NEAR EAST UNIVERSITY

Faculty of Engineering

Department of Electrical and Electronic Engineering

LIGHT OPERATED SCR SWICTHES

Graduation Project
EE 400

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IN THE NAME OF ALLAH, MOST GRACIOUS, MOST MERCIFUL.

I wish to express my deepest appreciation to my god who stood beside me all the time,who supported me in all my achievements and who has given me the power and patience to finish my college studies successfully.

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Last but not least i dedicate my work and my success to my father **Ali alkilany**, my mother, my brothers, my sisters and my friends who provided me the encouragement and assistance that have made the completion of this work possible and I hope them success and happiness in life.

Also I will never forget my wonderful times that I spent in Cyprus and Near East University with my good friends specially my house mate(Omar, Ahmad, Mohammad, Basil) and Mahmod Masuod, Mhamad Shanblh, and I wish for me and all our dreams comes true.

ABSTRACT

As the life is getting more complicated, many people try to make their environment more comfortable, which leads to design some systems such as light operated SCR switch. Which considered as an "intelligent" circuit can make our life more easy and controllable.

light operated SCR switch system depends on a sensitive element acts as the input of the circuit which is the photo resistive, photo resistive designed to act as high resistance under dark condition and as low resistance when brightly illuminated, under bright condition, the LDR resistance is low, so the voltage on emitter is not sufficient to trigger the SCR, and lamp is off. Under dark condition, the LDR resistance is high, so the voltage on emitter is sufficient to trigger the SCR, and lamp comes on.

This project presents the design, test and building of a system that is activated by darkness, and some application using this system to make our life more comfortable.

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INTRODUCTION

The inquiry into the nature of light has lead us to recognize light as a small part of the Electro-magnetic spectrum on one hand and as the beam of photons on the other, forcing us to accept wave particle duality as the fundamental tenet of nature.

In this project we are going to design, build and test light operated SCR switches. How to turn the switches on and off, during LEDs will be presented. Suggestion into where these switches can be used will be made.

Chapter one will present the components which will be used in building the circuits in general, their characteristics, properties and functions will also be discussed. Also safety guidelines, which must be kept in mind when working on electronic projects, will be described. Chapter two will give a brief description about light, what is light, how to produce a photon, frequencies, colors and behavior of light when it hits an object supported with many figures. The third chapter is the most important chapter, which explains the hardware project in details, how we built it, How it work, what its input and output? With the circuit diagrams of, light operated SCR switches.

The aims of this project are:

- To design and build a light operated SCR switches.
- To gain hands-on experience in electronic hardware project.
- To modify the original circuit where possible.
- To suggest potential real-life use of switches.

CHAPTER ONE
ELECTRONIC COMPONENTS

1.1 Overview

In this chapter a description about the electronics components used in general hardware projects will be described briefly in addition to safety guidelines.

1.2 Components

In this section i will generally explain each of the components structures and uses in the electronics circuits.

1.2.1 Resistors

A resistor is an electrical component that resists the flow of current. The electrical resistance is equal to the voltage drop across the resistor divided by the current that is flowing through the resistor. Resistors are used as part of electrical networks and electronic circuits. In general, a resistor is used to create a known voltage-to-current ratio in an electric circuit.

If the current in a circuit is known, then a resistor can be used to create a known potential difference proportional to that current. Conversely, if the potential difference between two points in a circuit is known, a resistor can be used to create a known current proportional to that difference. A resistor has a maximum working voltage and current above which the resistance may change or the resistor may be physically damaged. Most axial resistors use a pattern of colored stripes to indicate resistance. SMT ones follow a numerical pattern. Cases are usually brown, blue, or green, though other colors are occasionally found like dark red or dark gray.

The symbol for a resistor is shown in the following diagram (upper: American symbol, lower: European symbol.)

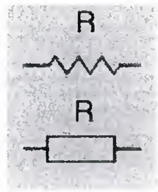


Figure 1.1 Resistor symbols

Resistance value is marked on the resistor body. To read the color code of a common 4 band resistor, start at the opposite side of the tolerance band and read from left to right. Write down the corresponding number from the color chart for the 1st color band to the right of that number, write the corresponding number for the 2nd band then multiply that number by the corresponding multiplier number of the 3rd band, the following table shows the colors used to identify resistor values.

Table 1.1: Resistor color code

Resistor Color Codes					
Band Color	1st Band #	2nd Band #	*3rd Band #	Multiplier x	Tolerances ± %
Black	0	0	0	1	
Brown	1	1	1	10	± 1%
Red	2	2	2	100	± 2 %
Orange	3	3	3	1000	
Yellow	4	4	4	10,000	
Green	5	5	5	100,000	± 0.5 %
Blue	6	6	6	1,000,000	± 0.25 %
Violet	7	7	7	10,000,000	± 0.10 %
Grey	8	8	8	100,000,000	± 0.05 %
White	9	9	9	1,000,000,000	
Gold				0.1	± 5 %
Silver				0.01	± 10 %
None					± 20 %

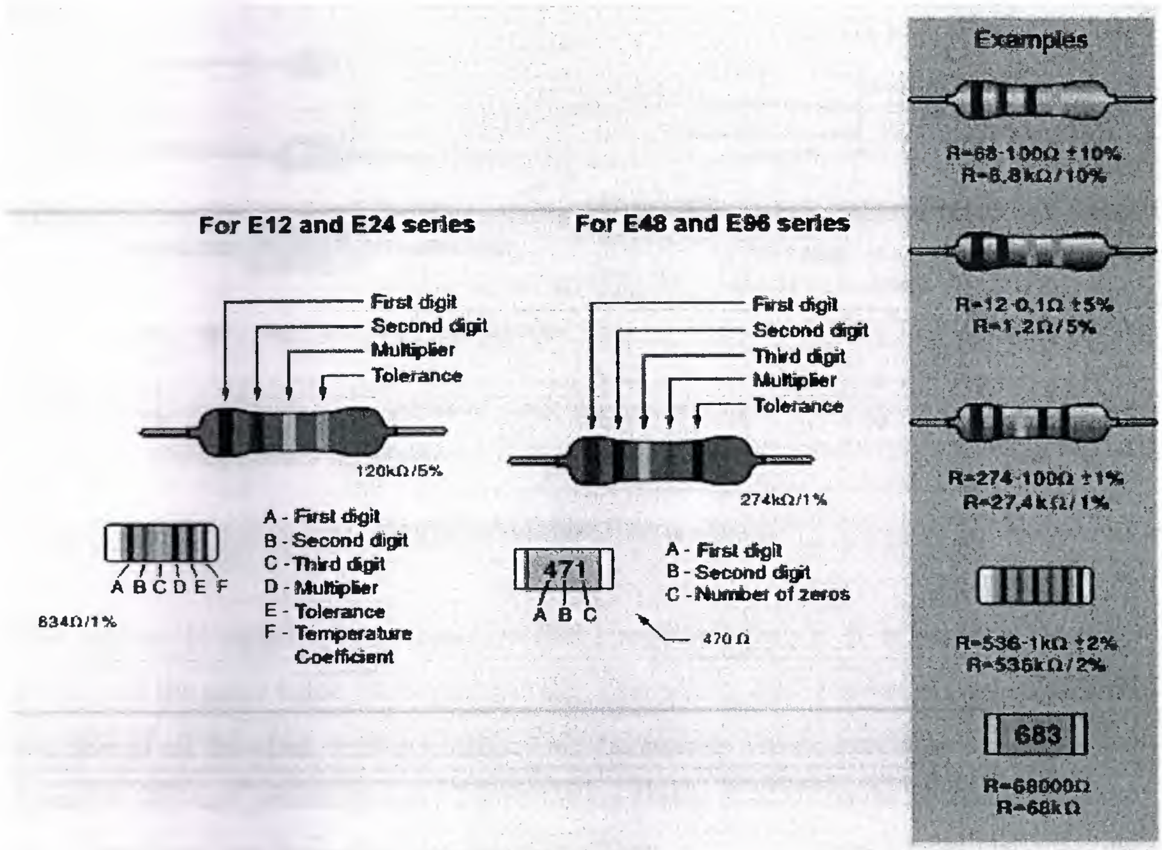
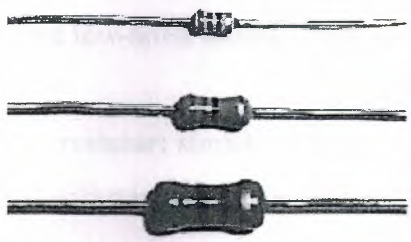


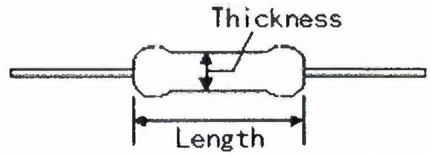
Figure 1.2 Four-band resistor, Five-band resistor, Cylindrical SMD resistor, Flat SMD resistor.

1.2.1.1 Types of resistors

Carbon film resistors: This is the most general purpose, cheap resistor. Usually the tolerance of the resistance value is ±5%. Power ratings of 1/8W, 1/4W and 1/2W are frequently used. Carbon film resistors have a disadvantage; they tend to be electrically noisy. Metal film resistors are recommended for use in analog circuits.



From the top of the photograph
1/8W
1/4W
1/2W



Rough size		
Rating power (W)	**Thickness (mm)**	**Length (mm)**
1/8	2	3
1/4	2	6
1/2	3	9

Figure 1.3 carbon film resistors.

This resistor is called a Single-In-Line (SIL) resistor network. It is made with many resistors of the same value, all in one package. One side of each resistor is connected with one side of all the other resistors inside. One example of its use would be to control the current in a circuit powering many light emitting diodes (LEDs). In the photograph on the left, 8 resistors are housed in the package. Each of the leads on the package is one resistor. The ninth lead on the left side is the common lead. The face value of the resistance is printed. (It depends on the supplier.) Some resistor networks have a "4S" printed on the top of the resistor network. The 4S indicates that the package contains 4 independent resistors that are not wired together inside. The housing has eight leads instead of nine. The internal wiring of these typical resistor networks has been illustrated below. The size (black part) of the resistor network which I have is as follows: For the type with 9 leads, the thickness is 1.8 mm, the height 5mm, and the width 23 mm. For the types with 8 component leads, the thickness is 1.8 mm, the height 5 mm, and the width 20 mm.

Metal film resistors: metal film resistors are used when a higher tolerance (more accurate value) is needed. They are much more accurate in value than carbon film resistors. They have good temperature stability, good long time stability, cannot handle overloads well. They have about ±0.05% tolerance. They have about ±0.05% tolerance. Resistors that are about ±1% are more than sufficient. Ni-Cr (Nichrome) seems to be used for the material of resistor. The metal film resistor is used for bridge circuits, filter circuits, and low-noise analog signal circuits.

Thick film resistor: similar properties as metal film resistor but can handle surges better, and withstand high temperatures,

Thin film resistor: good long time stability, good temperature stability, good voltage dependently rating, low noise, not good for RF, low surge handling capacity

Metal oxide resistor: mostly similar features as metal film resistor but better surge handling capacity, higher temperature rating them metal film resistor, low voltage dependently, low noise, better for RF than wire wound resistor but usually worse temperature stability

Variable resistors: there are two general ways in which variable resistors are used. One is the variable resistor which value is easily changed, like the volume adjustment of radio. The other is semi-fixed resistor that is not meant to be adjusted by anyone but a technician. It is used to adjust the operating condition of the circuit by the technician. Semi-fixed resistors are used to compensate for the inaccuracies of the resistors, and to fine-tune a circuit. The rotation angle of the variable resistor is usually about 300 degrees. Some variable resistors must be turned many times to use the whole range of resistance they offer. This allows for very precise adjustments of their value. These are called "Potentiometers" or "Trimmer Potentiometers." The symbol is used to indicate a variable resistor in a circuit diagram is shown below.

Figure 1.4 Variable resistors symbol.

There are three ways in which a variable resistor's value can change according to the rotation angle of its axis. When type "A" rotates clockwise, at first, the resistance value changes slowly and then in the second half of its axis, it changes very quickly.

The "A" type variable resistor is typically used for the volume control of a radio, for example. It is well suited to adjust a low sound subtly. It suits the characteristics of the ear. The ear hears low sound changes well, but isn't as sensitive to small changes in loud sounds. A larger change is needed as the volume is increased. These "A" type variable resistors are sometimes called "audio taper" potentiometers. As for type "B", the rotation of the axis and the change of the resistance value are directly related. The rate of change is the same, or linear, throughout the sweep of the axis. This type suits a resistance value adjustment in a circuit, a balance circuit and so on. They are sometimes called "linear taper" potentiometers. Type "C" changes exactly the opposite way to type "A". In the early stages of the rotation of the axis, the resistance value changes rapidly, and in the second half, the change occurs more slowly. This type isn't too much used. It is a special use. As for the variable resistor, most are type "A" or type "B".

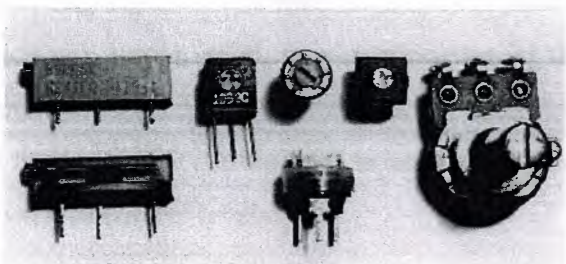


Figure 1.5 Variable resistors.

Wire wound resistors: There is another type of resistor other than the carbon-film type and the metal film resistors. It is the wire wound resistor. A wire wound resistor is made of metal resistance wire, and because of this, they can be manufactured to precise values. Also, high-wattage resistors can be made by using a thick wire material. Wire wound resistors cannot be used for high-frequency circuits. Coils are used in high frequency circuits. Since a wire wound resistor is a wire wrapped around an insulator, it is also a coil, in a manner of speaking. Using one could change the behavior of the circuit. Still another type of resistor is the Ceramic resistor. These are wire wound resistors in a ceramic case, strengthened with special cement. They have very high power ratings, from 1 or 2 watts to dozens of watts. These resistors can become extremely hot when used for high power applications, and this must be taken into account when designing the circuit. These devices can easily get hot enough to burn you if you touch one.

Composite resistor: usually some medium power resistors are built in this way. Has low inductance, large capacitance, poor temperature stability, noisy and not very good long time stability. Composite resistor can handle well short overload surges.

1.2.2 Capacitors

An electrical device capable of storing electrical energy . In general, a capacitor consists of two metal plates insulated from each other by a dielectric. The capacitance of a capacitor depends primarily upon its shape and size and upon the relative permittivity εr of the medium between the plates. In vacuum, in air, and in most gases, εr ranges from one to several hundred.

One classification of capacitors comes from the physical state of their dielectrics, which may be gas (or vacuum), liquid, solid, or a combination of these. Each of these classifications may be subdivided according to the specific dielectric used. Capacitors may be further classified by their ability to be used in alternating-current (ac) or direct-current (dc) circuits with various current levels.

Capacitors are also classified as fixed, adjustable, or variable. The capacitance of fixed capacitors remains unchanged, except for small variations caused by temperature fluctuations. The capacitance of adjustable capacitors may be set at any one of several discrete values. The capacitance of variable capacitors may be adjusted continuously and set at any value between minimum and maximum limits fixed by construction. Trimmer capacitors are relatively small variable capacitors used in parallel with larger variable or fixed capacitors to permit exact adjustment of the capacitance of the parallel combination. Made in both fixed and variable types, air, gas, and vacuum capacitors are constructed with flat parallel metallic plates (or cylindrical concentric metallic plates) with air, gas, or vacuum as the dielectric between plates. Alternate plates are connected, with one or both sets supported by means of a solid insulating material such as glass, quartz, ceramic, or plastic. Gas capacitors are similarly built but are enclosed in a leak proof case. Vacuum capacitors are of concentric-cylindrical construction and are enclosed in highly evacuated glass envelopes.

1.2.2.1 Capacitance

The capacitance of a capacitor depends on the geometry of the plates and the kind of dielectric used, since these factors determine the charge which can be put on the plates by a unit potential difference existing between the plates; which descripe mathmatically as The ratio of the charge q on one of the plates of a capacitor to the potential difference v between the plates.

In an ideal capacitor, no conduction current flows between the plates. A real capacitor of good quality is the circuit equivalent of an ideal capacitor with a very high resistance in parallel or, in alternating-current (ac) circuits, of an ideal capacitor with a low resistance in series.

1.2.2.2 Types of capacitors

There are many types of capacitor but they can be split into three groups, polarized, unpolarized and variable capoacitors; each group has its own circuit symbol.

1. **Polarized capacitors**

Figure 1.6 Circuit symbol & examples of the polarized capacitor.

Electrolytic Capacitors: The electrolytic capacitor was invented in 1921. It was largely responsible for the development of mains-powered radio receivers, since it permitted the filtering of the 50-60 hertz power supplied to residences, after it was rectified to power the radio tubes. This was not practical without the small volume as shown in figure below and low cost of electrolytic capacitors. This type of capacitor typically with a larger capacitance per unit volume than other types, making them valuable in relatively high-current and low-frequency electrical circuits. This is especially the case in power-supply filters, where they store charge needed to moderate output voltage and current fluctuations, in rectifier output, and especially in the absence of rechargeable batteries that can provide similar low-frequency current capacity. They are also widely used as coupling capacitors in circuits where AC should be conducted but DC should not; the large value of the capacitance allows them to pass very low frequencies.

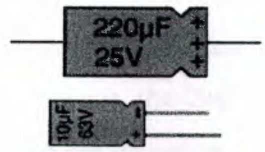


Figure 1.7 Electrolytic capacitor.

Tantalum Bead Capacitors: Tantalum bead capacitors are polarised and have low voltage ratings like electrolytic capacitors. They are expensive but very small, so they are used where a large capacitance is needed in a small size.

Modern tantalum bead capacitors are printed with their capacitance and voltage in full. However, older ones use a color-code system which has two stripes (for the two digits) and a spot of color for the number of zeros to give the value in µF. The standard capacitor color code is used but for the spot, grey is used to mean x0.01 and white means x0.1 so that values of less than 10µF can be shown. A third color stripe near the leads shows the working voltage (yellow 6.3V, black 10V, green 16V, blue 20V, grey 25V, white 30V, pink 35V).

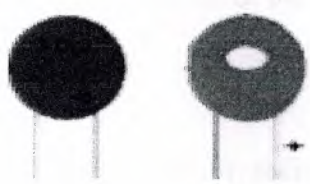


Figure 1.8 Tantalum Bead Capacitors

2. Unpolarized capacitor

Small value capacitors are unpolarised and may be connected either way round. They are not damaged by heat when soldering, except for one unusual type (polystyrene). They have high voltage ratings of at least 50V, usually 250V or so. It can be difficult to find the values of these small capacitors because there are many types of them and several different labeling systems! Many small value capacitors have their value printed but without a multiplier, so you need to use experience to work out what the multiplier should be! For example 0.1 means 0.1µF = 100nF. Sometimes the multiplier is used in place of the decimal point. For example: 4n7 means 4.7nF.

Capacitor Number Code: A number code is often used on small capacitors where printing is difficult: The 1st number is the 1st digit, the 2nd number is the 2nd digit, and the 3rd number is the number of zeros to give the capacitance in pF. Ignore any letters - they just indicate tolerance and voltage rating. For example: 102 means 1000pF = 1nF (not 102pF!), 472J means 4700pF = 4.7nF (J means 5% tolerance).

Capacitor Color Code: A color code was used on polyester capacitors for many years. It is now obsolete, but of course there are many still around. The colors should be read like the resistor code, the top three colors bands giving the value in pF. Ignore the 4th band (tolerance) and 5th band (voltage rating). For example: brown, black, orange means 10000pF = 10nF = 0.01µF.

Note that there are no gaps between the colors bands, so 2 identical bands actually appear as a wide band. For example: wide red, yellow means 220nF = 0.22µF.

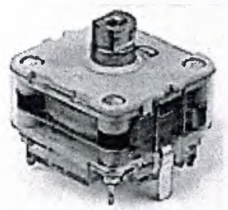
Figure 1.9 Circuit symbol & examples of the unpolarized capacitor.

3. Variable capacitor

Variable capacitors are mostly used in radio tuning circuits and they are sometimes called 'tuning capacitors'. They have very small capacitance values, typically between 100pF and 500pF (100pF = 0.0001µF). The type illustrated usually has trimmers built in (for making small adjustments - see below) as well as the main variable capacitor. Many variable capacitors have very short spindles which are not suitable for the standard knobs used for variable resistors and rotary switches. It would be wise to check that a suitable knob is available before ordering a variable capacitor. Variable capacitors are not normally used in timing circuits because their capacitance is too small to be practical and the range of values available is very limited. Instead timing circuits use a fixed capacitor and a variable resistor if it is necessary to vary the time period.

Trimmer capacitors: Trimmer capacitors (trimmers) are miniature variable capacitors. They are designed to be mounted directly onto the circuit board and adjusted only when the circuit is built. A small screwdriver or similar tool is required to adjust trimmers.
Trimmer capacitors are only available with very small capacitances, normally less than 100pF. It is impossible to reduce their capacitance to zero. Trimmers are the capacitor equivalent of presents which are miniature variable resistors.

Variable Capacitor Symbol



Variable Capacitor

Figure 1.10 Variable capacitors symbol & a variable capacitor.

1.2.3 Semiconductors

Semiconductors have a large amount of types. Transistors have three lead-out wires are called the base, emitter and conductor. It is essential that these are connected correctly, as there is no chance of project working if they are not. Fortunately modern transistors are not easily damaged, and incorrect connection is not likely to damage a device (or other components in the circuit) only one type is used in this project. One extremely important area of semiconductor technology is the field of telecommunications. The new "Information Super Highway" requires technology which can transmit and receive information at high rates. One approach which is already being applied to this area is optoelectronics or the use of light to transmit information. Electrons are used to transfer information within computers, but most information sent over long distances uses light pulses traveling through fiber optic cables. The laser diodes which create these pulses and semiconductor receivers that detect the pulses are areas of intensive research.

1.2.3.1 Diodes

An electronic device that restricts current flow chiefly to one direction. It is made of two different types of semiconductors exactly next to each other. We can just think of an ideal diode has two regions, a conduction region of zero resistance and an infinite resistance non-conduction region. For many circuit applications, the behavior of a (junction) diode depends on its polarity in the circuit. If the diode is reverse biased (positive potential on N-type material) the current through the diode is very small. The following figure is shown the characteristic of diode.

Figure 1.11 Diode.

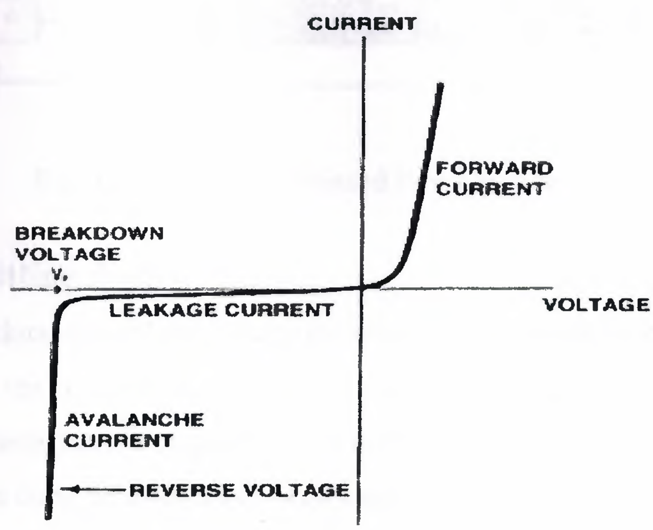


Figure 1.12 diode characteristic

Forward Biased P-N Junction: forward biasing the p-n junction drives holes to the junction from the p-type material and electrons to the junction from the n-type material. At the junction the electrons and holes combine so that a continuous current can be maintained.

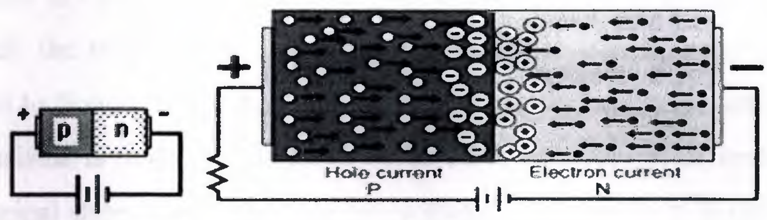


Figure 1.13 Forward Biased P-N Junction

Reverse Biased P-N Junction: the application of a reverse voltage to the p-n junction will cause a transient current to flow as both electrons and holes are pulled away from the junction. When the potential formed by the widened depletion layer equals the applied voltage, the current will cease except for the small thermal current.

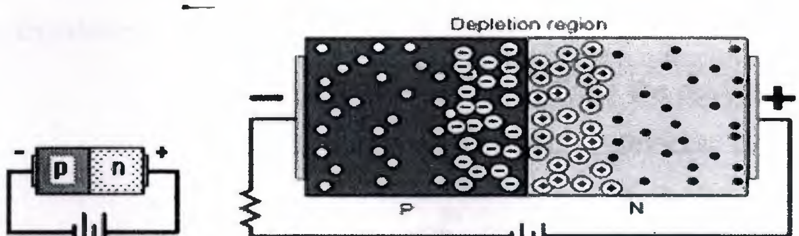


Figure 1.14 Reverse Biased P-N Junction

1.2.3.1.1 Light emitting diode

Some semiconductor junctions, composed of special chemical combinations, emit radiant energy within the spectrum of visible light as the electrons transition in energy levels. Simply put, these junctions glow when forward biased. A diode intentionally designed to glow like a lamp is called a light-emitting diode, or LED.

voltage, a series-connected "dropping" resistor must be included to prevent full source voltage from damaging the LED.

1.2.3.2 Transistors

a transistor is a device used to amplify voltage or current or sometimes function as an on/off switch. the transistor acts as a simple electronic switch, either preventing or allowing current to flow through. And it is made up of simiconductors material the active part of the transistor is made of silicon or some other semiconductor material that can change its electrical state when pulsed. When voltage is applied to it, it changes its state to the opposite. The triggering line, and the source and drain are the two end points.

A Bipolar Transistor essentially consists of a pair of PN Junction Diodes that are joined back-to-back. This forms a sort of a sandwich where one kind of semiconductor is placed in-between two others. There are therefore two kinds of bipolar sandwich, the NPN and PNP varieties. The three layers of the sandwich are conventionally called the Collector, Base, and Emitter. The reasons for these names will become clear later once we see how the transistor works. As shown in the figure 1.16 there are two symbol of type of bipolar transistors.

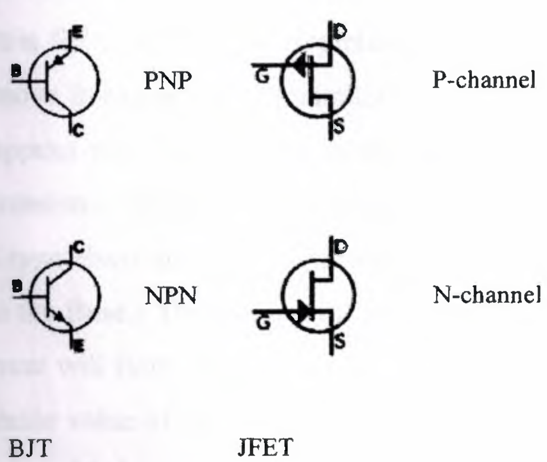


Figure 1.16 Symbol of NPN and PNP transistors.

Some of the basic properties exhibited by a Bipolar Transistor are immediately recognizable as being diode-like. However, when the 'filling' of the sandwich is fairly thin some interesting effects become possible that allow us to use the Transistor as an amplifier or a switch. To see how the Bipolar Transistor works we can concentrate on the NPN variety. The figure 1.17 shows the energy levels in an NPN transistor.

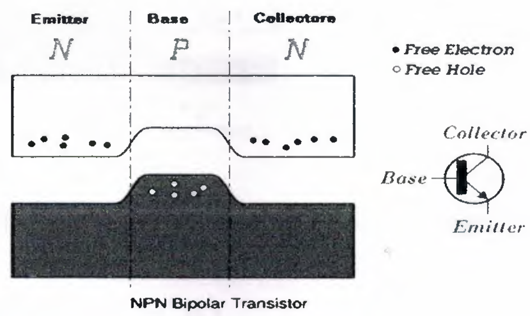


Figure 1.17 The energy levels in an NPN transistor.

Figure 1.17 shows the energy levels in an NPN transistor when we aren't externally applying any voltages. We can see that the arrangement looks like a back-to-back pair of PN Diode junctions with a thin P-type filling between two N-type slices of 'bread'. In each of the N-type layers conduction can take place by the free movement of electrons in the conduction band. In the P-type (filling) layer conduction can take place by the movement of the free holes in the valence band. However, in the absence of any externally applied electric field, we find that depletion zones form at both PN-Junctions, so no charge wants to move from one layer to another.

Consider now what happens when we apply a moderate voltage between the Collector and Base parts of the transistor. The polarity of the applied voltage is chosen to increase the force pulling the N-type electrons and P-type holes apart. (I.e. we make the Collector positive with respect to the Base.) This widens the depletion zone between the Collector and base and so no current will flow. In effect we have reverse-biased the Base-Collector diode junction. The precise value of the Base-Collector voltage we choose doesn't really matter to what happens provided we don't make it too big and blow up the transistor! So for the sake of example we can imagine applying a 10 Volt Base-Collector voltage. As shown in the figure 1.18 the applying collector-base voltage. [5]

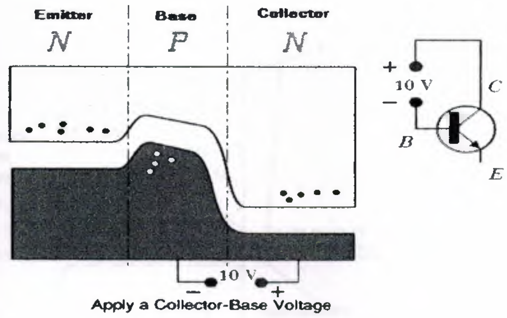


Figure 1.18 The applying collector-base voltage.

1.2.3.3 Silicon Control Rectifier (SCR)

The Silicon Controlled Rectifier (SCR) is four layer devices with three internal junctions and the device has three terminals anode A, cathode cathode K, and gate G. and it is a conventional rectifier controlled by a gate signal. The main circuit is a rectifier; however the application of a forward voltage is not enough for conduction. A gate signal controls the rectifier conduction. The schematic representation is:

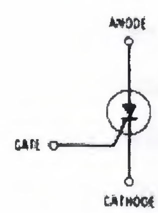


Figure 1.19 SCR

The rectifier circuit (anode-cathode) has a low forward resistance and a high reverse resistance. It is controlled from an off state (high resistance) to the on state (low resistance) by a signal applied to the third terminal, the gate. Once it is turned on it remains on even after removal of the gate signal, as long as a minimum current, the holding current, I_H, is maintained in the main or rectifier circuit. To turn off an SCR the anode-cathode current must be reduced to less than the holding current, I_H. The characteristic curve is as shown below.

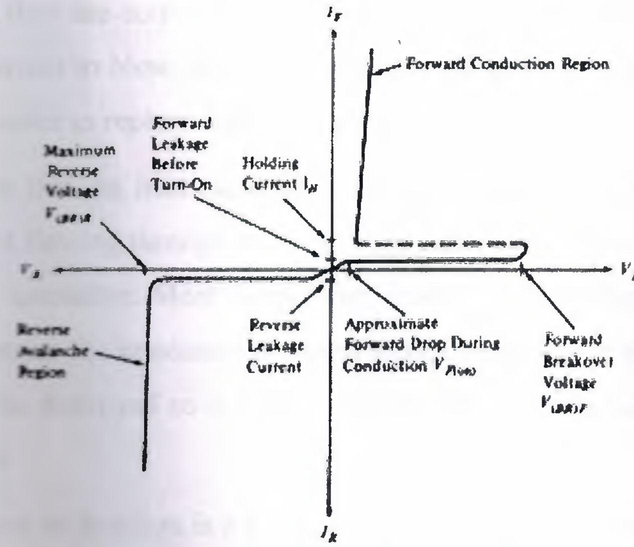


Figure 1.20 SCR characteristics

Notice the reverse characteristics are the same as discussed previously for the rectifier or diode, having a break over voltage with its attending avalanche current; and a leakage current for voltages less than the break over voltage. However, in the forward direction with open gate, the SCR remains essentially in an off condition (notice though that there is a small forward leakage) up until the forward break over voltage is reached. At that point the curve snaps back to a typical forward rectifier characteristic. The application of a small forward gate voltage switches the SCR onto its standard diode forward characteristic for voltages less than the forward break over voltage.

Obviously, the SCR can also be switched by exceeding the forward break over voltage, however this is usually considered a design limitation and switching is normally controlled with a gate voltage. One serious limitation of the SCR is the rate of rise of voltage with respect to time, dv/dt. A large rate of rise of circuit voltage can trigger an SCR into conduction. This is a circuit design concern. Most SCR applications are in power switching, phase control, chopper, and inverter circuits.

1.2.4.1 Fuses

The main job of the fuse is to protect the wiring Fuses should be sized and located to protect the wire they are connected to. So if there is a high current appeared suddenly draws enough current to blow the fuse. The fuse will be there to protect the wire, which would be much easier to replace than the device.

And as we know that the heat build-up in the wire depends on the resistance and the amount of current flowing through the wire. Fuses are really just a special type of wire in a self-contained connector. Most fuses today have two blade connectors and a plastic housing that contains the conductor so when a high current or if the heat went high this connection will be destroyed so it will not again so the circuit will be opened in I twill protect the device

A consumer unit or fuse box is a particular type of distribution board comprising a co-ordinate assembly for the control and distribution of electrical energy, principally in domestic premises. A consumer unit incorporates a manual means of isolation on the incoming circuit(s) - a main switch, and an assembly of one or more fuses, circuit-breakers or residual current devices.

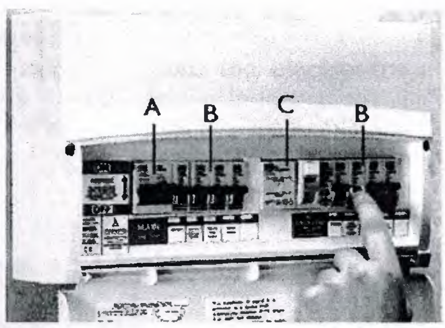


Figure 1.5 Fuse box

A = Main switch B = Circuit breakers C = Residual current device

CHAPTER TWO
TECHNICAL ON LIGHT

2.1 Overview

In this chapter a discription about light,what is light,how to produce a photon, frequinces, colors, making of colors and behavior of the light when it hits an object will be discribed briefly.

2.2 Introduction

We see things every day, from the moment we get up in the morning until we go to sleep at night. We look at everything around us using light. We appreciate kids' crayon drawings, fine oil paintings, swirling computer graphics, gorgeous sunsets, a blue sky, shooting stars and rainbows. We rely on mirrors to make ourselves presentable, and sparkling gemstones to show affection. But did you ever stop to think that when we see any of these things, we are not directly connected to it? We are, in fact, seeing light -- light that somehow left objects far or near and reached our eyes. Light is all our eyes can really see.

The other way that we encounter light is in devices that produce light –incandescent bulbs, fluorescent bulbs, laser, lightning bugs, the sun. Each one uses a different technique to generate photons.

In this article, we will look at light from many different angles to show you exactly how it works!

2.3 Ways of thinking about light

You have probably heard two different ways of talking about light:

There is the "particle" theory, expressed in part by the word photon. There is the "wave" theory, expressed by the term light wave. From the time of the ancient Greeks, people have thought of light as a stream of tiny particles. After all, light travels in straight lines and bounces off a mirror much like a ball bouncing off a wall. No one had actually seen particles of light, but even now it's easy to explain why that might be. The particles could be too small, or moving too fast, to be seen, or perhaps our eyes see right through them.

The idea of the light wave came from Christian Huygens, who proposed in the late 1600s that light acted like a wave instead of a stream of particles. In 1807, Thomas Young backed up Huygens' theory by showing that when light passes through a very narrow opening, it can spread out, and interfere with light passing through another opening. Young shined a light through a very narrow slit. What he saw was a bright bar of light that corresponded to the slit. But that was not all he saw. Young also perceived additional light, not as bright, in the areas around the bar. If light were a stream of particles, this additional light would not have been there. This experiment suggested that light spread out like a wave. In fact, a beam of light radiates outward at all times.

Albert Einstein advanced the theory of light further in 1905. Einstein considered the photoelectric effect, in which ultraviolet light hits a surface and causes electrons to be emitted from the surface. Einstein's explanation for this was that light was made up of a stream of energy packets called photons.

Modern physicists believe that light can behave as both a particle and a wave, but they also recognize that either view is a simple explanation for something more complex. In this article, we will talk about light as waves, because this provides the best explanation for most of the phenomena our eyes can see.

2.4 What is Light?

Why is it that a beam of light radiates outward, as Young proved? What is really going on? To understand light waves, it helps to start by discussing a more familiar kind of wave -- the one we see in the water. One key point to keep in mind about the water wave is that it is not made up of water: The wave is made up of energy traveling through the water. If a wave moves across a pool from left to right, this does not mean that the water on the left side of the pool is moving to the right side of the pool. The water has actually stayed about where it was. It is the wave that has moved. When you move your hand through a filled bathtub, you make a wave, because you are putting your energy into the water. The energy travels through the water in the form of the wave. All waves are traveling energy, and they are usually moving through some medium, such as water. You can see a diagram of a water wave in Figure 2.1. A water wave consists of water molecules that vibrate up and down at right angles to the direction of motion of the wave. This type of wave is called a transverse wave.

Light waves are a little more complicated, and they do not need a medium to travel through. They can travel through a vacuum. A light wave consists of energy in the form of electric and magnetic fields. The fields vibrate at right angles to the direction of movement of the wave, and at right angles to each other. Because light has both electric and magnetic fields, it is also referred to as electromagnetic radiation

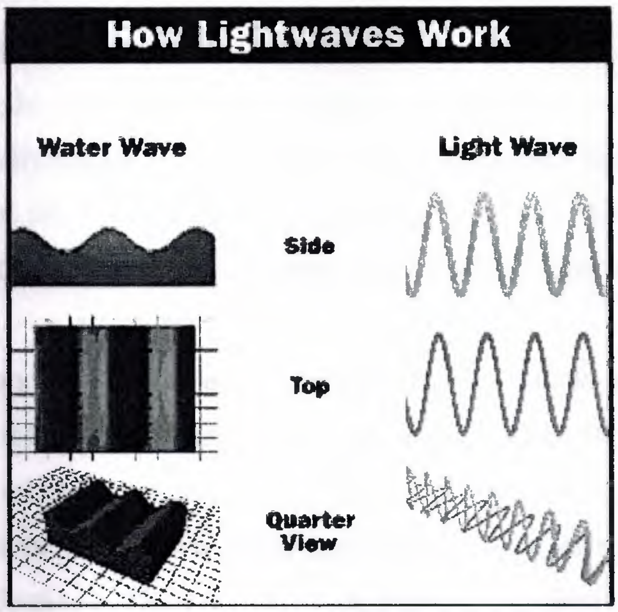


Figure 2.1 How lightwavwes work.

Light waves come in many sizes. The size of a wave is measured as its wavelength, which is the distance between any two corresponding points on successive waves, usually peak-to-peak or trough-to-trough (Figure 2.1). The wavelengths of the light we can see range from 400 to 700 billionths of a meter. But the full range of wavelengths included in the definition of electromagnetic radiation extends from one billionth of a meter, as in gamma rays, to centimeters and meters, as in radio waves. Light is one small part of the spectrum.

2.5 Frequencies

Light waves also come in many frequencies. The frequency is the number of waves that pass a point in space during any time interval, usually one second. It is measured in units of cycles (waves) per second, or Hertz (Hz). The frequency of visible light is referred to as color, and ranges from 430 trillion Hz, seen as red, to 750 trillion Hz, seen as violet. Again, the full range of frequencies extends beyond the visible spectrum, from less than one billion Hz, as in radio waves, to greater than 3 billion billion Hz, as in gamma rays.

As noted above, light waves are waves of energy. The amount of energy in a light wave is proportionally related to its frequency: High frequency light has high energy; low frequency light has low energy. Thus gamma rays have the most energy, and radio waves have the least. Of visible light, violet has the most energy and red the least.

Light not only vibrates at different frequencies, it also travels at different speeds. Light waves move through a vacuum at their maximum speed, 300,000 kilometers per second or 186,000 miles per second, which makes light the fastest phenomenon in the universe. Light waves slow down when they travel inside substances, such as air, water, glass or a diamond. The way different substances affect the speed at which light travels is key to understanding the bending of light, or refraction, which we will discuss later.

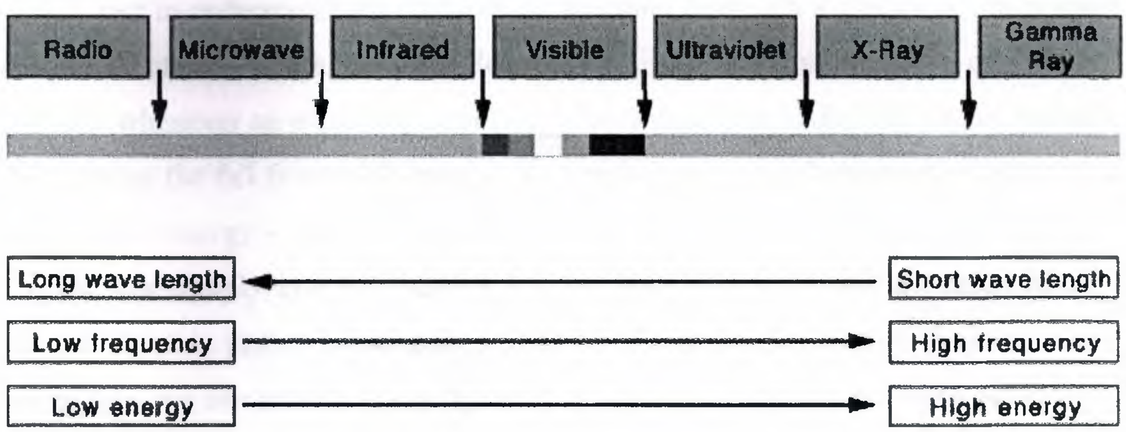


Figure 2.2 Electromagnatic spectrum.

So light waves come in a continuous variety of sizes, frequencies and energies. We refer to this continuum as the electromagnetic spectrum (Figure 2.2). Figure 2.2 is not drawn to scale, in that visible light occupies only one-thousandth of a percent of the spectrum.

2.6 Producing a photon

Any light that you see is made up of a collection of one or more photons propagating through space as electromagnetic waves. In total darkness, our eyes are actually able to sense single photons, but generally what we see in our daily lives comes to us in the form of zillions of photons produced by light sources and reflected off objects. If you look around you right now, there is probably a light source in the room producing photons, and objects in the room that reflect those photons. Your eyes absorb some of the photons flowing through the room, and that is how you see.

There are many different ways to produce photons, but all of them use the same mechanism inside an atom to do it. This mechanism involves the energizing of electrons orbiting each atom's nucleus. How nuclear radiatio works describes protons, neutrons and electrons in some detail. For example, hydrogen atoms have one electron orbiting the nucleus. Helium atoms have two electrons orbiting the nucleus. Aluminum atoms have 13 electrons orbiting the nucleus. Each atom has a preferred number of electrons orbiting its nucleus. Electrons circle the nucleus in fixed orbits -- a simplified way to think about it is to imagine how satellites orbit the Earth. There's a huge amount of theory around electron orbitals, but to understand light there is just one key fact to understand: An electron has a natural orbit that it occupies, but if you energize an atom you can move its electrons to higher orbitals. A photon of light is produced whenever an electron in a higher-than-normal orbit falls back to its normal orbit. During the fall from high-energy to normal-energy, the electron emits a photon -- a packet of energy -- with very specific characteristics. The photon has a frequency, or color, that exactly matches the distance the electron falls. There are cases where you can see this phenomenon quite clearly. For example, in lots of factories and parking lots you see sodium vapor lights. You can tell a sodium vapor light because it is very yellow when you look at it. A sodium vapor light energizes sodium atoms to generate photons. A sodium atom has 11 electrons, and because of the way they are stacked in orbitals one of those electrons is most likely to accept and emit energy (this electron is called the 3s electron) The energy packets that this electron is most likely to emit fall right around a wavelength of 590 nanometers. This wavelength corresponds to yellow light. If you run sodium light through a prism, you do not see a rainbow -- you see a pair of yellow lines.

2.7 Bring on the heat

Probably the most common way to energize atoms is with heat, and this is the basis of incandescence. If you heat up a horseshoe with a blowtorch, it will eventually get red hot, and if you heat it enough it gets white hot. Red is the lowest-energy visible light, so in a red-hot object the atoms are just getting enough energy to begin emitting light that we can see. Once you apply enough heat to cause white light, you are energizing so many different electrons in so many different ways that all of the colors are being generated, they all mix together to look white, as explained in one of the sections below.

Heat is the most common way we see light being generated, a normal 75-watt incandescent bulb is generating light by using electricity to create heat. However, there are lots of other ways to generate light, some of which are listed below:

Halogen lamps - Halogen lamps use electricity to generate heat, but benefit from a technique that lets the filament run hotter.

Gas lanterns :- Uses as fuel like natural gas or kerosene as the source of heat.

Fluorescent lights :- Use electricity to directly energize atoms rather than requiring heat.

Lasers :- Use energy to "pump" a lasing medium, and all of the energized atoms are made to dump their energy at the exact same wavelength and phase.

Glow-in-the-dark toys - In a Glow-in-the-dark toys, the electrons are energized but fall back to lower-energy orbitals over a long period of time, so the toy can glow for half an hour.

Indiglo watches - In Indiglo watches, voltage energizes phosphor atoms.

Chemical light sticks - A chemical light stick and, for that matter, fireflies, use a chemical reaction to energize atoms.

The thing to note from this list is that anything that produces light does it by energizing atoms in some way.

2.8 Making colors

Visible light is light that can be perceived by the human eye. When you look at the visible light of the sun, it appears to be colorless, which we call white. And although we can see this light, white is not considered to be part of the visible spectrum (Figure 2.2). This is because white light is not the light of a single color, or frequency. Instead, it is made up of many color frequencies. When sunlight passes through a glass of water to land on a wall, we see a rainbow on the wall. This would not happen unless white light were a mixture of all of the colors of the visible spectrum. Isaac Newton was the first person to demonstrate this. Newton passed sunlight through a glass prism to separate the colors into a rainbow spectrum. He then passed sunlight through a second glass prism and combined the two rainbows. The combination produced white light. This proved conclusively that white light is a mixture of colors, or a mixture of light of different frequencies. The combination of every color in the visible spectrum produces a light that is colorless, or white.

Colors by Addition - You can do a similar experiment with three flashlights and three different colors of cellophane -- red, green and blue (commonly referred to as RGB). Cover one flashlight with one to two layers of red cellophane and fasten the cellophane with a rubber band (do not use too many layers or you will block the light from the flashlight). Cover another flashlight with blue cellophane and a third flashlight with green cellophane. Go into a darkened room, turn the flashlights on and shine them against a wall so that the beams overlap, as shown in Figure 2.3. Where red and blue light overlap, you will see magenta. Where red and green light overlap, you will see yellow. Where green and blue light overlap, you will see cyan. You will notice that white light can be made by various combinations, such as yellow with blue, magenta with green, cyan with red, and by mixing all of the colors together.

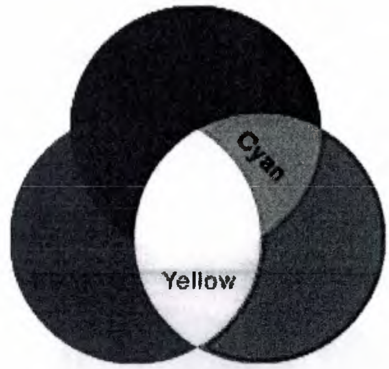


Figure 2.3 Mixing red,green and blue colors.

By adding various combinations of red, green and blue light, you can make all the colors of the visible spectrum. This is how computer monitors (RGB monitors) produce colors.

Colors by Subtraction :- Another way to make colors is to absorb some of the frequencies of light, and thus remove them from the white light combination. The absorbed colors are the ones you will not see, you see only the colors that come bouncing back to your eye. This is what happens with paints and dyes. The paint or dye molecules absorb specific frequencies and bounce back, or reflect, other frequencies to your eye. The reflected frequency (or frequencies) are what you see as the color of the object. For example, the leaves of green plants contain a pigment called chlorophyll, which absorbs the blue and red colors of the spectrum and reflects the green.

Here is an absorption experiment that any one can try at home: Taking a banana and the blue cellophane-covered flashlight made earlier. Going into a dark room, and shine the blue light on the banana. What color do you think it should be? What color is it? If you shine blue light on a yellow banana, the yellow should absorb the blue frequency; and, because the room is dark, there is no yellow light reflected back to your eye. Therefore, the banana appears black.

So, if you had three paints or pigments in magenta, cyan and yellow and you drew three overlapping circles with those colors, as shown in Figure 2.4, you would see that where you have combined magenta with yellow, the result is red. Mixing cyan with yellow produces green and mixing cyan with magenta creates blue. Black is the special case in which all of the colors are absorbed. You can make black by combining yellow with blue, cyan with red or magenta with green. These particular combinations ensure that no frequencies of visible light can bounce back to your eyes.

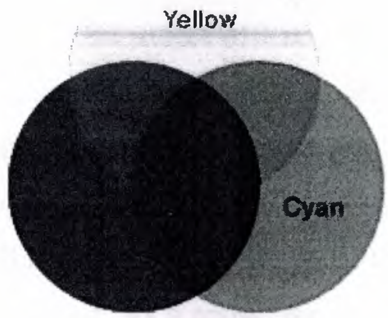


Fig. 2.4 Mixing magenta,cyan and yellow colors.

But the color scheme demonstrated in Figure 2.4 appears to go against what your art teacher told you about mixing colors, right? If you mix yellow and blue crayons, you get green, not black. This is because artificial pigments, such as crayons, are not perfect absorbers -- they do not absorb all colors except one. A "yellow" crayon can absorb blue and violet while reflecting red, orange and green. A "blue" crayon can absorb red, orange and yellow while reflecting blue, violet and green. So when you combine the two crayons, all of the colors are absorbed except for green. Therefore, you see the mixture as green, instead of the black demonstrated in Figure 2.4.

So there are two basic ways by which we can see colors. Either an object can directly emit light waves in the frequency of the observed color, or an object can absorb all other frequencies, reflecting back to your eye only the light wave, or combination of light waves, that appears as the observed color. For example, to see a yellow object, either the object is directly emitting light waves in the yellow frequency, or it is absorbing the blue part of the spectrum and reflecting the red and green parts back to your eye, which perceives the combined frequencies as yellow.

2.9 When light hits an object

When a light wave hits an object, what happens to it depends on the energy of the light wave, the natural frequency at which electrons vibrate in the material and the strength with which the atoms in the material hold on to their electrons. Based on these three factors, four different things can happen when light hits an object:

- The waves can be reflected or scattered off the object.
- The waves can be absorbed by the object.
- The waves can be refracted through the object.
- The waves can pass through the object with no effect.
- And more than one of these possibilities can happen at once.

Transmission - If the frequency or energy of the incoming light wave is much higher or much lower than the frequency needed to make the electrons in the material vibrate, then the electrons will not capture the energy of the light, and the wave will pass through the material unchanged. As a result, the material will be transparent to that frequency of light.

Most materials are transparent to some frequencies, but not to others. For example, high frequency light, such as gamma rays and X-rays, will pass through ordinary glass, but lower frequency ultraviolet and infrared light will not.

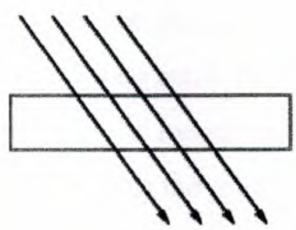


Figure 2.5 The waves pass through the object with no effect.

2.9.1 Absorption

In absorption, the frequency of the incoming light wave is at or near the vibration frequency of the electrons in the material. The electrons take in the energy of the light wave and start to vibrate. What happens next depends upon how tightly the atoms hold on to their electrons. Absorption occurs when the electrons are held tightly, and they pass the vibrations along to the nuclei of the atoms. This makes the atoms speed up, collide with other atoms in the material, and then give up as heat the energy they acquired from the vibrations. The absorption of light makes an object dark or opaque to the frequency of the incoming wave. Wood is opaque to visible light. Some materials are opaque to some frequencies of light, but transparent to others. Glass is opaque to ultraviolet light, but transparent to visible light.

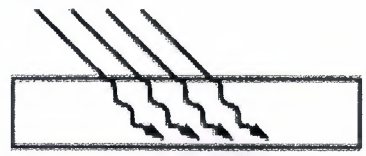


Figure 2.6 The waves absorbed by the object.

2.9.2 Reflection

The atoms in some materials hold on to their electrons loosely. In other words, the materials contain many free electrons that can jump readily from one atom to another within the material. When the electrons in this type of material absorb energy from an incoming light wave, they do not pass that energy on to other atoms. The energized electrons merely vibrate and then send the energy back out of the object as a light wave with the same frequency as the incoming wave. The overall effect is that the light wave does not penetrate deeply into the material.

In most metals, electrons are held loosely, and are free to move around, so these metals reflect visible light and appear to be shiny. The electrons in glass have some freedom, though not as much as in metals. To a lesser degree, glass reflects light and appears to be shiny, as well. A reflected wave always comes off the surface of a material at an angle equal to the angle at which the incoming wave hit the surface. In physics, this is called the Law of Reflectance. You have probably heard the Law of Reflectance stated as "the angle of incidence equals the angle of reflection."

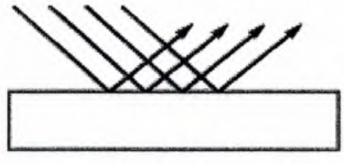


Figure 2.7 The waves reflected by the object.

You can see for yourself that reflected light has the same frequency as the incoming wave. Just look at yourself in a mirror. The colors you see in the mirror's image are the same as those you see when you look down at yourself. The colors of your shirt and hair are the same as reflected in the mirror as they are on you. If this were not true, we would have to rely entirely on other people to tell us what we look like!

2.9.3 Scattering

Scattering is merely reflection off a rough surface. Incoming light waves get reflected at all sorts of angles, because the surface is uneven. The surface of paper is a good example. You can see just how rough it is if you look at it under a microscope. When light hits paper, the waves are reflected in all directions. This is what makes paper so incredibly useful -- you can read the words on a printed page regardless of the angle at which your eyes view the surface.

Another interesting rough surface is Earth's atmosphere. You probably don't think of the atmosphere as a surface, but it nonetheless is "rough" to incoming white light. The atmosphere contains molecules of many different sizes, including nitrogen, oxygen, water vapor and various pollutants. This assortment scatters the higher energy light waves, the ones we see as blue light. This is why the sky looks blue.

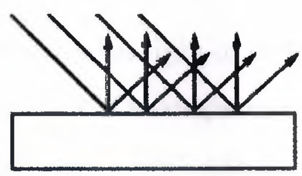


Figure 2.8 The waves can be scattered off the object.

2.9.4 Refraction

Refraction occurs when the energy of an incoming light wave matches the natural vibration frequency of the electrons in a material. The light wave penetrates deeply into the material, and causes small vibrations in the electrons. The electrons pass these vibrations on to the atoms in the material, and they send out light waves of the same frequency as the incoming wave. But this all takes time. The part of the wave inside the material slows down, while the part of the wave outside the object maintains its original frequency. This has the effect of bending the portion of the wave inside the object toward what is called the normal line, an imaginary straight line that runs perpendicular to the surface of the object. The deviation from the normal line of the light inside the object will be less than the deviation of the light before it entered the object. The amount of bending, or angle of refraction, of the light wave depends on how much the material slows down the light. Diamonds would not be so glittery if they did not slow down incoming light much more than, say, water does. Diamonds have a higher index of refraction than water, which is to say that they slow down light to a greater degree.

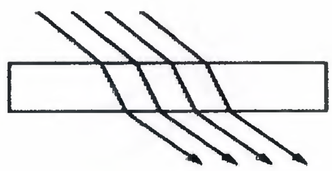


Figure 2.9 The waves refracted through the object.

One interesting note about refraction is that light of different frequencies, or energies, will bend at slightly different angles. Let's compare violet light and red light when they enter a glass prism. Because violet light has more energy, it takes longer to interact with the glass. As such, it is slowed down to a greater extent than a wave of red light, and will be bent to a greater degree. This accounts for the order of the colors that we see in a rainbow. It is also what gives a diamond the rainbow fringes that make it so pleasing to the eye.

When two incoming light waves of the same frequency strike a thin film of soap, as seen in Figure below, parts of the light waves are reflected from the top surface, while other parts of the light pass through the film and are reflected from the bottom surface. Because the parts of the waves that penetrate the film interact with the film longer, they get knocked out of sync with the parts of the waves reflected by the top surface. Physicists refer to this state as being out of phase. When the two sets of waves strike the photoreceptors in your eyes, they interfere with each other; interference occurs when waves add together or subtract from each other and so form a new wave of a different frequency, or color.

Basically, when white light, which is a mixture of different colors, shines on a film with two reflective surfaces, the various reflected waves interfere with each other to form rainbow fringes. The fringes change colors when you change the angle at which you look at the film, because you are changing the path by which the light must travel to reach your eye. If you decrease the angle at which you look at the film, you increase the amount of film the light must travel through for you to see it. This causes greater interference.

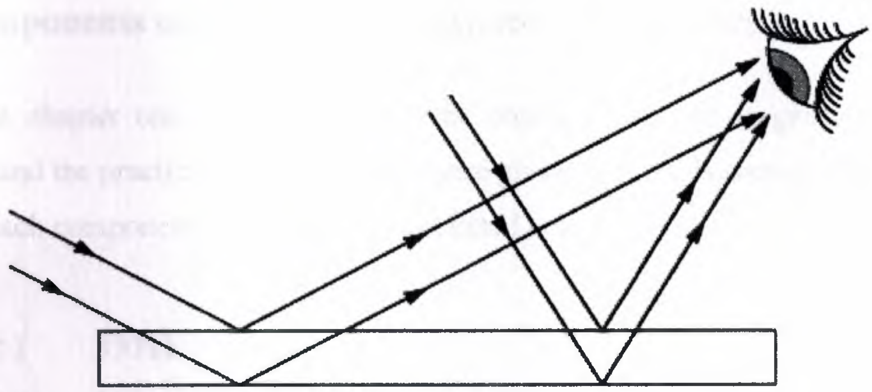


Figure 2.10 The angle of looking to an object change the color.

Everything we see is a product of, and is affected by, the nature of light. Light is a form of energy that travels in waves. Our eyes are attuned only to those wave frequencies that we call visible light. Intricacies in the wave nature of light explain the origin of color, how light travels, and what happens to light when it encounters different kinds of materials.

2.10 Summary

In this chapter a discription about light,what is light,how to produce a photon, frequinces, colors, making of colors and behavior of the light when it hits an object discribed briefly.

CHAPTER THREE
HARDWARE APPROACH

3.1 Overview

This chapter will present detailed technical information about this light operated SCR switches. Also it will include the components of this project and explanation of most important ones, in addition to some applications of this kind of switches in general.

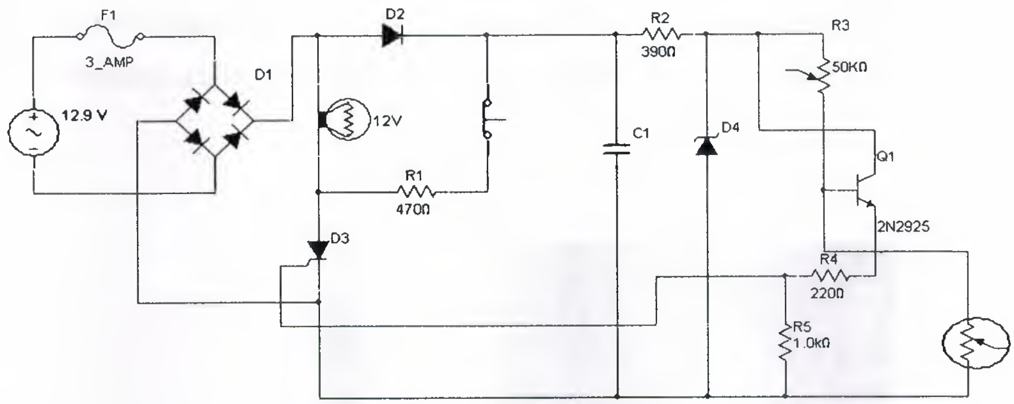
3.2 Components of project (light operated SCR switches.)

In chapter one, a description of the components used in general hardware projects and the practical use of each one were given, but in this section, the value and type of each component used in this circuit listed below

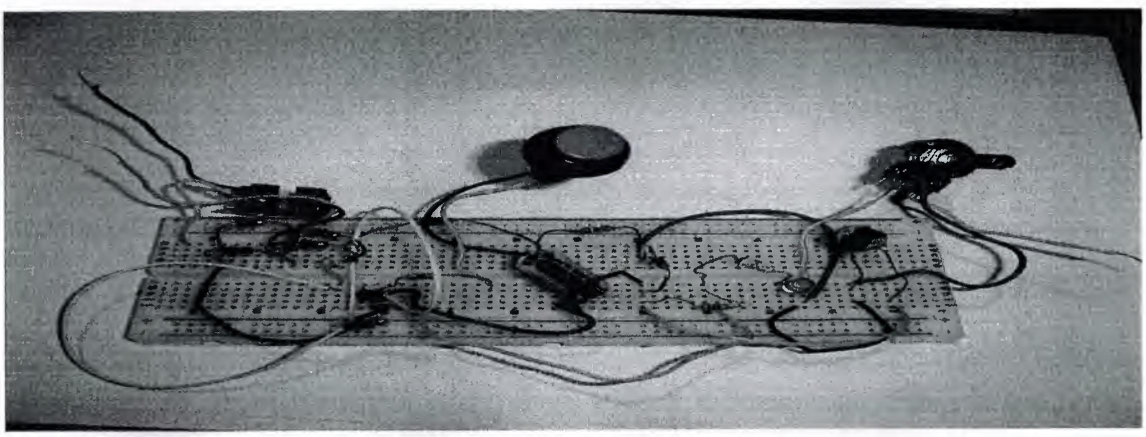
- R 1 370 Ω
- R 2 390 Ω
- R 3 50 KΩ (Variable Resistor)
- R 4 220 KΩ
- R 5 1 KΩ
- LDR Photo resistor
- Q 1 Transistor (BC 107B)
- D[1,2] Diode
- D3 Thyristor (SCR)
- D4 Zener diode
- C1 Capacitor (1000μF)
- L1 lump (12V)
- F1 Fuse (3A)
- PS Power Supply

3.3 light operated SCR switches

These tow circuit's shows e practical and the diagram of light operated SCR switches circuits and description of most important components of it.



(a)



(b)

Figure 3.1 Circuit of light operated SCR switches (diagram and practical)

The circuit shown above has two important components one of them is the photo resistor which is the input device of the circuit that receive the light and the other one is the SCR which is the output of the circuit that used to switch the circuit which will operate the light.

• Photocell

A photocell is a type of resistor. When light strikes the cell, it allows current to flow more freely. When dark, its resistance increases dramatically. Photocells need some calibration to be responsive in the exact lighting scenario you have. They can be used to detect large or small fluctuations in light levels to distinguish between one light bulb and two, direct sunlight and total darkness, or anything in between. Each scenario requires a slightly different voltage divider setup, which we'll get into below.

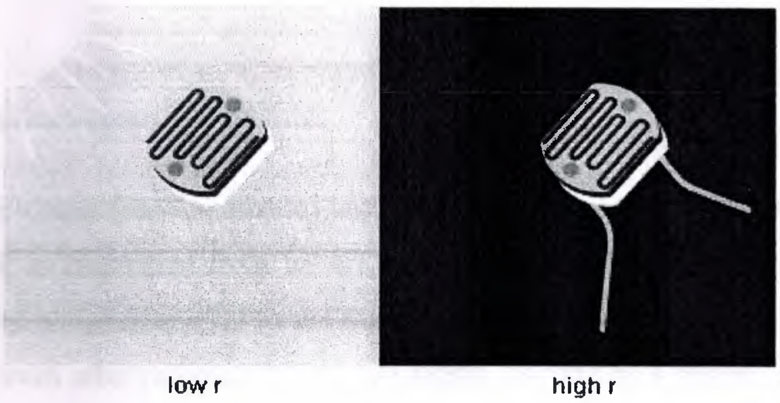


Figure 3.2 Concept diagram.

Circuit diagram: You can see in the circuit below that the as the resistance of the photo resistor reduces (as a result of more light reaching it) the voltage on Ain will go up towards 5V. If the resistance of the photo resistor increases (as a result of less light reaching it) the voltage on Ain will fall towards Gnd (0V).

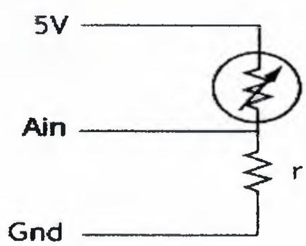


Figure 3.3 Circuit diagramsas

• SCR

The Silicon Controlled Rectifier (SCR) is simply a conventional rectifier controlled by a gate signal. The main circuit is a rectifier; however the application of a forward voltage is not enough for conduction. A gate signal controls the rectifier conduction. The schematic representation in figure 3.4 below:

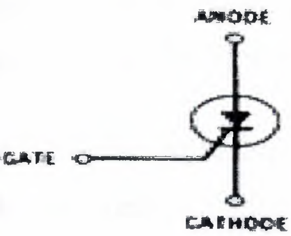


Figure 3.4 silicon controlled rectifier

The rectifier circuit (anode-cathode) has a low forward resistance and a high reverse resistance. It is controlled from an off state (high resistance) to the on state (low resistance) by a signal applied to the third terminal, the gate. Once it is turned on it remains on even after removal of the gate signal, as long as a minimum current, the holding current, is maintained in the main or rectifier circuit. To turn off an SCR the anode-cathode current must be reduced to less than the holding current, The characteristic curve is as shown below in figure 3.5.

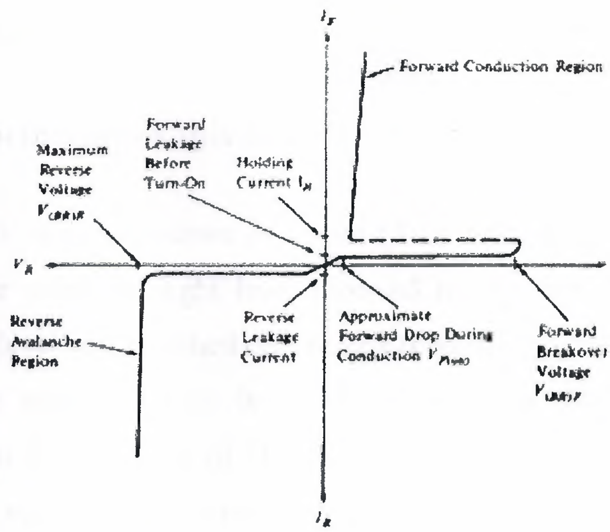


Figure 3.5 characteristic of the SCR with gate open

The reverse characteristics are the same as discussed previously for the rectifier or diode, having a breakover voltage with its attending avalanche current; and a leakage current for voltages less than the breakover voltage. in the forward direction with open gate, the SCR remains essentially in an off condition (notice though that there is a small forward leakage) up until the forward breakover voltage is reached. At that point the curve snaps back to a typical forward rectifier characteristic. The application of a small forward gate voltage switches the SCR onto its standard diode forward characteristic for voltages less than the forward breakover voltage.

The SCR can also be switched by exceeding the forward breakover voltage, however this is usually considered a design limitation and switching is normally controlled with a gate voltage. One serious limitation of the SCR is the rate of rise of voltage with respect to time, dV/dt. A large rate of rise of circuit voltage can trigger an SCR into conduction. This is a circuit design concern. Most SCR applications are in power switching, phase control, chopper, and inverter circuits.

Major considerations when ordering a SCR are:
(a) Peak forward and reverse breakdown voltages.
(b) Maximum forward current.
(c) Gate triggers voltage and current.
(d) Minimum holding current.
(e) Power dissipation.
(f) Maximum dV/dt.

3.4 Working principle of this circuit

The circuit diagram shown in figure (3.1) is for a switch of the type that activates thyristor when the light level received by the light sensor rises above a certain threshold level and switched off because there is no received gate current from the emitter again when the light level falls back below the threshold level. The thyristor is driven from emitter of Q1, and the thyristor will be activated if Q1 is switched on by a suitable base current and voltage. The voltage and current available as the base of Q1 is dependent on two main factors, the resistance provided by PCC1, and the setting of VR1. If VR1 is set at maximum value PCC1 needs to have a resistance of about 50 kilo ohm or less in order to bias Q1 conduction and activate the thyristor. In total darkness PCC1 has resistance of 100-kilo ohm or more, but only a very low light level is sufficient to reduce its resistance sufficiently to switch on Q1 and the thyristor.

If VR1 is set for a lower resistance level, PCC1 needs to exhibit a lower resistance in the order to bias Q1 in conduction, and the sensitivity of the circuit is reduced since PCC1 must be subjected to a higher light level in order to produce this lower resistance. If VR1 is steady adjusted lower resistance, the sensitivity of the circuit is progressively reduced. With VR1 at virtually minimum resistance even an extremely high level of light will be insufficient to operate the circuit. Thus VR1 acts as a sensitivity control, and enables the light threshold level to be varied over extremely wide limits.

3.5 Results

The circuit shown in figure 3.1 is actually for a switch of type that activates a thyristor when the light level received by light sensor rises above certain threshold level, and switch off again when the light level falls back below the threshold level.

3.6 Applications

Light operated SCR switches have many applications in many fields it can used in home and industry. One of applications we can see it every day which is illumination of streets.

3.7 Summary

This chapter presented detailed technical information about the light operated SCR switch. Also it has included the components of this project and explanation of Most important ones, in addition to some applications of this kind of switches in general.

CONCLUSION

As the electronic fields are considered as a real revolution in the world, it is obviously seen in this project chapters, that useful light operated SCR switches can be created, to be practical and useful to the people life.

light operated SCR switches is actually a circuit acting as a switch depends on intensity of the light can control thyristor, but since this project is intended for undergraduate electrical and electronic engineering level, the electronic devices that will be controlled via this switch is a simple device, as a simulation for a more complicated system or device. Here the light is driven by a thyristor at the output of the circuit which the thyristor controls turning the light on.

After a great deal of working over this experiment of preparing this project theoretically and practically; it has been found out that too much knowledge gained and too much techniques learned by using simple components were to have a simple and useful light operated SCR switches.

Two important aims accomplished were:

- To modify the original circuit where possible. This aim is accomplished by a simple change which is replaced the thyristor by a relay which will control the light to turn on and the objective of rally that used for high voltage application to control the current.

- To illuminate areas of applications. This aim is accomplished by referring to many references and consulting many people who have technical knowledge about real-life applications as light streets, playing fields to light operated SCR switches.

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