Evolution of Technology: Display System

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Abstract

To put simply *Displays have gotten better and there is no stopping it*. When you are seeing us it means our laptops camera captures a still image breaks it down into 921,600 individual pixels and converts them into instructions comprising of hue, saturation, and lightness which is then made into a data package by my image processor and this data package goes from my laptop to my local ISP racing through a fibre optic cable at the speed of light to Mumbai and then bouncing off a satellite in geosynchronous orbit to Lisbon Portugal where the data packets will get rerouted to your local ISP to your laptop where your laptop will convert the signal into a viewable image and this happens 24 times in a second to just provide a visual feed. S0 the next time you cannot see your girlfriend's pretty face in a video chat just know there's a lot going on. But we have been sending visual feeds before world war 2, but there were no digital circuits back then, how did we do it? Back then we only had a black and white video which made it easier because in order to produce black or white we only need to control how much power a light source gets and the engineers back then quickly fashioned radio signals to transmit how much light should be emitted by the source and when all of these sources are stitched together we get an image in our Cathode Ray Televisions.

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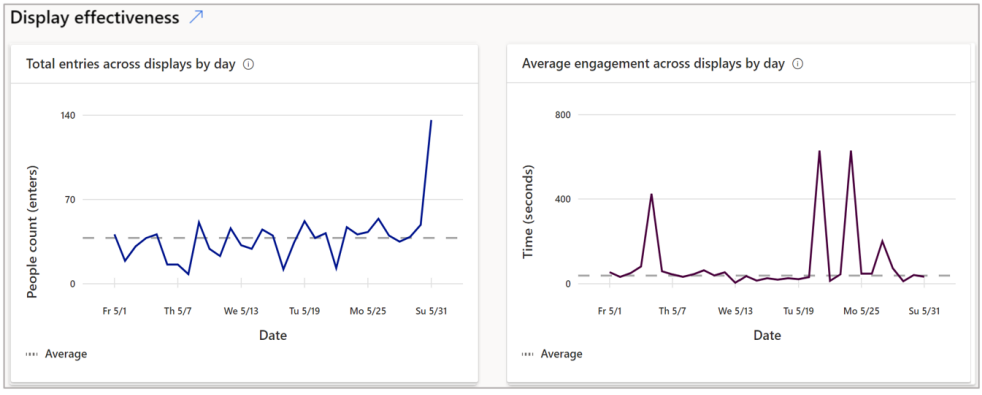
1. Introduction

We read text, watch movies and see our friends. The number one way of content consumption we have at our disposal right now is DISPLAY. It's an output device for displaying information in a visual form.

Now I don't have to remind any of you how important a display is in our day-to-day lives. The first iteration of displays that humans say was not in a form of cathode ray tube television although that played the largest hand in the widespread interaction of displays we see now.

The applications of electronic display range from the simple alphanumeric display on a metre or washing machine to the ubiquitous television set and to its role as a window into a radar or computer system. Of particular interest is its role as an information transducer that translates data in a format that is compatible with a computer or electronic system to information and is comprehensible to a human. During the 1960s, attempts were made to increase picture complexity by the use of rear port tubes so that fixed information (e.g., maps) could be projected optically onto the screen and variable data then written by the electron beam. Recent developments utilise, within the glass envelope, many phosphor-coated anodes that are themselves connected to the drains of an array of field effect transistors. They are used for very small displays in the viewfinders of camcorders.



2. History of Displays

- Cathode Ray Tube (1935-1970) is a vacuum tube containing one or more electron guns the beams of which are manipulated to display images on a phosphorescent screen, The images may represent electrical waveform (oscilloscope), pictures (tv sets, monitors not the speakers).

The electron gun, positioned in the tube, is the main component of a CRT monitor in a black and white monitor; there requires only one electron gun; whereas the colour monitors require three individual guns to produce red, green, and blue. The charged electrons coming out of the guns hit the screen which is on the front side. The screen is coated with phosphor dots which are ablaze by hitting the electrons and as a result, we see the picture on the monitor.

- Segment Displays (1970-1990) which were introduced to us in early 1990 had the capability of showing simple text and they were built on a technology built upon the

  Twisted Nematic Effect - the basic underlying principle was based on the precisely controlled realignment of liquid crystal molecules between different ordered molecules. This technology is so powered efficiently that it is still being used in most digital watches and all calculators and without those, there is no way we can pass an exam without that.
- Electrically operated display devices have developed from electromechanical systems for the display of text, up to all-electronic devices capable of full-motion 3D colour graphic displays. Electromagnetic devices, using a solenoid coil to control a visible flag or flap, were the earliest type, and were used for text displays such as stock market prices and arrival/departure display times. The cathode ray tube was the workhorse of text and video display technology for several decades until being displaced by plasma, liquid crystal (LCD), and solid-state devices such as thin-film transistors (TFTs), LEDs, and OLEDs. With the

advent of metal-oxide-semiconductor field-effect transistors (MOSFETs), integrated circuit (IC) chips, microprocessors, and microelectronic devices, many more individual picture elements ("pixels") could be incorporated into one display device, allowing graphic displays and video.

➢ UNDERLYING TECH:
- Incandescent Filaments
- Vacuum Fluorescent display
- Cold Cathode
- Light Emitting Diode (LED)
- Liquid Crystal Display (LCD)

Let's talk about the other display that didn't break the mainstream but did accelerate the production. Vacuum Fluorescent Display, ELectroluminescent (ELD) display, Plasma (PDD) display.

➢ 2 Dimensional Displays Matrix Display (1990-2000)
2-dimensional displays that cover a full area (usually a rectangle) are also called video displays. This is a scientific name for what we call television. This laid out the foundational technology for the future of display technologies being used in television to this date.

3.“Trend Setters”

➢ All of these advancements have led to the development of industry-wide “best practices”, some of which are mentioned below.

➢ 24 fps — This is a universally accepted frame rate in the industry. You can expect to see this in movies. You may be wondering why did the industry choose 24 fps and not something higher like 25 or 35. It came about through a trial and error process that goes back to the early days of film. Early developers who worked or experimented with film, including Thomas Edison, began testing different ways to create motion. They started seeing results at 16 to 18 fps. Creating motion from still images

on film required creating a reel for continuous filming. Now in order for the eyes to see motion, no noticeable flicker or delays must be present when it is displayed on the screen. They finally came upon a standard to use 24 fps. Over the years there have been improvements in camera technology and digital electronic sensors instead of film, but the frame rate remains the same. It is now possible to use higher frame rates, but the industry still plays movies in cinemas at standard 24 fps.

- 60 fps — Shooting or filming at this frame rate is higher than the standard. This is for high definition or HD video starting from 720p all the way up to 8K resolution. For NTSC playback compatibility though, the frame rate is actually reduced to 59.94 fps which is oftentimes referred to as 60 fps anyway. The reason for compatibility with NTSC formats is because this is the standard for television broadcasting in North America and Japan. Using frame rates depends on what you are filming or what application you are using. For video 24 fps is ideal for a cinematic look and feel. Capturing more motion for great slow motion and smoother video requires higher frame rates. For games, higher frame rates at higher resolution are the best performance but require higher costs. In typical game consoles, high frame rates lead to a lower resolution but it is not noticeable in HD. When playing games at 4K or higher resolution at high frame rates then the resolution does become noticeable so having a higher refresh rate is ideal.
- The claimed showstopper of CES 2022, was (Quantum Dot-Organic) QD OLED Display by Lg Displays which is a spinoff brand of display manufacturers of the parent brand LG, The tech was in development since 2019 and will feature in both Samsung and Sony's TVs this year.

4. Modern Displays

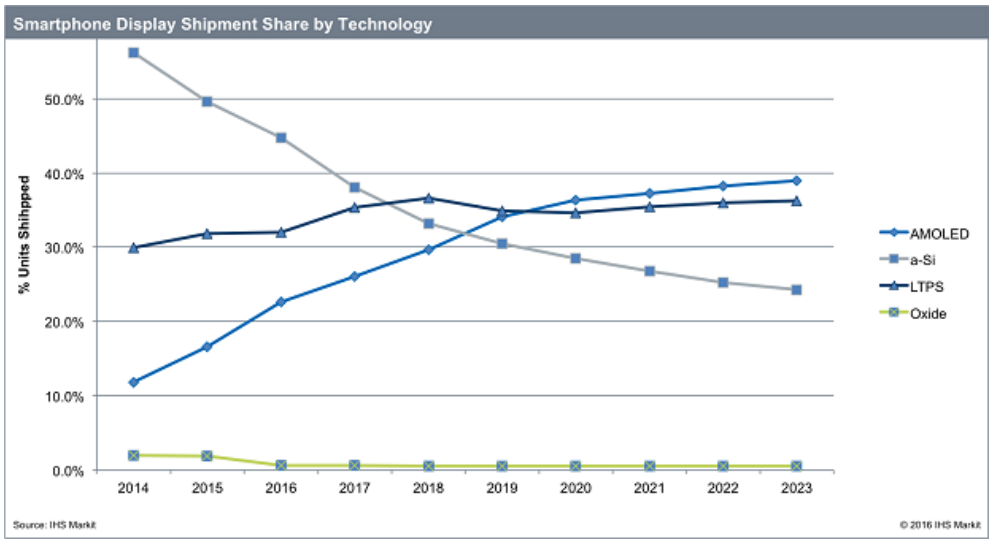
- TFT LCD – (Thin Film Transistor technology)

- TFT LCDs are supposedly the most common type of display unit found in mobile devices. TFT LCD gives you good image quality and higher resolutions compared to earlier generation LCD displays however, in narrow viewing angles and indirect light or sunlight there's poor visibility.

- IPS-LCD – (In-Place Switching)
  IPS LCDs are the next level of TFT LCD displays providing wider viewing angles and lower power consumption which leads to much-improved battery life. IPS-LCDs obviously are costlier than normal TFT LCDs and hence are located only on higher-end smartphones. A higher resolution (640 x 960 pixels) IPS LCD is found in Apple's iPhone 4 which is called Retina Display because of its brilliant picture quality.

- Capacitive Touchscreen LCD
  Capacitive touchscreen technology happens to have a layer of glass laced with a transparent conductor (like indium tin oxide). When touched by the human body (finger), an interruption is created in the screens electrostatic field (which is measurable as a change in capacitance) and this, in turn, is detected by the phone's processor or chip and which in turn will instruct the phone's operating system to trigger an event or action accordingly.

- OLED – (Organic Light Emitting Diode)
  This happens to be the newest technology for displays of mobiles and monitors. As far as the OLED tech is concerned you will find an organic material that is placed between two conducting sheets (an anode and a cathode), which are also put between a glass top plate (seal) and a glass-bottom plate (substrate). The time an electric pulse passes or is applied between the two conducting sheets, electro-luminescent light is produced directly from the organic material sandwiched between.



- AMOLED – (Active-Matrix Organic Light-Emitting Diode)
  AMOLED is a different type of OLED display for mobiles and is fast gaining popularity in the top-end smartphone segment. AMOLED screens can show us many things that are present on an OLED display like brilliant colour reproduction, lightweight, good battery life, proper brightness, etc.

- Super AMOLED displays
  These have taken upon the AMOLED displays and are primarily developed by Samsung. Super AMOLED is constructed with touch sensors placed on the display itself, as opposed to creating a separate touch-sensitive layer (as in a capacitive touch screen). This makes it the thinnest display technology on the market. Super AMOLED displays are currently only present in Samsung.

5. Conclusion

We cannot possibly conclude a groundbreaking technology space such as the display technology space, and get it right ever changing ever evolving in just a lifetime of a human we have gone from CRTS to displays that can fold and bend without like and are touch-sensitive in nature. But we can say something for sure, "*This here is an ever-growing space of unimaginable force and will*".

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