

E-Paper Technology

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Abstract :- E-paper technology has made a drastic change over the years, this generation is more dependent on digitalizing everything. The e-paper is portable and which look like paper in the displays of electronic devices, and it's a revolutionary material which holds the every information on single chip. E-paper displays aims to mimic real paper with high reflectance and low power consumption similar to original paper ,E-papers of the future are just about to replace most printed newspapers before the end of next decade. An ideal e-paper display can be read in direct sunlight that is the image will not appear to fade.

INTRODUCTION :

The first e-paper was developed in 1974's by "Nicholas K Sheridan" at Xerox's palo alto research centre. An Electronic display is a converter of electronic information for recognition by brain via vision. Software and hardware components of electronic display(E-Display) enables us to visualize data .mainly E-displays aims to represent the maximum variance in human perception while perceiving an information with physical environmental considerations. In this technology glare and light pollution is completely reduced E-paper is very flexible ,e-paper have a wide viewing angle ,it has two different parts mainly like front plane and back plane ,The main core point in this technology is display embedded in smart cards. This version on paper was also released in a subscription basis

- Front plane consist of E-ink.
- Backplane consist of electronic circuits.
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TECHNOLOGY

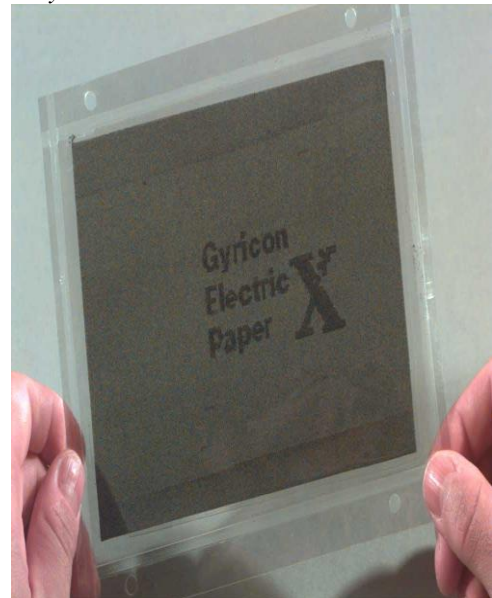


Fig (1) Prototype of flexible display

The first electronic paper called Gyricon which consisted of polyethylene spheres between 75 and 106 micrometers across.

Each sphere is a Janus particle composed of negatively charged black plastic on one side and positively charged white plastic on the other. Another approach to this problem of low-power and high quality colour in E-paper comes from the Novel devices lab at the University of Cincinnati. The technology, called electrofluidic display, uses voltage to manipulate colored ink in much the same way that print heads operate in color printers

- Gyricon



Fig(2) Gyricon Electric paper

it was the first e-paper developed in 1970s at Xerox's Palo Alto Research Centre,

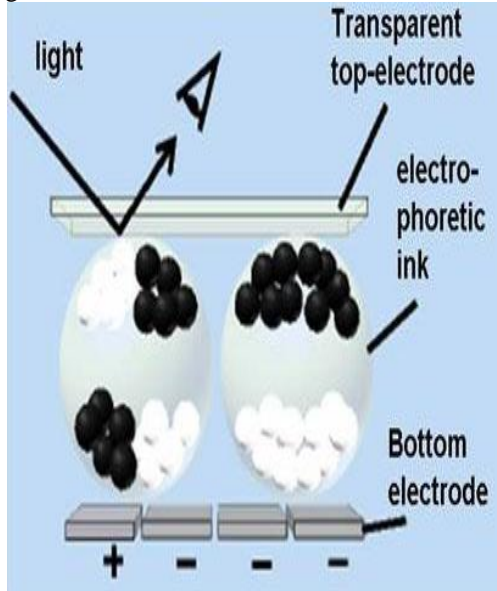
It is composed of polyethylene spheres of about 75 to 106 micrometers across and Each sphere is composed of black plastic on one side and white plastic on the other side which is negatively and also positively charged respectively ,this spheres are embedded within the transparent silicone sheet .each and every spheres are suspended in a bubble of oil so that it will able rotate freely. The polarity of the voltage applied to each pair of electrodes and then determines whether the white or black side is face-up, hence giving the pixel a white or black look.

Images and text will be created by the combined display, which is bi-stable Data is downloaded to the E-

Paper through a wireless connection to a computer or to a cell phone[3][1]

• *Electrophoretic display:*

Electrophoretic ink (E-Ink) technology creates an image and it looks like real printed paper from all angles and lighting condition



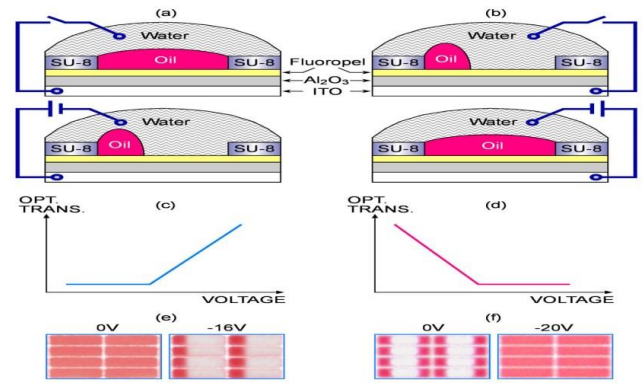
Fig(3) Electrophoretic Display

As shown on the picture below an ED is made up of an ink layer, sandwiched between the two layers that can be plastic, glass or even paper. All together The thickness of the layer structure is between 0.5mm on glass and 0.1mm on plastic, which is in the order of a sheet of paper.[3][1]

ELECTROWETTING:

By applying appropriate voltage in electrowetting technology the shape of water/oil interface is controlled. and it uses the same underlying technology but the titanium is replaced with the layers of colored oil and water, electrowetting is a microfluidic phenomenon which modifies the surface tension of liquids on a solid surface with voltage.

This results in a partly transparent pixel or in case, a reflective white surface is being used under the switchable element, a white pixel. The switching between white and coloured reflection is fast enough to display video content, The average reflection is experienced by the observer due to the small size of pixels and reflection forms the basis of reflective display.



Fig(4) Electrowetting

APPLICATIONS ON E-PAPER

1. Electronic watch and clock
2. E-Book
3. Smart card Display
4. Newspaper
5. Cell phones
6. Other Products Like : Clothes, digital photo frames, keyboards and information boards are the other proposed applications of e-paper. Applications like games or video editing and for less represented languages uses the keyboards with dynamically changeable keys[4][1]

HIGHLIGHTS OF ELECTRONIC INK

E-ink moves the information to the dynamic level with a drastic benefits

superior look : its superior because it is made up of the same basic materials as regular ink and paper and its very high in contrast, and it has a wide viewing angle and it's a bright paper with white background

Versatile : its versatile because it can be printed in any surface like it can be plastic, metal and even paper and it also can be coated over a large areas very cheaply

Advantages:

1. Readability
2. Clarity
3. Reduced eyestrain
4. Inexpensive
5. Electronic ink can be printed on any surface including walls and bill boards
6. High reflectivity of the white state and high contrast.

Disadvantages:

1. Very low switching speed
2. Electrochemical complexity
3. Refreshing rate is very low
4. E-paper technology cannot support animation

CHALLENGES:

The main challenge that is faced in E-paper is like poor Quality and it is also very expensive, the present e-paper technology is not able to provide moving images

ARCHITECTURE

E-paper is embedded with a cylindrical tube (about 15 to 20 centimetres long) that anybody can carry in their pocket and make portable, the tube will contain the tightly rolled sheet of E-paper which can easily spooled out with a slit in the tube as an flat sheet for reading purpose

The information will downloaded with the help of the cell phone network or with the help of the internal chip which will cost quite less so that everyone can one. by the recent developments In e-paper this technology is growing very bright in future years consumers might find a large number of e-papers on the market.

CONCLUSION:

Electronic Paper Display technology has been a long time coming, this technology has developed a long time back but this is becoming popular these days and this is a display looks and works like ordinary paper. The E-paper is readable in the presence of sunlight and it can hold the contents without consuming power and the content could be erased and rewritten any number of times. This leading us to think of a truly paperless world.

Electronic ink will not diminish or do away with these days traditional displays, instead the electronic ink will co-exist with traditional paper and other displays technologies. but the electronic ink may have a million-dollar impact on the publishing industry. as we know it could bring down the newspaper to an end according to the drastically growing technology.

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