AD analog-to-digital conversion experiment

Introduction to AD

We often hear A/D or D/A conversion in the professional vocabulary, so what are the A/D and D/A? A/D (Analog to Digital) means the device to convert analog signal into digital signal , then DA converts digital signal into analog signal.

Arduino has six analog interfaces numbered from 0 to 5, the six interface can also be interface function reuse. In addition to the analog interface function, the six interface can be used as digital interfaces and numbered from digital 14-19. After the simple understanding, let us begin our experiment below. Potentiometer is a kind of well-known typical analog value output element, it will be used to complete this experiment.

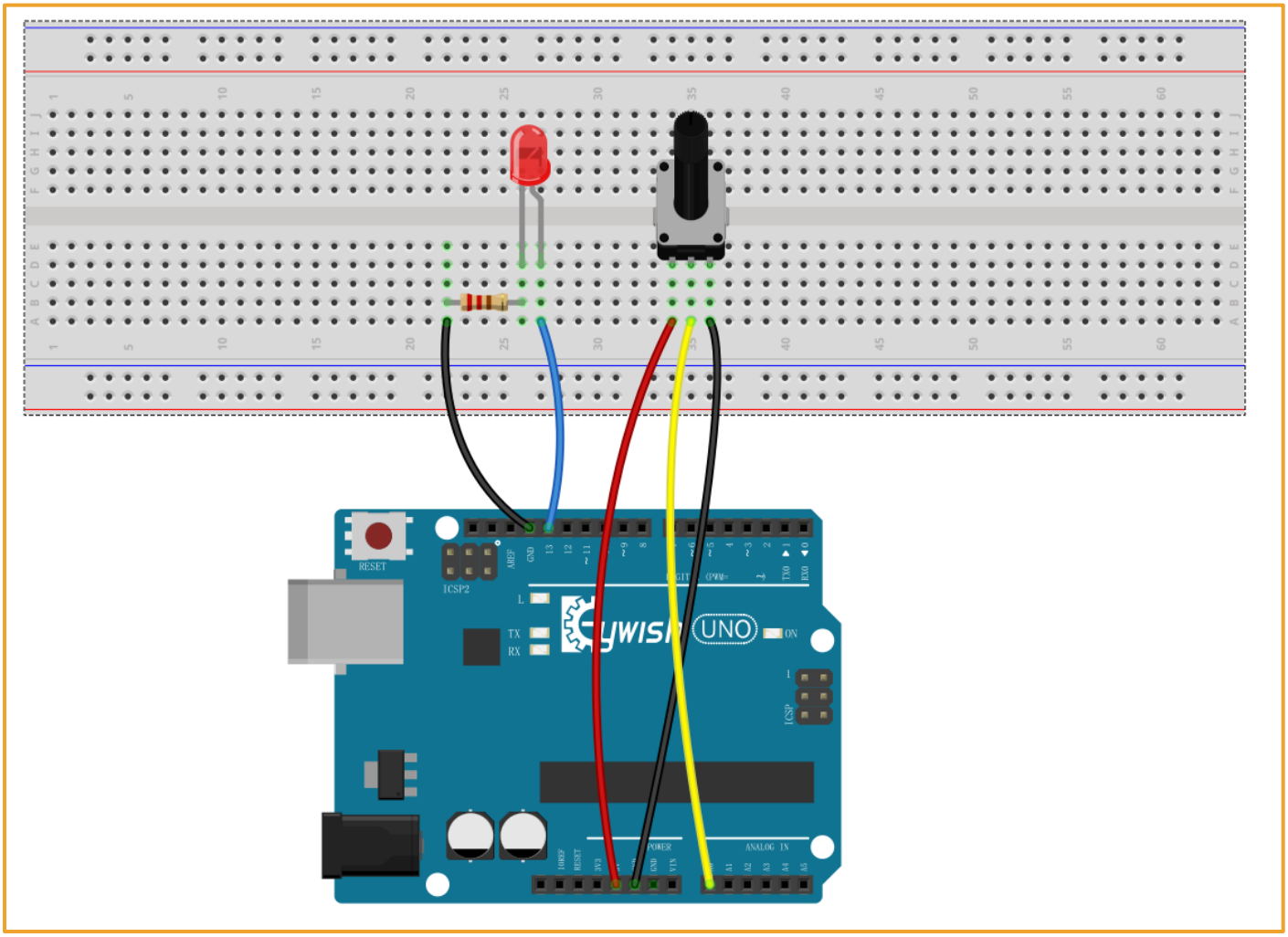
Component List

- Keywish Arduino Uno Mainboard
- Breadboard
- USB cable
- 10k Potentiometer * 1
- Several jumper wires

Experiment Purpose

In this experiment, we'll convert resistance value of potentiometer into analog value and read it out, then the value will be displayed on the screen, this is also a very application example for us to grasp in order to complete our experiments required in the future.

Wiring of Circuit



Experiment Principle

Through the function analogRead ();, statements can read out the value of analog interface. Arduino 328 takes A/D sampling by 10 bit, so the analog value range is 0 ~ $2^{10}-1$ （0-1023）, the number is just the value of the AD, it needs to be converted into the actual voltage value, so we will use the following formula to calculate:

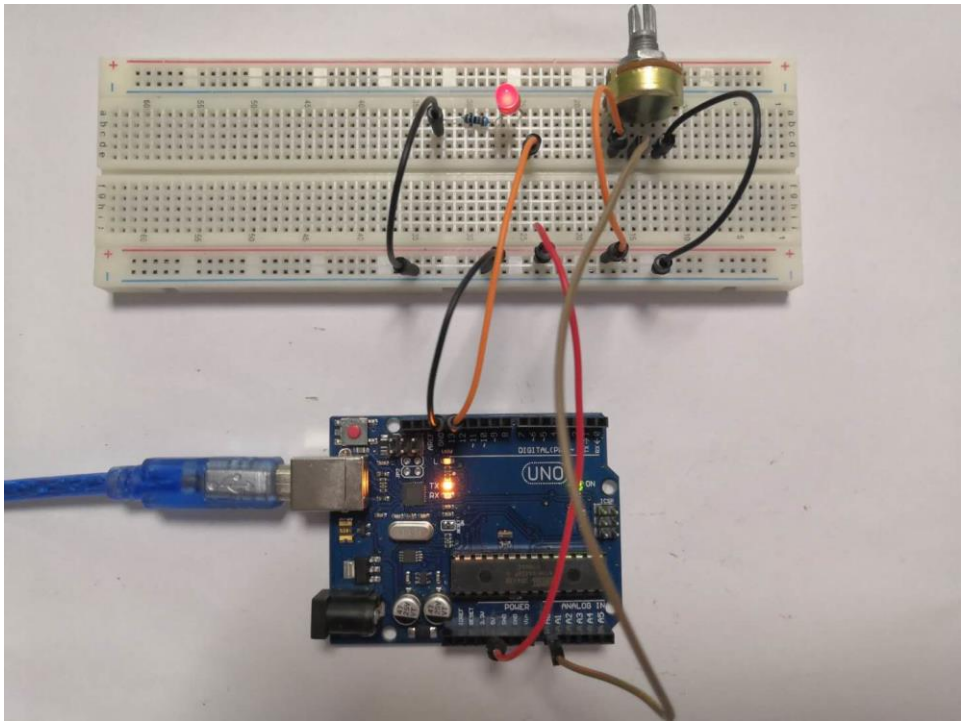
$$V_R = \frac{Value}{2^{10}-1} \times V_{DD}$$

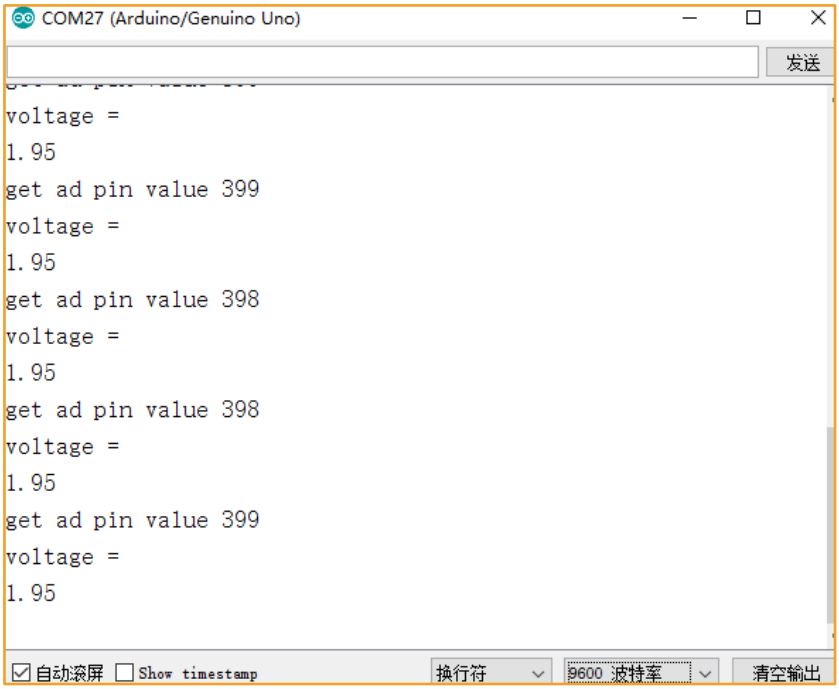
- V_R : real voltage
- Value : Sampled AD value
- V_{DD} : AD reference voltage value

Code

```
int  ADPIN  = A0 ;
int  LEDPIN = 13 ;
int  value = 0 ;
float voltage = 0.0 ;
void setup()
{
    pinMode(ADPIN,INPUT);   // define ADPIN input LEDPIN output
    pinMode(LEDPIN,OUTPUT);
    Serial.begin(115200);    //Serial Baud rate is 115200
}
void loop()
{
    digitalWrite(LEDPIN,HIGH);      // light on led
    value =  analogRead(ADPIN);     // read analog pin raw data
    voltage = ( ( float )value )/1023 ;
    voltage = voltage * 5 ;         // convert analog raw data to real voltage
                                      = //(analog/1023)*5
    Serial.print("get ad pin value ");   //printf Analog pin value
    Serial.print(value);
    Serial.println("\nvoltage =  ");
    Serial.println(voltage);
    delay(1000);
    digitalWrite(LEDPIN,LOW);             //turn off led
}
```

Experiment Result





This experiment is done here. Now when you rotate the potentiometer knob , you will see numerical changes on the screen. This method of reading the analog value will always accompany us, it is also our common function, because most of sensors output analog value, we read the analog value and do corresponding algorithm processing, then it can be applied to the function that we need to implement.

Mblock programming program

MBlock prepared AD digital-to-analog conversion program as shown in the figure below:

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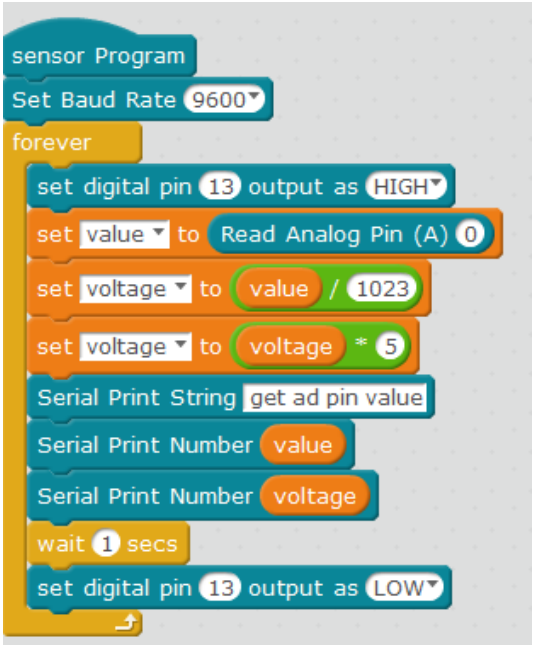
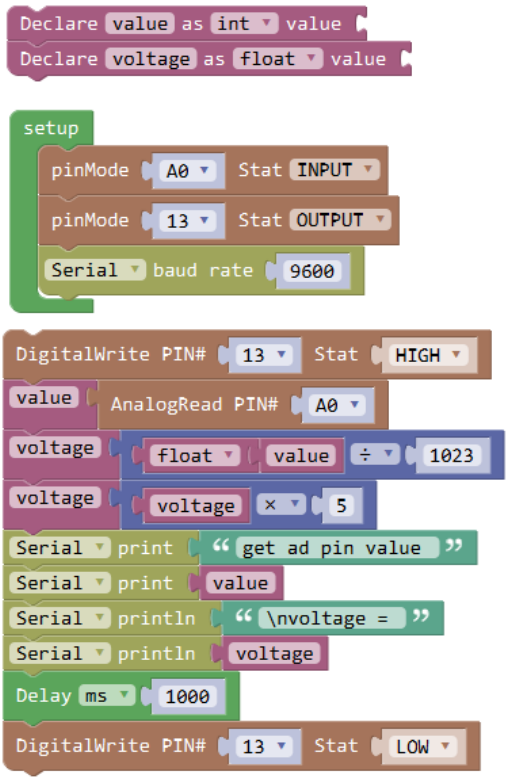
-- Set the digital pin output to low or high level



Mixly graphical programming program



MagicBlock graphical programming program