Study Notes of Iteaduino Part IV

-Light Sensor

In the last note, I described how to use output of digital pins on Iteaduino to control LED lamp. In this chapter, I will introduce input of digital and analog pins on Iteaduino.

I will use the pin input of Iteaduino to receive information from light sensor electronic brick, thus I can determine the light conditions outside and control LED lamp according to it.

To do this test, we will need:

- Iteaduino board x 1
- LED electronic brick x 1
- Light sensor electronic brick x 1

Introduction of materials

Light Sensor electronic brick module is to induce the external light variations by using photoresistors.

The actual light sensor electronic brick is shown in figure 1:

① Photoresistor：Photoresistor is one type of resistor made with use of the photoelectric effect of a semiconductor, whose resistance value will change based on brightness of the incident light. The brighter the incident light, the lower the resistance; vise versa. The photoresistor is usually used for light measurement, light control and photoelectric conversion (to convert light changes into electrical changes).

② Analog state and digital state switch: when the switch is pushed to A end, output of light sensor electronic brick is analog voltage value, and it must be connected to analog input interfaces A0-A5 of Iteaduino board via the connection cable; when the switch is pushed to D end, the output is digital signal,

and it can be connected to digital interfaces D0-D13 of Iteaduino board (A0-A5 can also be used as digital interfaces when there is no analog input).

③ Operational amplifier SGM358.

④ Rheostat: When the Light Sensor electronic brick is under digital output state, the threshold voltage can be adjusted by regulating the rheostat. When the voltage at two terminals of photoresistor is higher than the threshold , the output is high; vise versa. For example, the voltage at two terminals of photoresistor is 2V with light and 4V without light, we can set the threshold voltage as 3.0V (the threshold voltage varies based on different light conditions, please adjust according to the testing environment). With light radiation, light sensor electronic brick module will output high level; vise versa. In addition, the circuit is with hysteresis comparator function, threshold hysteresis is VCC * 0.09. For example, the threshold voltage is set as 3.0V, only when the voltage at both ends of the photoresistor exceeds 3.22V (3 +5 * 0.09 / 2), the output will become low level; when the voltage at both ends of the photoresistor exceeds 2.78V (3-5 * 0.09 / 2), the output will become high level. In this way, the voltage at both ends of the photoresistor will be close to the threshold voltage, thus output fluctuation is prevented and the output is more stable.

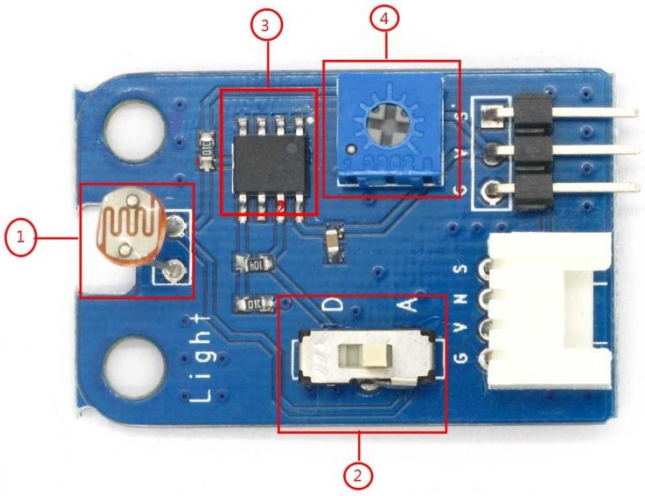

Figure 1

Construction of hardware circuit

First, connect LED electronic brick module to D9 pin of Iteaduino via the connection cable. Thus cathode of the LED lamp is linked to GND terminal of Iteaduino board and anode is linked to D9 pin via S pin.

Push the state switch of light sensor electronic brick to D end, use digital output first. Connect the light sensor electronic brick to D3 interface on Iteaduino board via the connection cable, then the light sensor electronic brick will be powered by Iteaduino, and output pin S will be connected to D3 pin of Iteaduino.

The actual circuit diagram is shown in Figure 2:

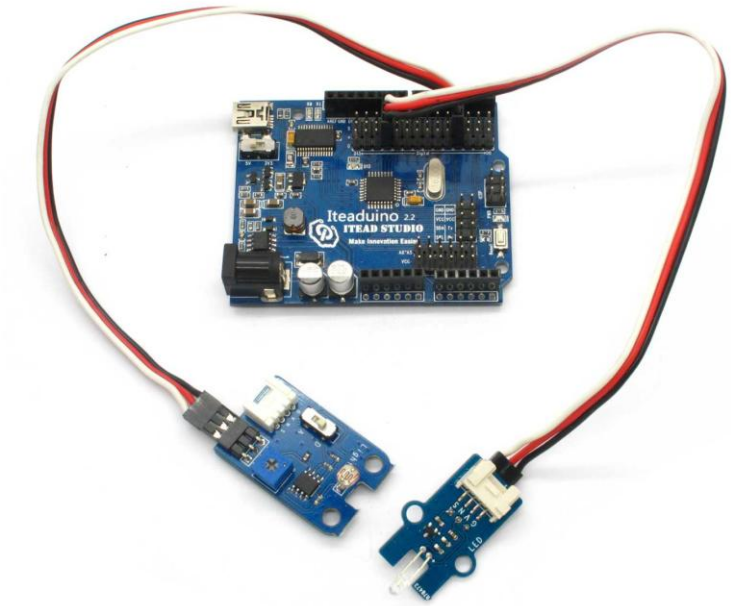

Figure 2

Writing of control program

I′ d like to briefly introduce Arduino library functions used in the test:

digitalRead (pin)

Function: to read the input value of the specified digital pin

Parameters:

- Pin: the pin number for which the input value needs to be read.

For example: digitalRead (3) means to read value of D3 pin.

The complete program used in the test is as follows:

```
int Light =1;
int pin=3;
void setup ()
{
 Serial.begin(9600);
 pinMode(9,OUTPUT);
}
void loop()
{
 Light = digitalRead(pin);
 if (Light )
 {
    digitalWrite(9,HIGH);
 }
 else
 {
  digitalWrite(9,LOW);
 }
}
```

Compiling and uploading of the program

Then compile and download the above program to Iteaduino, the operation is the same as that in last test.

After the program is downloaded and when light sensor electronic brick is put in a place with light, it will output high level, then Iteaduino can read high input and LED lamp will ON; when the light sensor electronic brick is blocked by objects, it will output low level, then Iteaduino will read low input and LED lamp will be OFF.

In the test above, I used digital pin input of Iteaduino to read the value of an external light sensor input to determine the external light conditions and to control ON/OFF of LED lamp. Now, I’ d like to use analog pin input of Iteaduino to achieve the same result:

Construction of hardware circuit

First, connect LED electronic brick to D9 pin on Iteaduino board via the connection cable. Thus the cathode of LED lamp is linked to GND terminal of Iteaduino board, and anode is linked to D9 pin of Iteaduino via S pin.

Push the state switch of light sensor electronic brick to A end to use analog voltage output. Connect the light sensor electronic brick to A0 interface on Iteaduino board via the connection cable, then the light sensor electronic brick will be powered by Iteaduino, and output pin S will be connected to A0 pin of Iteaduino.

The actual circuit diagram is shown in figure 3:

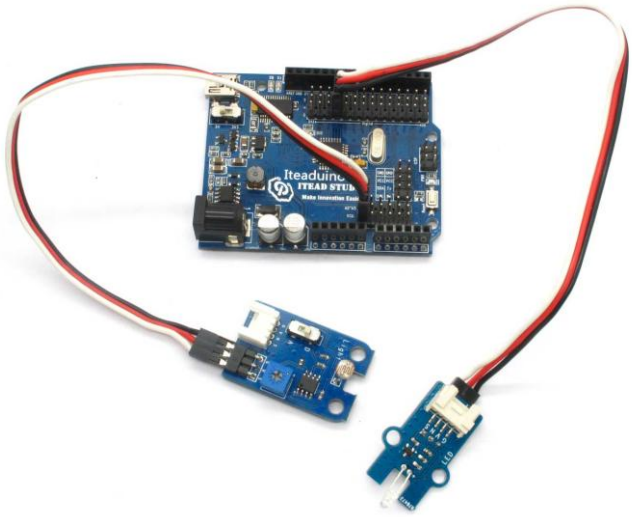

Figure 3

Writing of control program

AnalogRead(pin)

Function：to read input value of analog IO interface. (ADC unit in Iteaduino has 10-bit resolution, thus the digital signal converted from voltage read will be divided into 1024 levels)

Parameters：

- Pin: pin N.O. of analog input interface, generally A0-A5.

Serial.begin(speed)

Function：to set the baud rate of serial ports

Parameters：

- Speed：baud rate, generally takes value of 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600 and 115200

For example, Serial.begin(9600) means to set the baud rate of serial port as 9600.

Serial.println(val)

Function：Serial port output data function, the output data carries enter character, and you can find the value of output data in the serial monitor (as shown in figure 4), .

Parameters：

- Val：Value printed, any data type.

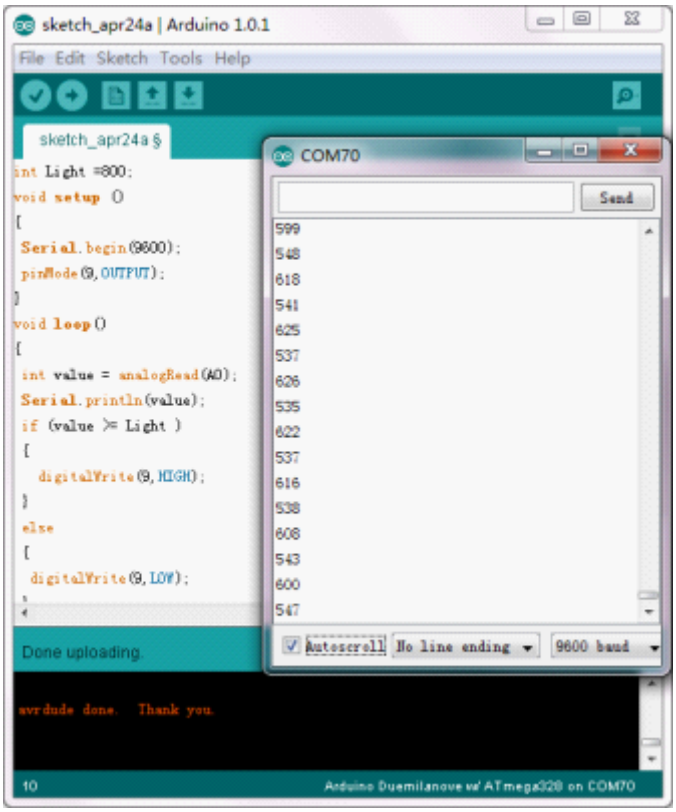

Figure 4

The complete program used in the test is as follows:

```
int Light =800;
//Value of light is determined according to the testing environment. After compiling and downloading this program, you can find different values output with and without light on the serial port monitor. In this test, value is about 600 with light and 920 without light, so we select 800 which is an appropriate value in between these two values.
void setup ()
```

```
{
  Serial.begin(9600);//to set the baud rate of serial port as 9600
  pinMode(9,OUTPUT);//to set D9 pin as output port
}
void loop()
{
  int value = analogRead(A0); //to read value of A0
  Serial.println(value);//to display value of A0 on serial port monitor
  if (value >= Light )
  {
     digitalWrite(9,HIGH);
  }
  else
  {
   digitalWrite(9,LOW);
  }
}
```

Compiling and uploading of program

Next, compile and download the above program to Iteaduino, the operation is the same as in last test.

After downloading the program, when the light sensor electronic brick is put in a place with light, it will output about 3V, and Iteaduino will read an input value of about 600 via A0 and determine LED lamp to be OFF as it is less than 800. When light sensor is blocked by objects, it will output about 4.3V, and

Iteaduino will read an input value of about 920 via A0 and determine LED lamp to be ON as it is more than 800.