

WORKING OF LCD

Engineering Physics Project 1

Pranav Mayekar

Alston Menezes

Aareen Mhatre

Kiara Mathias

Leon Mendonca

Alyssa Miranda

Sufiyan Mohammed

What is an LCD (Liquid Crystal Display)?

A liquid crystal display or LCD draws its definition from its name itself. It is a combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screens that are generally used in laptop computer screens, TVs, cell phones, and portable video games. LCD's technologies allow displays to be much thinner when compared to a cathode ray tube (CRT) technology.

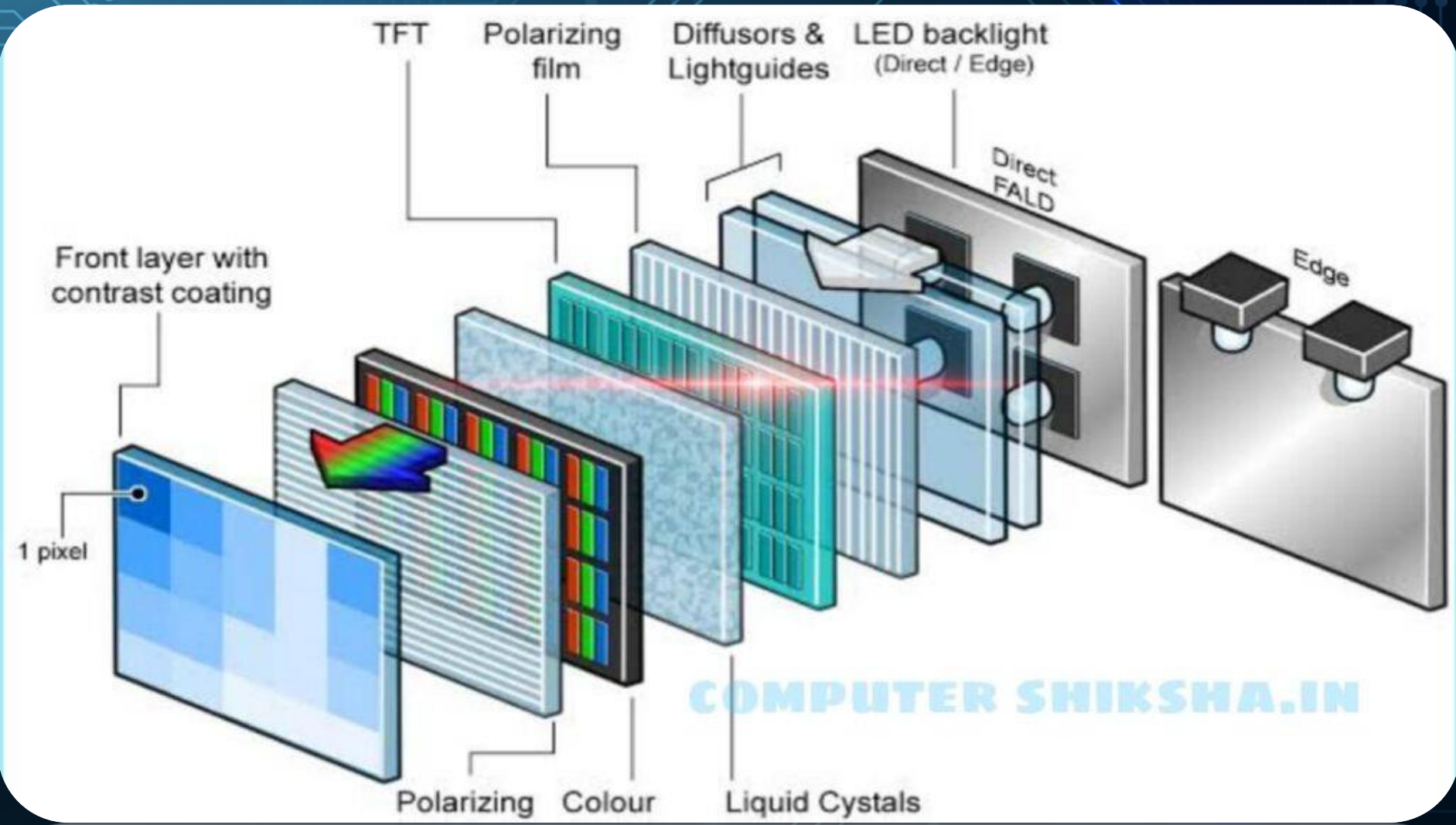
The liquid crystal display screen works on the principle of blocking light rather than emitting light. LCDs require a backlight as they do not emit light themselves. We always use devices which are made up of LCD's displays which are replacing the use of cathode ray tube. Cathode ray tube draws more power compared to LCDs and is also heavier and bigger.

HOW LCD'S ARE CONSTRUCTED?

we need to take two polarized glass pieces filter in the making of the liquid crystal. The glass which does not have a polarized film on the surface of it must be rubbed with a special polymer that will create microscopic grooves on the surface of the polarized glass filter. The grooves must be in the same direction as the polarized film.

Now we have to add a coating of pneumatic liquid phase crystal on one of the polarizing filters of the polarized glass. The microscopic channel causes the first layer molecule to align with filter orientation. When the right angle appears at the first layer piece, we should add a second piece of glass with the polarized film. The first filter will be naturally polarized as the light strikes it at the starting stage.

Thus the light travels through each layer and guided to the next with the help of a molecule. The molecule tends to change its plane of vibration of the light to match its angle. When the light reaches the far end of the liquid crystal substance, it vibrates at the same angle as that of the final layer of the molecule vibrates. The light is allowed to enter into the device only if the second layer of the polarized glass matches with the final layer of the molecule.



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HOW LCDs WORKS?

The principle behind the LCDs is that when an electrical current is applied to the liquid crystal molecule, the molecule tends to untwist. This causes the angle of light which is passing through the molecule of the polarized glass and also causes a change in the angle of the top polarizing filter. As a result, a little light is allowed to pass the polarized glass through a particular area of the LCD.

Thus that particular area will become dark compared to others. The LCD works on the principle of blocking light. While constructing the LCDs, a reflected mirror is arranged at the back. An electrode plane is made of indium-tin-oxide which is kept on top and a polarized glass with a polarizing film is also added on the bottom of the device. The complete region of the LCD has to be enclosed by a common electrode and above it should be the liquid crystal matter.

Next comes the second piece of glass with an electrode in the form of the rectangle on the bottom and, on top, another polarizing film. It must be considered that both the pieces are kept at the right angles. When there is no current, the light passes through the front of the LCD it will be reflected by the mirror and bounced back. As the electrode is connected to a battery the current from it will cause the liquid crystals between the common-plane electrode and the electrode shaped like a rectangle to untwist. Thus the light is blocked from passing through. That particular rectangular area appears blank.

HOW LCD UTILIZES LIQUID CRYSTALS & POLARIZED LIGHT?

An LCD TV monitor utilizes the sunglasses concept to operate its colored pixels. On the flip side of the LCD screen, there is a huge bright light that shines out in the direction of the observer. On the front side of the display, it includes the millions of pixels, where each pixel can be made up of smaller regions known as sub-pixels. These are colored with different colors like green, blue, and red. Each pixel in the display includes a polarizing glass filter at the backside and the front side includes at 90 degrees, so the pixel looks dark normally. A small twisted nematic liquid crystal is there among the two filters which control electronically. Once it is turned OFF, then it turns the light to pass through 90 degrees, efficiently letting light to supply throughout the two polarizing filters so that pixel seems bright. Once it is activated then it doesn't turn the light because it is blocked through the polarizer & the pixel seems dark. Every pixel can be controlled through a separate transistor by turning ON and OFF several times every second.

The followings are the advantages and disadvantages of Liquid-Crystal Displays (LCDs):

Advantages	Disadvantages
Vibrant Visual Delight	Limited Contrast
Slim and Sleek Design	Viewing Angle Restrictions
Energy Efficiency	Motion Blur
Wide Viewing Angle	Limited Refresh Rates
Reduced Eye Strain	Susceptibility to Pressure

APPLICATIONS OF LCD

1. Smartphone displays

Vibrant, high- resolution screens in mobile devices .

2. Television screens

Slim, energy efficient displays in moderns TVs.

3. Computer monitors

Sharp and clear screens for desktops and laptops.

4. Automotive dashboards

Essential for vehicle information and entertainment

5. Medical equipment

Used in patient monitors, ultrasound machines and more.

6. Industrial control panels

Durable displays for machinery and automation.





THE END!