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Photoresistor

Overview

Photoresistors (also called photo-conductive cells, photocells, CdS cells, or light-dependent resistors) are variable resistors that exhibit *photoconductivity.* This means they increase their conductivity (or decrease their resistance to conduction) as incident light intensity increases. Photoresistors are mainly used in various photoelectric control systems, such as navigation lights, street lights, and other controls systems that take action when the lights go out (or come on). They can be used in manufacturing contexts (e.g. automatic protection device), position detection, automatic camera exposure controllers, smoke alarms, and other photosensitive contexts as well.

In this course, we will use the Raspberry Pi to drive an LED light based on the photoresistor's signal.

Experimental Materials

Raspberry Pi	x1
Breadboard	x1
Photoresistor	x1
ADC0832	x1
LED (3-pin)	x1
Resistor (330Ω)	x1
Dupont jumper wires	

Experimental Procedure

1. If you have not done so already, prepare your development system by installing the Python interpreter, RPi.GPIO library, and wiringPi library as described in READ_ME_FIRST.TXT.

2. Install the ADC0832 analog/digital converter IC, photoresistor, three-pin LED and resistor on your breadboard, and use Dupont jumper wires to connect them to each other and your Raspberry Pi as illustrated in the Wiring Diagram below. Note you will connect only two of the three pins on the LED.

3. Execute the sample stored in this experiment's subfolder.
   If using C, compile and execute the C code:

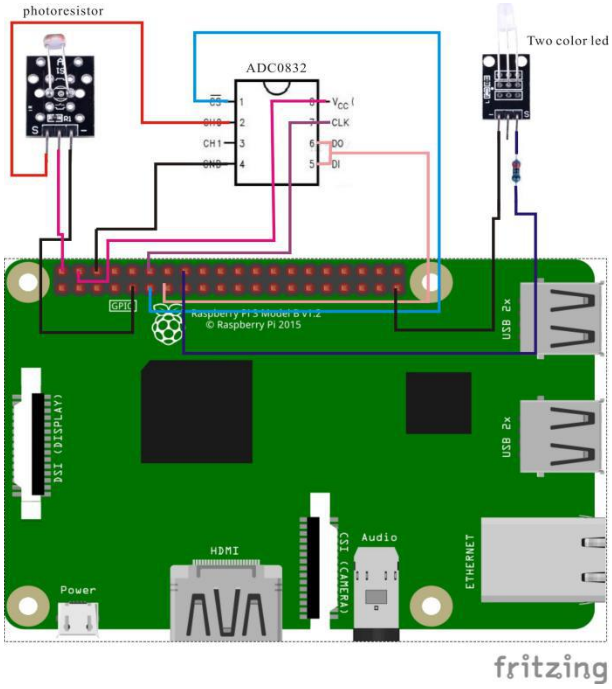
```
cd Code/C
gcc photoResistor.c -o photoResistor.out -lwiringPi
./photoResistor.out
```

   If using Python, launch the Python script:

```
cd Code/Python
python photoResistor.py
```

4. Make experimental observations as you vary the ambient light falling on the photoresistor. As it becomes darker, the LED illuminates. As it becomes brighter, the LED extinguishes.

Wiring Diagram



AD0382 Pin position:

CS	↔	Raspberry Pi pin 11
CLK	↔	Raspberry Pi pin 12
DI	↔	Raspberry Pi pin 13
DO	↔	Raspberry Pi pin 13
CH0	↔	Photoresistor pin "S"
VCC	↔	Raspberry Pi +5V
GND	↔	Raspberry Pi GND

Photoresistor pin position:

"S"	↔	ADC0382 pin CH0
"+"	↔	Raspberry Pi +5V
"-"	↔	Raspberry Pi GND

LED pin position:

"S”	↔	Raspberry Pi pin 16 (through resistor)
"-"	↔	Raspberry Pi GND

Sample Code

Python Code

```
#!/usr/bin/env python
import RPi.GPIO as GPIO
import ADC0832
import time

LedPin = 16
threshold = 120
```

```
def init():
    ADC0832.setup()
    GPIO.setup(LedPin, GPIO.OUT)

def loop():
    while True:
        res = ADC0832.getResult(0)
        print 'res = %d' % res
        if(res > threshold):
            print 'It is night, light on...'
            GPIO.output(LedPin, GPIO.HIGH)
        else:
            print 'It is already dawn, light off'
            GPIO.output(LedPin, GPIO.LOW)
        time.sleep(0.2)

if __name__ == '__main__':
    init()
    try:
        loop()
    except KeyboardInterrupt:
        ADC0832.destroy()
        print 'The end !'
```

C Code

```
#include <wiringPi.h>
#include <stdio.h>

typedef unsigned char uchar;
typedef unsigned int uint;

#define     ADC_CS        0
#define     ADC_CLK       1
#define     ADC_DIO       2
#define     LedPin        4
#define     threshold     120
```

```
uchar get_ADC_Result(uchar channel)
{
   uchar i;
   uchar dat1=0, dat2=0;

   digitalWrite(ADC_CS, 0);
   digitalWrite(ADC_CLK,0);
   digitalWrite(ADC_DIO,1);  delayMicroseconds(2);
   digitalWrite(ADC_CLK,1);  delayMicroseconds(2);

   digitalWrite(ADC_CLK,0);
   digitalWrite(ADC_DIO,1);   delayMicroseconds(2);
   digitalWrite(ADC_CLK,1);  delayMicroseconds(2);

   digitalWrite(ADC_CLK,0);
   digitalWrite(ADC_DIO,channel);  delayMicroseconds(2);
   digitalWrite(ADC_CLK,1);
   digitalWrite(ADC_DIO,1);   delayMicroseconds(2);
   digitalWrite(ADC_CLK,0);
   digitalWrite(ADC_DIO,1);   delayMicroseconds(2);

   for(i=0;i<8;i++)
   {
      digitalWrite(ADC_CLK,1);  delayMicroseconds(2);
      digitalWrite(ADC_CLK,0);   delayMicroseconds(2);

      pinMode(ADC_DIO, INPUT);
      dat1=dat1<<1 | digitalRead(ADC_DIO);
   }

   for(i=0;i<8;i++)
   {
      dat2 = dat2 | ((uchar)(digitalRead(ADC_DIO))<<i);
      digitalWrite(ADC_CLK,1);  delayMicroseconds(2);
      digitalWrite(ADC_CLK,0);   delayMicroseconds(2);
   }

   digitalWrite(ADC_CS,1);
   pinMode(ADC_DIO, OUTPUT);

   return(dat1==dat2) ? dat1 : 0;
}
```

```
int main(void)
{
    uchar analogVal;
    if(wiringPiSetup() == -1)
    {
        printf("setup wiringPi failed !");
        return -1;
    }
    pinMode(ADC_CS,  OUTPUT);
    pinMode(ADC_CLK, OUTPUT);
    pinMode(ADC_DIO, OUTPUT);
    pinMode(LedPin, OUTPUT);
    while(1)
    {
        analogVal = get_ADC_Result(0);
        printf("analogVal is %d.\n", analogVal);
        if(analogVal > threshold)
        {
            printf("It is night,light on!\n");
            digitalWrite(LedPin, HIGH);
        }
        else
        {
            printf("It is already dawn, light off!\n");
            digitalWrite(LedPin, LOW);
        }
        delay(200);
    }
    return 0;
}
```

Technical Background

◆Maximum voltage: 150V DC

◆ Max Power: 100 mW

◆Ambient Temperature: -30°C … +70°C

◆ Spectrum Peak: 540nm

◆Response Time: rise: 20ms; drops: 30ms