AUTOMATIC LIGHT OPERATED SWITCH FOR LED

SY ENTC
Batch: A3

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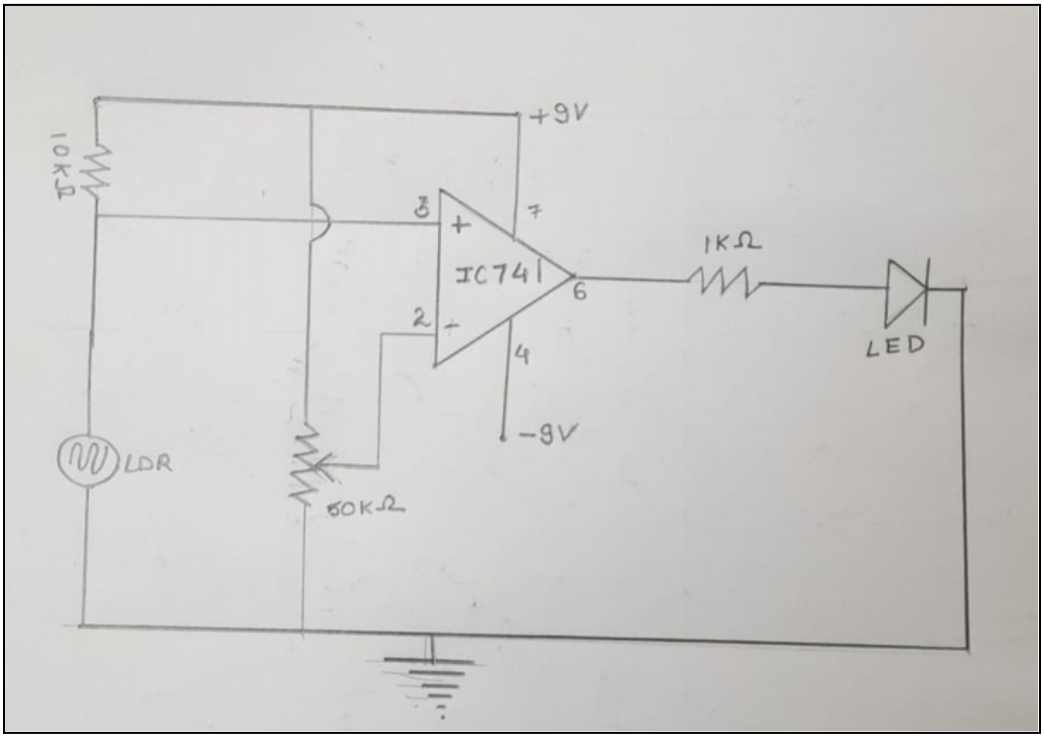
Circuit Diagram:



Components used:

COMPONENT	QUANTITY	COST(Rs)
OP AMP IC741	1	14
9V Batteries	2	38
Battery patch	2	20
LED	1	5
LDR	1	10
Variable Resistor(50 KΩ)	1	20
1 KΩ Resistor	1	2
10 KΩ Resistor	1	2
PCB	1	60
Wires	2m	20

Construction:

We have connected the wiper terminal of the *50 KΩ Potentiometer* to the *inverting terminal* (Pin 2) of the OP – Amp and the other end is grounded. The *non – inverting terminal* (Pin 3), has been connected to the junction between a *10 KΩ Resistor* and the *Light Dependent Resistor(LDR)* .

These two will form a potential divider feeding its output to the Op Amp.The other end of the 10KΩ resistor is connected to *positive supply* (+9V) and the other end of the LDR is grounded. Pin 4 is given *negative supply* of the DC voltage i.e -9V and Pin 7 of Op amp is given *positive supply* of the DC voltage i.e +9V.
The *anode* of the LED is connected to one end of the 1KΩ resistor and the *cathode* of the LED is connected to the ground. The output is collected at Pin 6 of the op amp.

Working:

The main components of the project are IC 741 Op – Amp and LDR. First let us see about LDR (Light Dependent Resistor). A Light Dependent Resistor or LDR , as the name suggests, is a type of resistor, whose resistance changes depending on the intensity of the light incident on it.

Typically, when light is incident directly on the LDR, its resistance will be very low and when there is no light i.e. in darker conditions, its resistance jumps to a few mega Ω. We will use this feature of the LDR in our project to detect darkness and turn on the LED.

For this we have used an Operational Amplifier. The Op – Amp is configured in Comparator mode i.e. it will compare the voltages at inverting and non – inverting terminals and correspondingly generate a **HIGH** or **LOW** output. The operation of a comparator is that it produces one of the two values, $+Vsat$ and $-Vsat$ at the output based on the values of its input voltages(at inverting and non inverting terminal).

Light-mode condition: When the light is incident on the LDR, its resistance decreases, therefore the voltage at non inverting terminal is less than that at the inverting terminal, and so we get **-Vsat** at the output and **LED turns OFF** as it is now *reverse-biased*.

Dark-mode condition: When no light falls on the LDR, the resistance of the LDR becomes very high and therefore the voltage at the non inverting terminal is greater than that at the inverting terminal and therefore we get **+Vsat** at the output and **LED turns ON** since it is now *forward biased*.

Observations: Value of variable resistor: 50kΩ

Voltage of LED when:

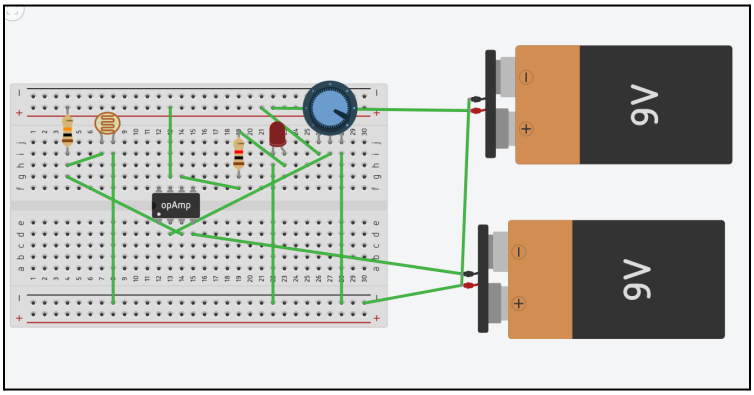
- LED is OFF: -7.2V (reversed biased)
- LED is ON: +3.1V (forward biased)

Output voltage at:	**Light condition**	**Dark condition**
Pin 2(inverting)	+3.8V	+3.7V
Pin 3(non inverting)	+2.2V	+7.9V
Pin 6(output)	-7.1V	+3.45V

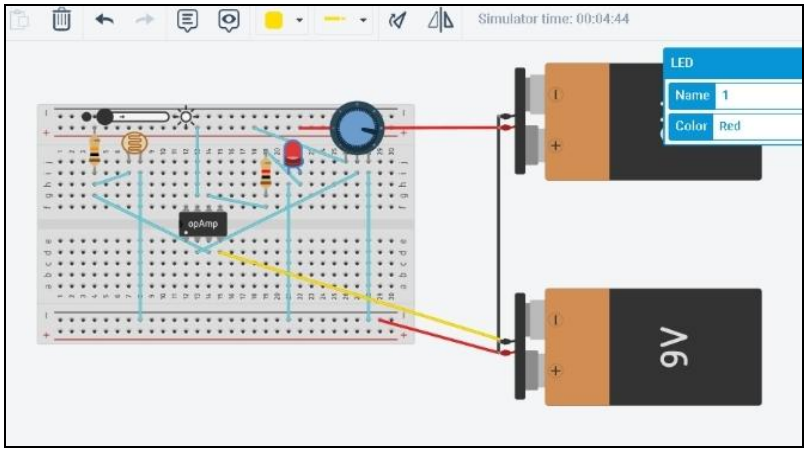
LDR is subjected to:	**Resistance of LDR (kΩ)**
flashlight	0.7
Normal room lighting	2.3
darkness	9

Snaps:

1. Tinkercad Simulation Software

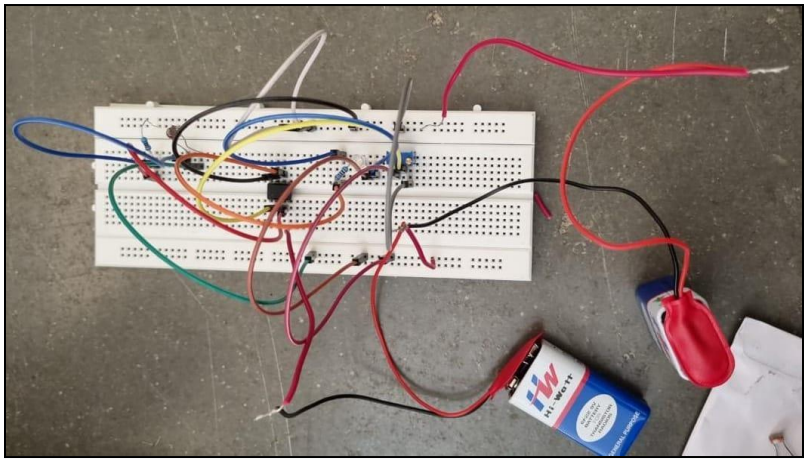


LIGHT MODE

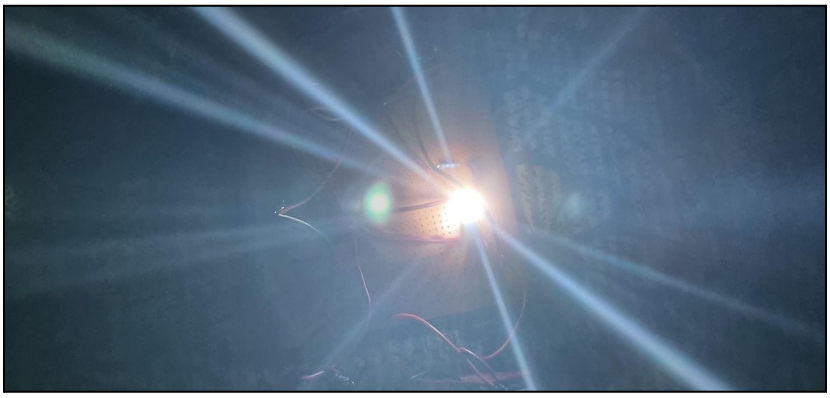


DARK MODE

2. Breadboard

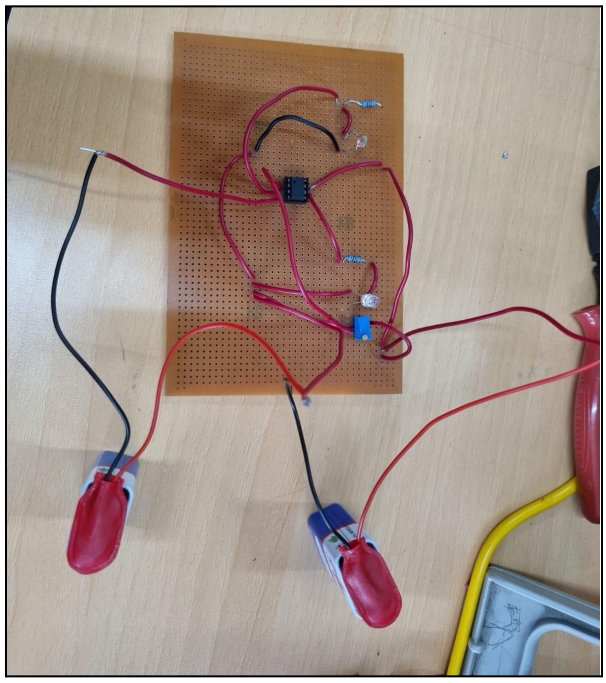


LIGHT MODE

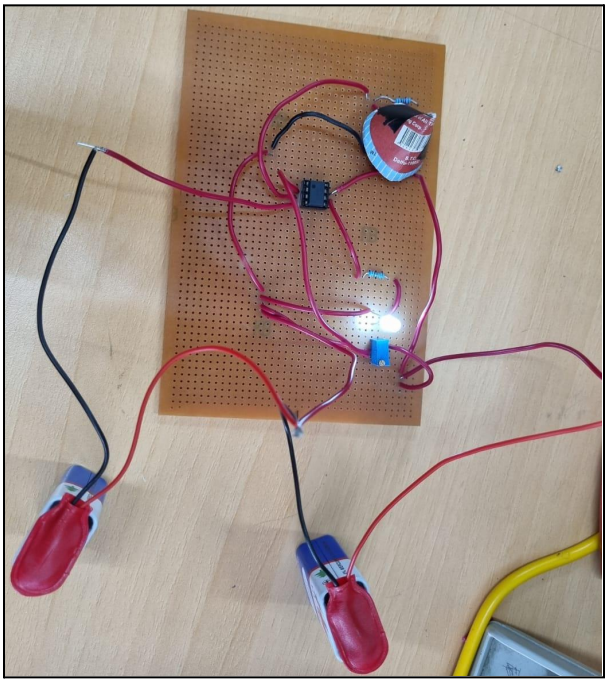


DARK MODE

3. Printed Circuit Board:



LIGHT MODE



DARK MODE

Conclusion:

1. We have used a comparator circuit since it has fast switching speed due to highest slew rate,accuracy is high(high CMRR,voltage gain,minimum offset voltage)with a compatible output(output voltage swing within specific limits).
2. Here other than op amp 741 other ICs such op amp LM 311, 351 ,356 who have larger Slew rates could be used as they are more suitable for comparator applications but here as 741 is readily available,is cost efficient and the application in the project is minor therefore we have chosen op amp 741 which provides high voltage gain and can be operated over a wide range of voltages.
3. Simple Light Detector Circuit can be used in many applications like automatic switching of appliances up on detecting light, security systems, etc.
4. This circuit can be used in an alarm system, where increasing intensity of light will trigger the alarm.
5. It can also be used in cupboards or wardrobes. When the door is opened, the light will automatically turn on.