CODENAME47

Sensors

IR reflective sensors have one emitter (IR LED) and one receiver (Photo-Transistor or photo diode.*)*
If we have white surface it reflects the light and it will sensed by the receiver, similarly if we have black surface it absorbs the light and receiver cannot sense light.

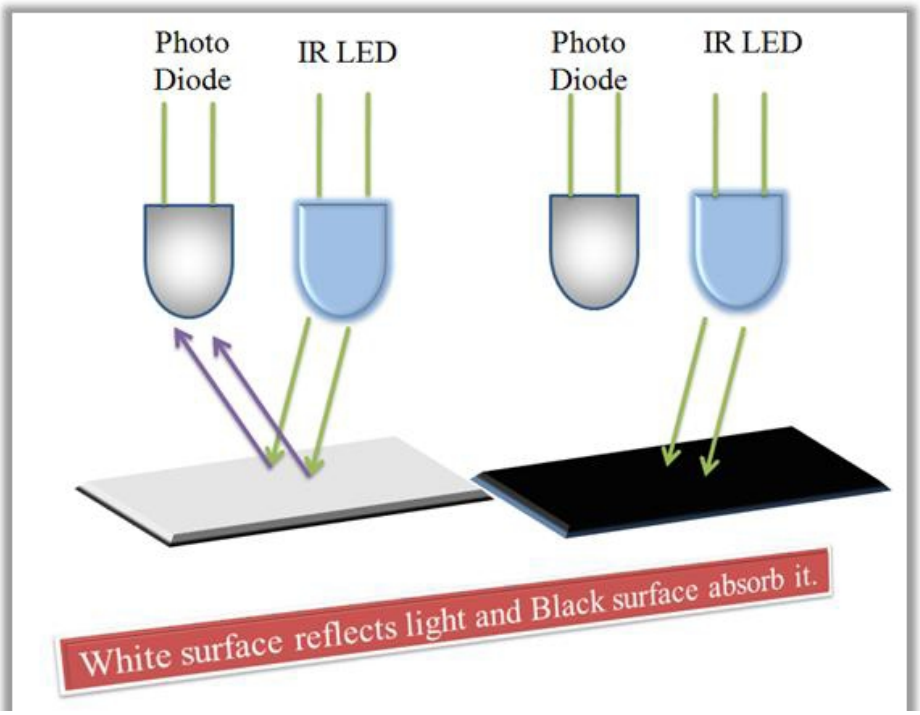
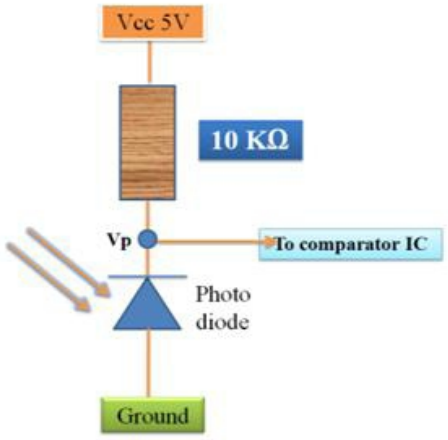


Photo diode has the property that if IR light fall on it, its electrical resistance comes down(i.e. it comes down from 150kΩ to 10kΩ if no noise present).To sense the change in resistance we use voltage divider circuit (as shown in figure below).



Sample Calculation:
Say Receiver has resistance-
Rs=150kΩ without light (on black surface)
Rs=10kΩ with light (on white surface)
The voltage that goes to comparator
Without light: (on black surface)
Vp= Rs/(Rs+R)*Vcc=150/(150+10)*5=**4.6875 V**
With light: (on white surface)
Vp= Rs/(Rs+R)*Vcc=10/(10+10)*5==**2.500 V**

Comparator

Comparator is a device which compares two input voltages and gives
output high/low.

Use of comparator in IR sensor

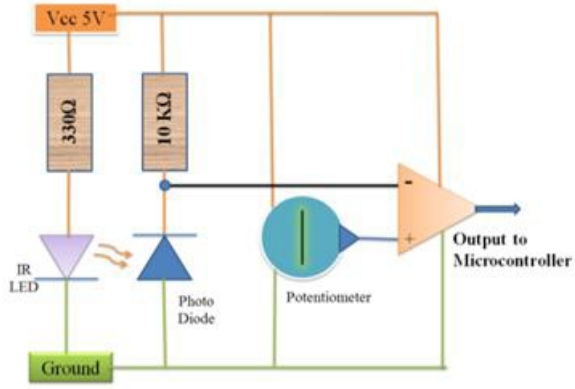
One input is from photo-receiver (like photo-diode), other is generated by using potentiometer. The second voltage is also called as reference voltage for that sensor.

Setting of reference voltage (Vref)

Reference voltage can be varied by using potentiometer, such that it can vary from 0V to Vcc. Reference voltage is set as mean value of the sensor inputs measured with and without light.

Eg. From above example Vref = (4.675+2.5)/2= **3.5875 V**

Connect Inverting Input of Comparator to photo- receiver, Non-Inverting Input to potentiometer (as shown in figure) and output goes to micro controller.



Sample Calculation:

Let V+ = **3.5875 V**

With light :(on white surface)

V- = **2.500 V**

Thus ***V***+>***V***- and Vo= Vcc = 5 V

Thus we got digital **HIGH** output.

Without light:(on black surface)

V- = **4.6875 V**

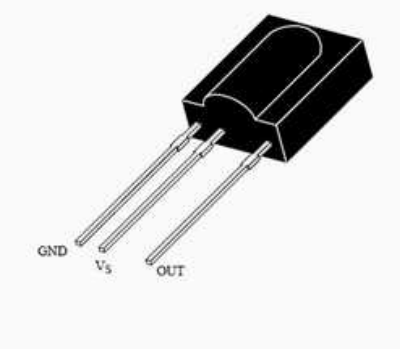
Thus ***V***+<***V***- and Vo = 0 V

Thus we got digital **LOW** output.

TSOP

TSOP is also a kind of IR sensor: it also uses IR LED as a transmitter but difference here is that TSOP is sensitive to a particular frequency so its range is better compared to normal photo diode. You can adjust it up to 15 cm. It can be used for detecting the blocks in the arena.

PIN diagram:



As shown in the diagram TSOP has three pin: GND, Vs and out
GND is connected to common GND
Vs is connected to +5 volt
Out is output pin. When TSOP senses it give GND at this pin else +5 volts

WORKING:

TSOP sensors are commonly used in TV remote receivers. TSOP senses only a particular frequency and for transmitter you can use a normal IR LED. A 555 time IC is used to generate a desired frequency square wave.
For more details check the links given below:

http://robotiks4u.blogspot.com/2008/05/this-is-simple-yet-effective-ir.html
http://www.societyofrobots.com/member_tutorials/files/TSOP.pdf

Phototransistors can also be used instead of photodiodes. For more details on phot transistors check the link below.
http://www.radio-electronics.com/info/data/semicond/phototransistor/photo-transistor-circuits-symbols.php