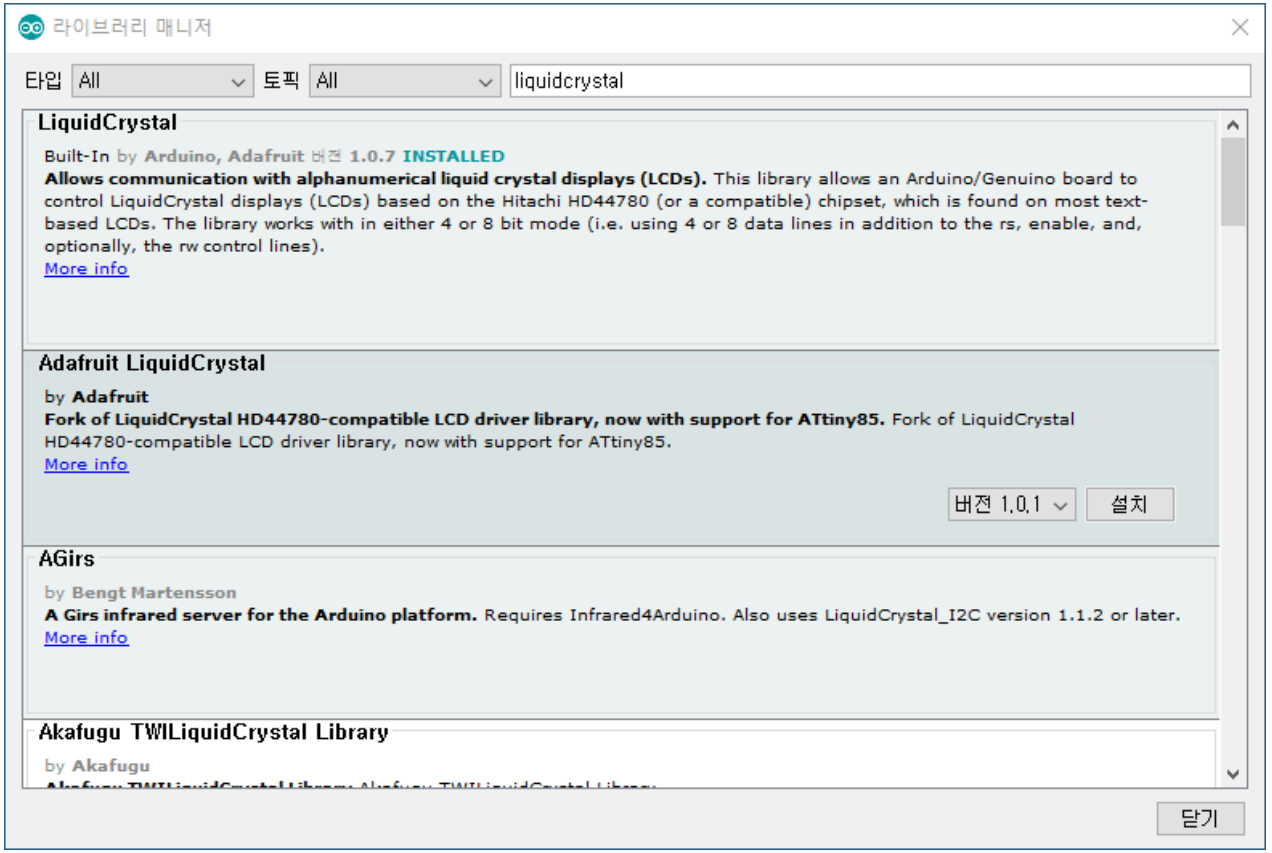

LCM1602 IIC
SCL
SDA
VCC
GND
Power
LED
16
1
UNO
ARDUINO
DIGITAL (PWM ~)
POWER
ANALOG IN

Library 추가하기

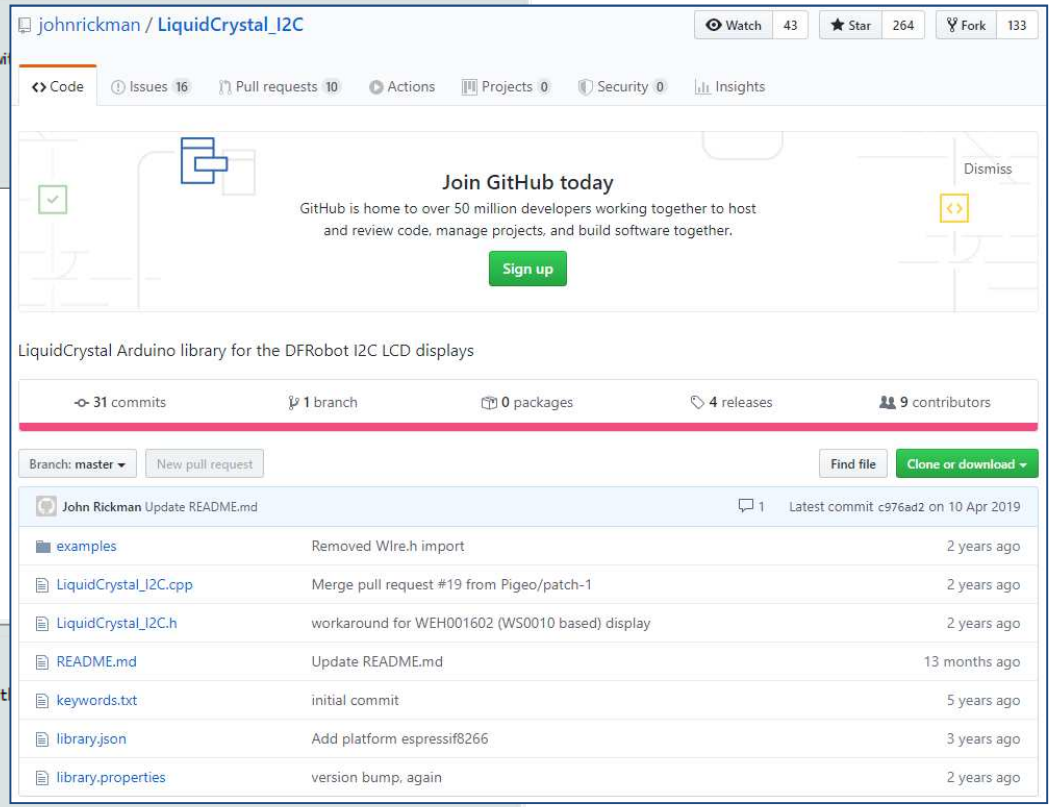
- 메뉴 [스케치][라이브러리 포함하기][.ZIP 라이브러리 추가]



Serch LiquidCrystal



LiquidCrystal_I2C



A9-1 : Hello

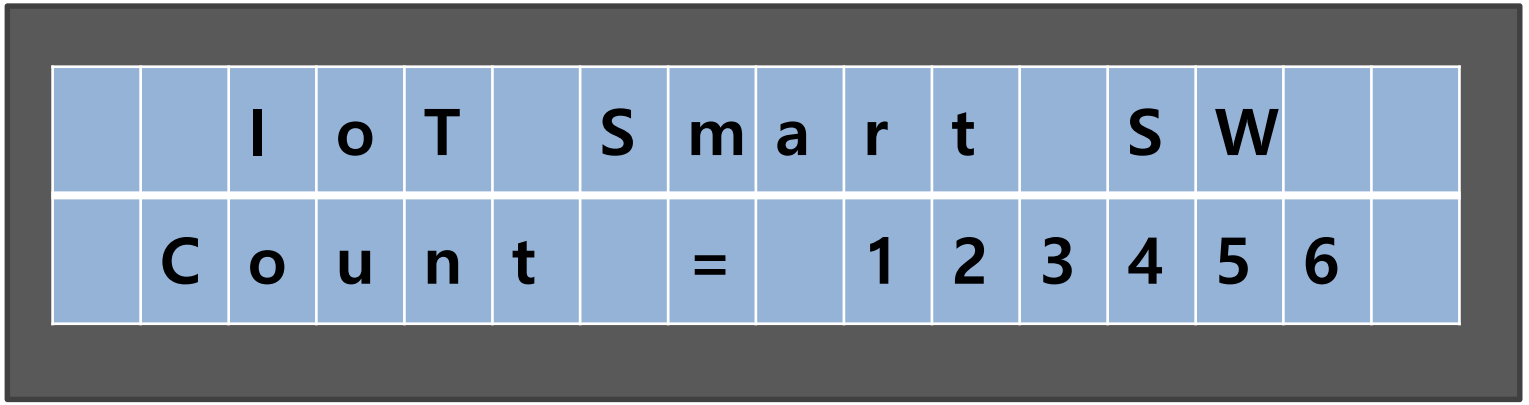
```
#include <LiquidCrystal_I2C.h>

// Set the LCD address to (0x20, 0x27, 0x3F) for 16 x 2 display
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup( ){
   lcd.init( );
   lcd.backlight( );          //backlight On
   lcd.print("Hello");
}

void loop( ){
   // Do nothing here...
}
```

A9-2 : SetCursor

```
#include <LiquidCrystal_I2C.h>

// Set the LCD address to (0x20, 0x27, 0x3F) for 16 x 2 display
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup( ){
   lcd.init( );
   lcd.backlight( );                    //backlight On
   lcd.setCursor(2,0);                  //3 Column 0 Row
   lcd.print("IoT Smart SW");
   lcd.setCursor(2,1);                  //2 Column 1 Row
   lcd.print("Geun-Taek  Ryu");
}

void loop( ){
   // Do nothing here...
}
```

A9-3 : Count Display

- Text LCD 에 다음과 같이 표시하여 보자
- Count 값은 0~999999



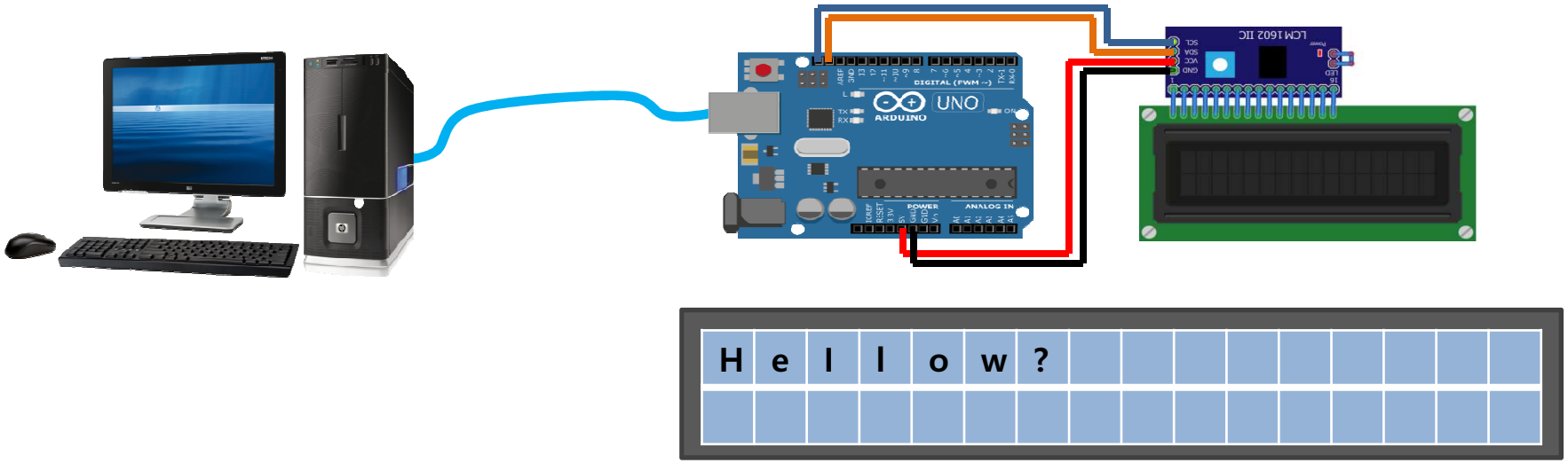
A9-3 : I2C_LCD

```
#include <LiquidCrystal_I2C.h>
// LCD address : (0x20, 0x27, 0x3F) for 16 x 2
LiquidCrystal_I2C lcd(0x27, 16, 2);

long Count=0;

void setup( ) {
  lcd.init( );
  lcd.backlight( );
  lcd.setCursor(0, 0);
  lcd.print("  IoT Smart SW  ");
  lcd.setCursor(0, 1);
  lcd.print(" Count = ");
  Serial.begin(9600);
}
```

```
void loop( ) {
  lcd.setCursor(9, 1);
  lcd.print(Count);

  delay(500);
  if (++Count>999999) Count=0;
}
```

A9-4 : Serial Display

- Text LCD 에 Serial로 수신받은 문자를 표시하여 보자



A9-4 : Serial Receive Data

```
#include <LiquidCrystal_I2C.h>

// LCD address : (0x20, 0x27, 0x3F) for 16 x 2
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup( ){
    lcd.init( );
    lcd.backlight( );

    Serial.begin(9600);
}
```

```
void loop( ){
    if (Serial.available( )) {
        delay(100);
        lcd.clear( );       // Clear the screen

        while (Serial.available( ) > 0) {
            lcd.print((char)Serial.read( ));
        }
    }
}
```