Part Number :   FK-FA1417

Product Name :   MULTI-FUNCTION RTC SHIELD

This is the experimental board for Time-Base or we call REAL TIME CLOCK (RTC). This circuit is well-known in recording the data of time and date as the history of period of times. It can be also used to connect with sensors such as Temperature Controller, Moisture Indicator, Infrared Receiver Module, Ultrasonic Module. This circuit is adaptable to the other forms of circuits such as DATA LOGGER, Time and Temperature Recorder.

Specification

1.Power Supply direct from Microcontroller Board.

2.The circuit can be used with Microcontroller Board such as Arduino UNO R3.

3.The circuit is composed of 4 sets which are 1 piece of RTC, 3 pieces of Switch, 2 LCDs and Sensor Connector such as Temperature Controller, Moisture Indicator, Infrared Receiver Module.

4.PCB dimension : 2.15"x2.05"

Circuit Function

The circuit is composed of 4 main sections:

Section1 REAL TIME CLOCK (RTC) is functioning as Reference Time-Base to other circuits. IC No.DS1307 is the main part for setting the Reference Time-Base. Back-up battery 3VDC is used to supply power to this IC (this IC consumes less electric current which causes RTC is has long useful life). The IC No.DS1307 has 3 pins which are DATA pin (Pin5) connected with A4 pin of Arduino Board, CLOCK pin (Pin6) connected with A5 pin of Arduino Board and OUT pin (Pin7) connected with A3 pin of Arduino Board.

Section2 There are 3 switches in Switch circuit connected with the port of P10, P11 and P12.

Section3 The LED circuit has 2 switches which connected with the port of P4, P6 and P7.

Section4 is for connecting with Sensor Connectors;

- CON1 is used to connect with Moisture Indicator DHT11, DHT22 or Ultrasonic Module HC-SR04 through the port P8 and P9. To connect CON1 with Moisture Indicator, jump the jumpers of JP-P8 and JP-P9 but if we want to connect with Ultrasonic Module, remove the jumpers of JP-P8 and JP-P9 .

-CON2 is used to connect with Moisture Indicator such as 18B20 through the port P3.

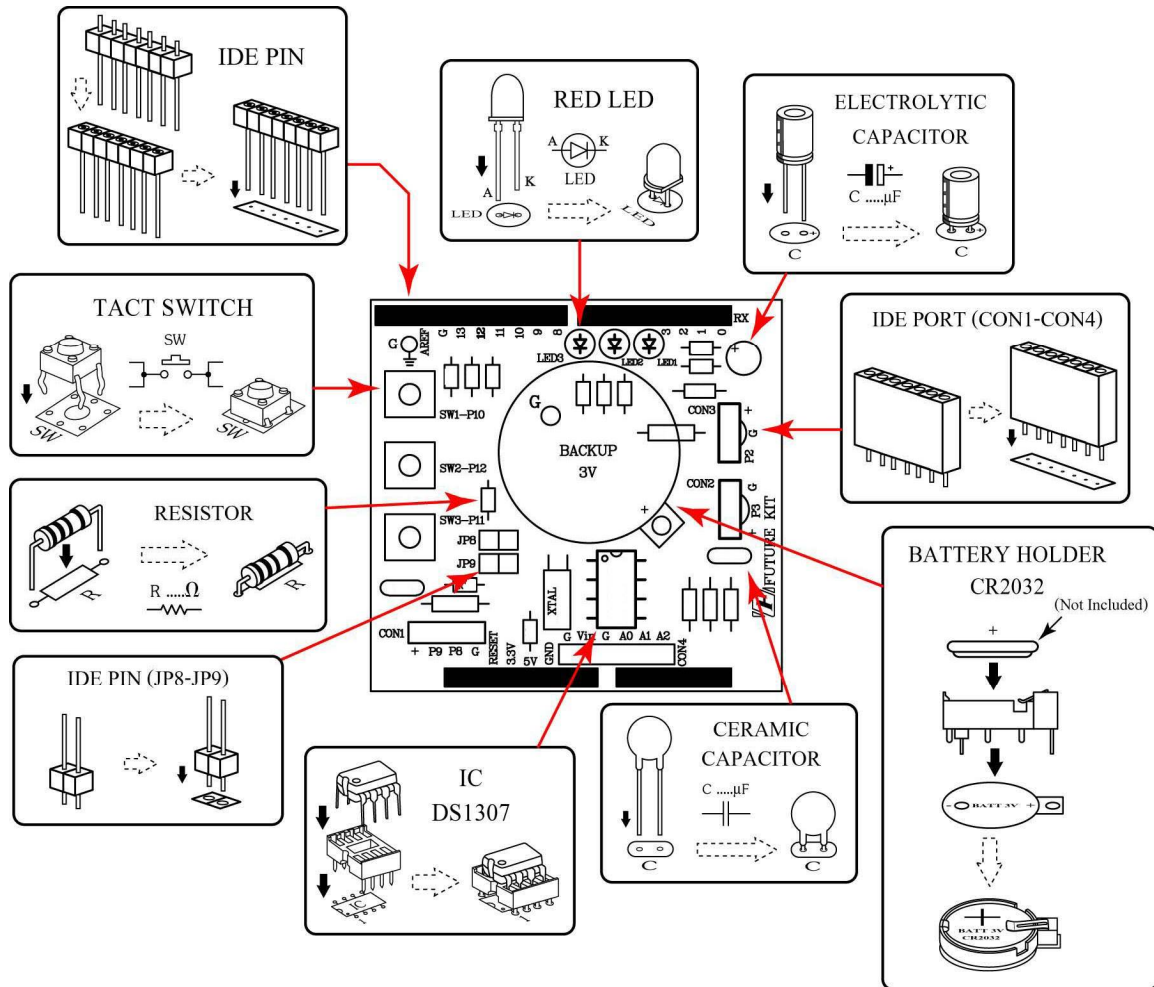-CON3 is used to connect with Infrared Receiver Module through the port P2.

Figure 1. Circuit Diagram of FK1417

Circuit Assembling

According to Figure 2, the easy assembling should be started with putting the smallest part on the circuit which is resistor. Caution, all parts must be on the right electrodes such as LED. Please see Figure 3 for putting parts on electrodes. On the soldering, use a soldering iron max. 40 watts and tin/lead at 60/40 with flux. After assembling and soldering, re-check the positions of each part. In case some parts are on the wrong positions, use solder suction or solder wick to correct the positioning of those parts.

Figure 2. The positions for assembling and PCB copper line.

Figure 3. Positioning the parts on PCB

Programming instrument for the experimental board

1.FK-FA1417 MULTI-FUNCTION RTC SHIELD	1	set
2.Microcontroller Board ex. Arduino UNO R3	1	set
3.USB Cable	1	Piece
4.Computer Set	1	Set
5.Arduino Software	1	Piece
6.CR2032 Battery 3V	1	Piece

Testing Arduino UNO R3 Board

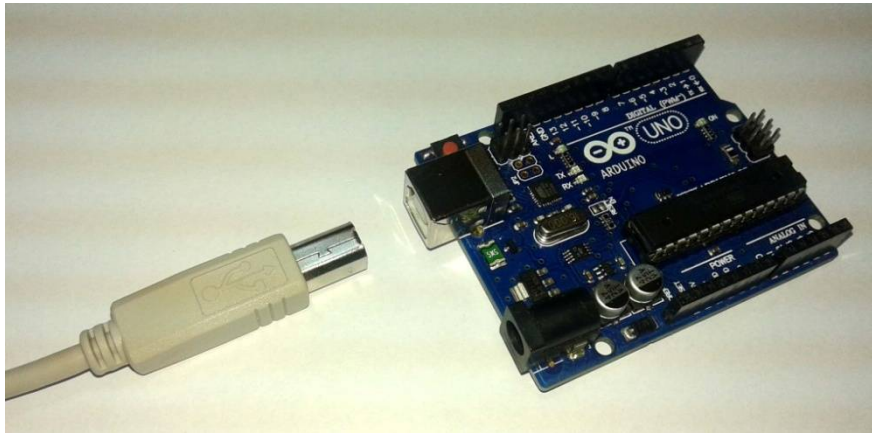1.Connect USB cable with USB port of computer and USB port of Arduino UNO R3 Board.

Figure 4. Connecting USB cable with USB port of Arduino Board

2. Open Arduino program by double-click on Arduino icon. Go to the menu bar, click on File and choose Open. Go to folder "EX" and open folder "TEST". Click on file "Test".
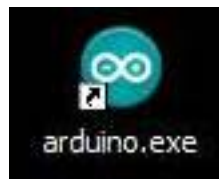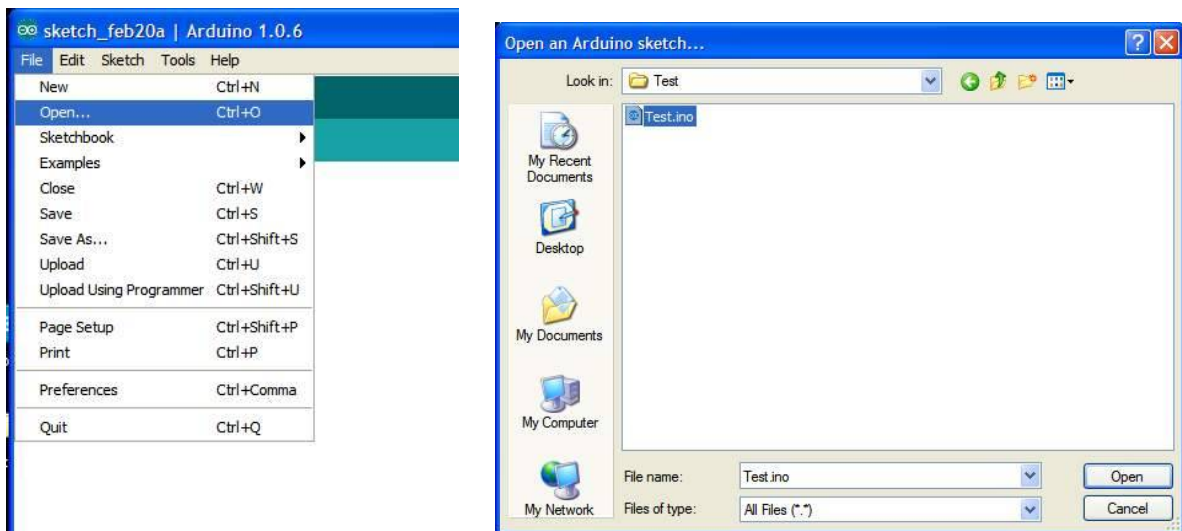

Figure 5. Opening Arduino program

Figure 6. TEST Program

3.Download TEST program to Arduino Board.

Figure 7. Downloading TEST program

4.After downloading, the LED L on Arduino Board will blink which means Arduino board is working.

Figure 8. The position of LED L on Arduino Board circuit

The details of TEST program, Flashing Light Program, Arduino UNO R3 experiment.

```
void setup() {

  pinMode(13, OUTPUT);          // Set the pin 13 is OUTPUT pin.

}
void loop() {

  digitalWrite(13, HIGH);        // LED at the pin 13 is light-on.

  delay(1000);                   // delay time 1 second

  digitalWrite(13, LOW);         // LED at the pin 13 is light-off.

  delay(1000);                   // delay time 1 second

}
```

The method to connect the circuit with Arduino UNO R3 board

Put FK1417 in Arduino UNO R3 (please see Figure 9) and insert the 3V CR2032 Battery in into the 3V battery holder on FK1417 board (please see Figure 10).

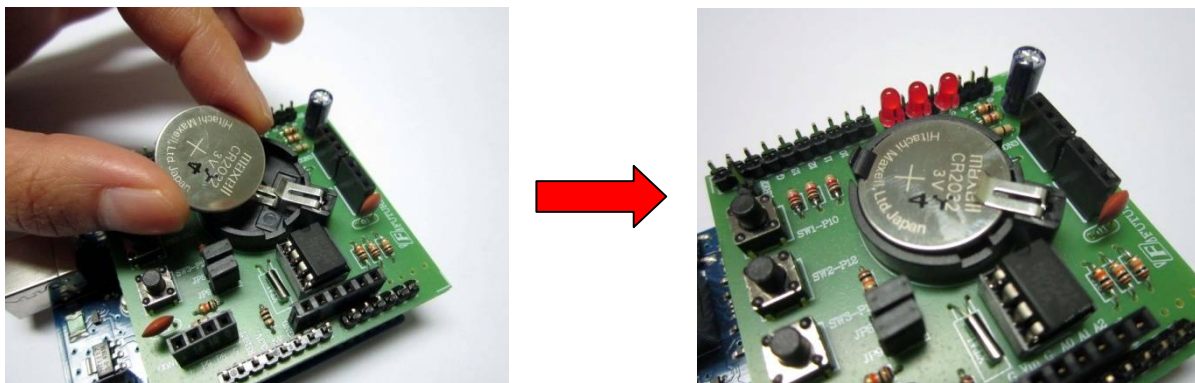Figure 9. Connecting FK1417 board with Arduino UNO R3 board

Figure 10. insert the 3V CR2032 Battery into the 3V battery holder on FK1417 board

Programming

1.Connect Arduino UNO R3 board with experimental board by following the instruction of the method to connect the circuit with Arduino UNO R3 board.

2.Connect the USB cable with USB port of computer and USB port of Arduino UNO R3 board.

Figure 11. Wiring the USB cable

3.Double-click on Arduino icon to open Arduino program. Go to "File" in menu bar and choose "Open". Click on folder "Ex", choose folder "FK1417" , choose folder "LAB1417-1" and click on file "LAB1417-1".
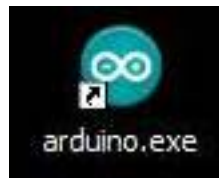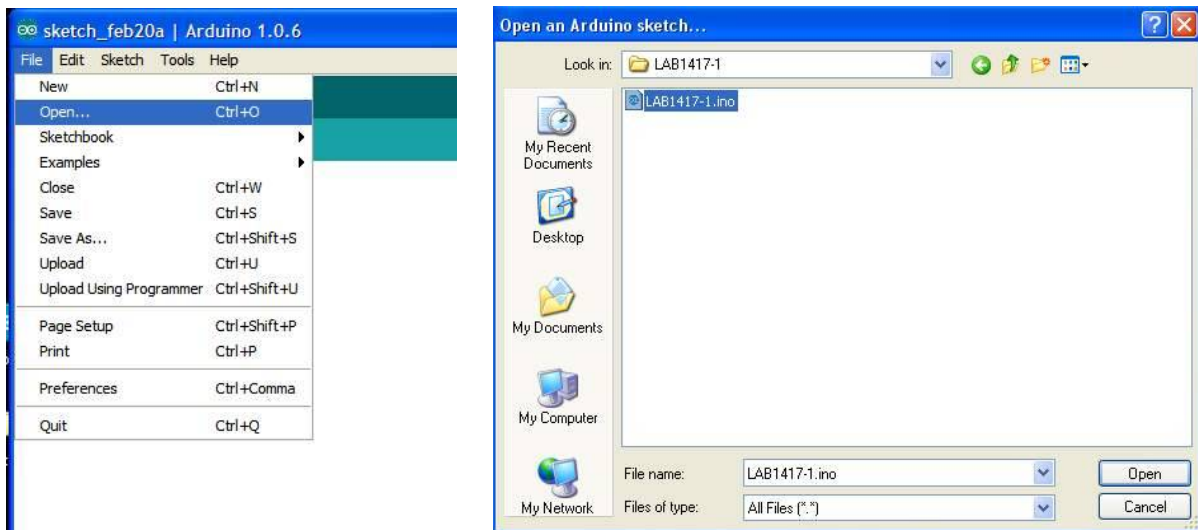

Figure 12. Opening Arduino Program

Figure 13. LAB1417-1 program

4.Download LAB1417-1 program to Arduino board.

Figure 14. Downloading LAB1417-1 program

5. After downloading, open the function of Serial Monitor in Arduino program by going the menu bar, click on Tools and choose Serial Monitor, the window of Serial Monitor will appear on the screen (please see Figure….). In the window, date and time will be shown. (Date and time is from the old database. If you would like to set the real date and time, you have to program for it.) If there is date and time shown in the window, it means RTC circuit is functional.

6. Connect LED TEST with CON3 point. The pin of Resistor must be connected with G point and the pin of LED TEST must be connected with P2. Open LAB1417-2 program in folder "FK1417". Download LAB1417-2 program to Arduino board, LED TEST will blink. Afterwards, remove LED TEST and connect it with CON2 point, do it in the same way as connecting with CON3 point but change the pin's position from P2 to P3. LED TEST will blink. Remove LED TEST and connect it with CON1 point and put the pin that's no connection with Resistor in P8, then P9. If LED blinks, it means the connector point is working.
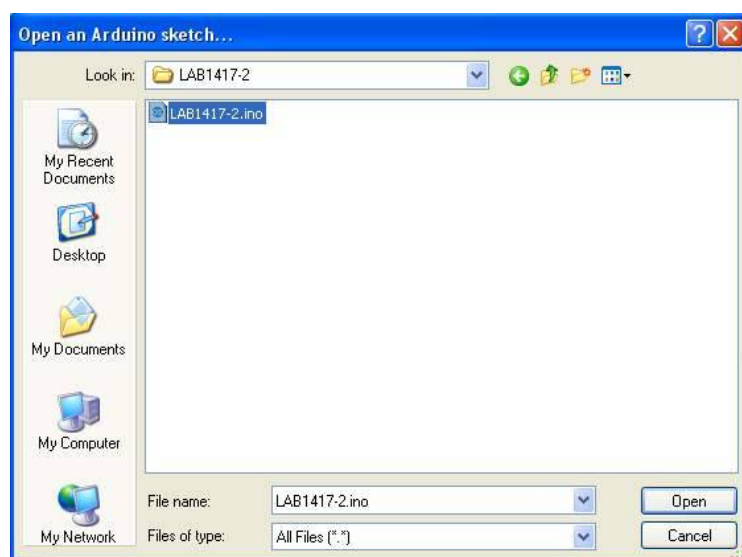
Figure 15. LAB1417-2 program

Figure 16. Downloading LAB1417-2 program

7.Open LAB1417-3 in folder "FK1417" and download this program to Arduino UNO R3 board.

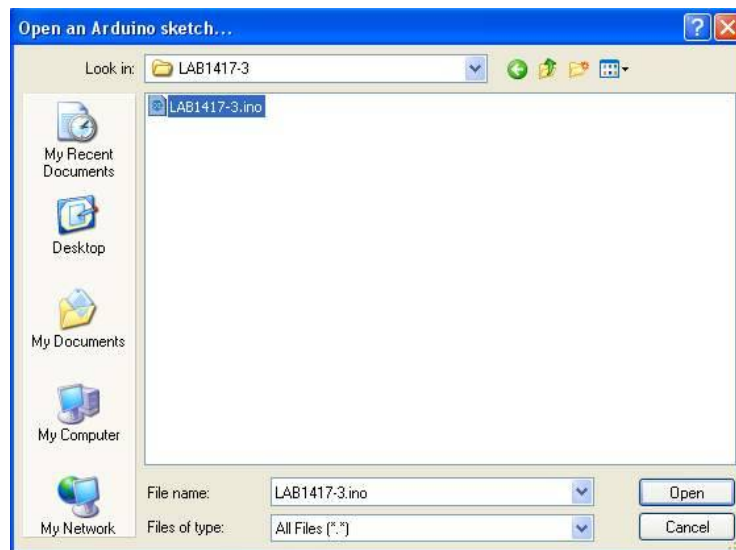Figure 17. LAB1417-3 program

8.Press and hold switch SW1, LED1 will be light-on, release switch SW1, LED1 will be light-off.

9.Press and hold switch SW2, LED2 will be light-on, release switch SW2, LED2 will be light-off.

10.Press and hold switch SW3, LED3 will be light-on, release switch SW3, LED-3 will be light-off.

11.If the test in step 8 to step 10 works, it means the switch circuit can work.

The details of LAB1417-1 REAL TIME CLOCK (RTC) TEST program

```
#include <Wire.h>              // Using "Wire.h" Libraries.

void setup()

{

 Wire.begin();                // Using the I2C

 Serial.begin(9600);          // Setting the band rate is 9600 bit per second.

}

void loop()

{

     Wire.beginTransmission(0x68);      // Setting the start address of send the data at
position 0x68.

     Wire.write(0);

     Wire.endTransmission();


     Wire.requestFrom(0x68, 7);         // Send the 7 byte of data.

     byte second = Wire.read();

     byte minute = Wire.read();

     byte hour = Wire.read();

     byte day = Wire.read();

     byte date = Wire.read();

     byte month = Wire.read();

     byte year = Wire.read();


     // Showing the Hour, Minute and Second.

     Serial.print("The time is ");              // Showing the message "The time is".

     if (hour < 10) Serial.print("0");

     Serial.print(hour,HEX);

     Serial.print(":");                         // Showing the message ":".

     if (minute < 10) Serial.print("0");

     Serial.print(minute, HEX);
```

```
Serial.print(":");                              // Showing the message ":".

if (second < 10) Serial.print("0");

Serial.println(second, HEX);


// Showing the Date, Month and Year.

Serial.print("The date is ");                   // Showing the message "The date is".

if (date < 10) Serial.print("0");

Serial.print(date,HEX);

Serial.print("-");                              // Showing the message "-".

if (month < 10) Serial.print("0");

Serial.print(month, HEX);

Serial.print("-");                              // Showing the message "-".

Serial.print("20");

if (year < 10) Serial.print("0");

Serial.println(year, HEX);

Serial.println();                    // Next line the display

delay(1000);                         // delay time 1 second

}
```

Function of LAB1417-1 program

The function of LAB1417-1 program starts from opening Library Wire.h in Arduino program. Install the rapidity of the port at 9600 bit/sec. Set the address to start at 0x68. Set the program to send the data at 7-bite per once which composed of second, minute, hour, day, month, year.

Set the first data as "The time is", follow by hour : minute : second. Set the second line to show the data "The date is", follow by date-month-year. And then the message will started the second line and relay the timing 1 second. The message is showing alternately between the first line and the second line continuously.

The details of LAB1417-2 CON1-CON3 CONNECTOR TEST program

```
void setup() {

pinMode(2, OUTPUT);          // Set the pin 2 is OUTPUT pin.

pinMode(3, OUTPUT);          // Set the pin 3 is OUTPUT pin.
```

```
pinMode(8, OUTPUT);        // Set the pin 8 is OUTPUT pin.

pinMode(9, OUTPUT);        // Set the pin 9 is OUTPUT pin.

}

void loop() {

digitalWrite(2, HIGH);       // LED at the pin 2 is light-on.

digitalWrite(3, HIGH);       // LED at the pin 3 is light-on.

digitalWrite(8, HIGH);       // LED at the pin 8 is light-on.

digitalWrite(9, HIGH);       // LED at the pin 9 is light-on.

delay(1000);                 // delay time 1 second

digitalWrite(2, LOW);        // LED at the pin 2 is light-off.

digitalWrite(3, LOW);        // LED at the pin 3 is light-off.

digitalWrite(8, LOW);        // LED at the pin 8 is light-off.

digitalWrite(9, LOW);        // LED at the pin 9 is light-off.

delay(1000);                 // delay time 1 second

}
```

Function of LAB1417-2 program

The program will set pin 2, pin 3, pin 8 and pin 9 as OUTPUT pin. It will light up the LED at pin 2, pin 3, pin 8 and pin 9 at 1 second and will extinguish at 1 second, the program will start repeating the all LED.

Remark: In case we want LED ON/OFF to blink frequently, we can reduce the value in the parentheses by commanding "delay". The unit of the digit is millisecond.

The details of LAB1417-3 SWITCH TEST program

```
void setup() {

pinMode(4, OUTPUT);              // Set the pin 4 is OUTPUT pin.

pinMode(6, OUTPUT);              // Set the pin 6 is OUTPUT pin.

pinMode(7, OUTPUT);              // Set the pin 7 is OUTPUT pin.

pinMode(10, INPUT_PULLUP); // Set the pin 10 is INPUT pin and using the PULL UP
function.

pinMode(11, INPUT_PULLUP); // Set the pin 11 is INPUT pin and using the PULL UP
function.
```

```
        pinMode(12, INPUT_PULLUP);  // Set the pin 12 is INPUT pin and using the PULL UP
function.

    }

    void loop() {

      int SW3 = digitalRead(11);              // Set "SW3" word is the variable of value at pin 11.

      int SW2 = digitalRead(12);              // Set "SW2" word is the variable of value at pin 12.

      int SW1 = digitalRead(10);              // Set "SW1" word is the variable of value at pin 10.

      if (SW3 == LOW) { digitalWrite(7, HIGH); } else { digitalWrite(7, LOW); }
```

// If press the switch SW3 (LOW status), LED at pin 7 will be light-on. But if no press the switch SW3 (HIGH status), LED at pin 7 will be light-off.

```
      if (SW2 == LOW) { digitalWrite(6, HIGH); } else { digitalWrite(6, LOW); }
```

// If press the switch SW2 (LOW status), LED at pin 6 will be light-on. But if no press the switch SW2 (HIGH status), LED at pin 6 will be light-off.

```
      if (SW1 == LOW) { digitalWrite(4, HIGH); } else { digitalWrite(4, LOW); }
```

// If press the switch SW1 (LOW status), LED at pin 4 will be light-on. But if no press the switch SW1 (HIGH status), LED at pin 4 will be light-off.

```
    }
```

Function of LAB1417-3 program

The program will set pin 4, pin 6 and pin 7 as OUTPUT pin and pin 10, pin 11 and pin 12 as INPUT pin. Besides INPUT pin, pin 10, pin 11 to pin 12 can be used for activating the function PULL UP as well.

Press and hold switch SW3 at pin 11, LED3 will be light-on, release switch SW3, LED3 will be light-off.

Press and hold switch SW2 at pin 12, LED2 will be light-on, release switch SW2, LED2 will be light-off.

Press and hold switch SW1 at pin 10, LED1 will be light-on, release switch SW1, LED1 will be light-off.