KINDLES AND THE LATEST LCD AND E-INK TECH.

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OUTLINE

Kindles
  - Background
  - Hackability
  - Demos

LCD technology
  - Demo of Boogie Board

e-ink technology
KINDLES

Why I choose kindle....

Background on
Kindle Touch (5.0)
iMX508 (800MHz ARM Cortex A8)

Kindle Fire

Kindle Keyboard (3.0)
iMX35 (532MHz ARM)

Basic (4.0)
iMX50 (800MHz ARM Cortex A8)

Kindle 2/DX
iMX3 (400MHz ARM)
KINDLES

Hackability
-Kindle Touch
-Kindle Keyboard
-Basic
“ENABLE_DIAGS”
-older
KINDLES

Hackability

- Kindle Keyboard

Been around awhile

Lots of hacks exist
Demos
Adding a hack to the touch
"ENABLE_DIAGS"
on the Basic
MineSweeper on Keyboard
The Latest and Greatest?
According to a sharp catalog these are some advance LCD capabilities/Improvements

Demo of Boogie Board

Can hold approx 200 pdfs in its memory
Can’t browse

Chelina
Josh
LCD TECHNOLOGY

The Latest and Greatest?
According to NLT catalog
Super-Reflective Natural Light TFT

According to NLT catalog
Super-Transmissive Natural Light TFT

LCD TECHNOLOGY

NLT catalog
Zero Chip Display
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NLT catalog
Horizontal Double Density Pixels
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NLT catalog
On-Cell touch panel LCD
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NLT catalog

Application shaped Display Technology

Conventional Technology

- Division of circuit
- Overlap of circuit

The complexity of the circuitry makes it difficult to achieve a narrow frame design.

Application-Shaped Display Technology

- Gate line drive circuit
- Data line drive circuit

This technology eliminates the division or overlapping of circuits, simplifying panel structures and making it possible to create narrower frames.

Example of feasible shape

- Car shape
- Leaf shape
- Heart shape
- Arrow shape
What other options are out there?

Table 1-2. Comparison of current dominant technology, LCD, with competing emerging display technologies

<table>
<thead>
<tr>
<th>Display Technology</th>
<th>Need for backlight and its power</th>
<th>Power consumption</th>
<th>Thickness</th>
<th>Weight</th>
<th>Sustainability (lifetime)</th>
<th>Readability in daylight</th>
<th>Brightness</th>
<th>Response time</th>
<th>Flexibility of format/screen size</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD</td>
<td>Yes</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>OLED</td>
<td>No</td>
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<td>0</td>
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<td>++</td>
</tr>
<tr>
<td>E-paper</td>
<td>No</td>
<td>++</td>
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<td>++</td>
<td>0</td>
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<td>-</td>
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<tr>
<td>Plasma</td>
<td>No</td>
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<td>++</td>
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<td>0</td>
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<td>LED</td>
<td>No</td>
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<td>CRT</td>
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<td>SED/FED</td>
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<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

++ better performance than LCD; 0 same as LCD; - poorer than LCD; + LCD performance level for comparison

Sources: Various industry sources

“It's so much like paper, it actually utilizes the same pigments used in the printing industry today.”

Electronic ink is made up of millions of tiny microcapsules, about the diameter of a human hair. Each microcapsule contains positively charged white particles and negatively charged black particles suspended in a clear fluid.
To form a smart ink display, the ink is coated onto a sheet of plastic film that is laminated to a layer of circuitry. The circuitry forms a pattern of pixels that can then be controlled by a display driver. The microcapsules are suspended in a liquid "carrier medium" allowing them to be coated using existing coating processes.

For more information on e-ink see:
http://www.eink.com
E-INK TECHNOLOGY

Latest

LG begins mass production of first flexible, plastic e-ink displays
LG begins mass production of first flexible, plastic e-ink displays

LG’s latest flexible e-ink display measures six inches diagonally, and has a 1024 by 768-pixel resolution. Unlike a typical e-reader, the display is made of plastic and it does not need a thick and heavy sheet of glass to protect it.

Source: [http://www.extremetech.com/electronics/](http://www.extremetech.com/electronics/)
LG begins mass production of first flexible, plastic e-ink displays

The press release says that the plastic display survives repeated 1.5-meter drop tests and break/scratch tests with a small hammer, and that it’s flexible up to 40 degrees from the midpoint.

Source: http://www.extremetech.com/electronics/
E-INK TECHNOLOGY

Why e-ink?
Compared to Flexible O-led........

Compared to LCD...........

Source:  http://www.extremetech.com/electronics/
### E-INK TECHNOLOGY

**General Comparison**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Market pricing</th>
<th>Response time</th>
<th>Ease of entry</th>
<th>Contrast</th>
<th>Roll to roll, Ink-jet, Low-temp</th>
<th>Colours</th>
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</thead>
<tbody>
<tr>
<td>Flexible OLED</td>
<td>High/ Med, descending</td>
<td>&lt;1ms</td>
<td>High/ medium</td>
<td>&gt;10,000:1</td>
<td>Yes</td>
<td>&gt;16Mn</td>
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<tr>
<td>E-paper, Electrophoretics</td>
<td>Low, descending</td>
<td>&lt;500ms</td>
<td>Medium, descending</td>
<td>&gt;10:1</td>
<td>Yes</td>
<td>Monochrome, future &gt;4096</td>
</tr>
<tr>
<td>Flexible LCD (Cholesteric)</td>
<td>Low/ medium</td>
<td>&lt;2ms</td>
<td>Low/ medium</td>
<td>&gt;250:1</td>
<td>Yes</td>
<td>&gt;4096</td>
</tr>
</tbody>
</table>

*Sources – various industry sources including Display Technology Centre/ITRI, Taiwan, NCTU/Display Institute, Taiwan, 2007, 2008 and other sources*