Vetronics Technology Demonstrator
Display Technology

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Vetronics Technology Demonstrator Display Technology

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Overview

- Computing Devices Flat Panel Displays
- Vetronics Technology Demonstrator
  - Program Requirements
  - Crew Station
  - Display Content Requirements
- Display & Touch Panel Technology Review
- Display Architecture
- Display Characteristics
Computing Devices Flat Panel Displays

- Proven Military Flat Panel Display Expertise
  - Thousands of FPD’s sold into land, naval and airborne applications
  - >15 years of FPD production experience
  - Participation in DARPA Technical Re-Investment Program (TRP)
  - Participation in United Stated Display Consortium (USDC) Military and Aerospace User Group (MAUG)
  - Member of the Society for Information Display (SID)
Vetronics Technology Demonstrator

- US Army TACOM Sponsored Program
  - Develop and demonstrate next generation crewstation
  - Crew stations evaluated in both lab and vehicle environments
  - Vehicle trial scheduled for summer 2001
Vetronics Technology Demonstrator

Requirements

- Rugged
- High performance
- Low cost (both NRE & recurring)
- State of the art (latest fieldable technology)
- Flexible - must enable system functionality to be changed with a minimum of impact on the crewstation design
Crew Station Concept

Indirect Vision Displays (IVD’s)

Multi-Function Displays (MFD’s)
Display Content Requirements
# Display Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Pro's</th>
<th>Con's</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD</td>
<td>Mature &amp; low cost</td>
<td>Requires heaters, Warm-up time</td>
</tr>
<tr>
<td></td>
<td>Good optical performance &amp; contrast ratio</td>
<td>Poorer off-axis viewing performance, Moderate video response, delicate polarisers</td>
</tr>
<tr>
<td></td>
<td>Good MTBF</td>
<td></td>
</tr>
<tr>
<td>EL</td>
<td>Mature, very rugged, available in custom size/formats, fast video response, high-resolution, Excellent MTBF.</td>
<td>Moderate brightness and poor colour availability, moderate voltage matrix drive electronics.</td>
</tr>
<tr>
<td>PDP</td>
<td>Mature, Rugged, Good colour gamut.</td>
<td>Poor resolution , marginal brightness, heavy, high power consumption. Limited sizes</td>
</tr>
<tr>
<td>FED</td>
<td>&quot;Flat CRT&quot; Good color gamut, fast video response, good uniformity, low power for luminance, wide operating temperature, Low voltage matrix drive.</td>
<td>Emerging technology, poor lifetime, moderate brightness, high anode voltage (~8KV), has to overcome the economics of AMLCD to succeed.</td>
</tr>
<tr>
<td>LED</td>
<td>Mature, simple, rugged, low-voltage, limited colour gamut, very long life.</td>
<td>Power-hungry, very poor Resolution.</td>
</tr>
<tr>
<td>OLED</td>
<td>Printable, flexible, very fast video response, low power consumption, wide colour gamut, potentially for very bright, high resolution, wide temperature, active matrix.</td>
<td>Unproven (unobtainable). Probably UV-degradable, moisture sensitive and short life span.</td>
</tr>
<tr>
<td>LEP</td>
<td>Printable, embedded drive circuits, compatible with low cost flexible substrate, low power, potential for good color, temperature &amp; video response.</td>
<td>Unproven, UV-degradable, cannot obtain. Short life expectancy at this time.</td>
</tr>
<tr>
<td>DMD</td>
<td>Wide operating temperature range. Available.</td>
<td>Bulky (projection), optical cross talk, poor contrast (requires reflecting surface to project images).</td>
</tr>
<tr>
<td>VFD</td>
<td>Mature, Simple, Cheap, and rugged.</td>
<td>Very low resolution, moderate luminance, high reflectivity, poor brightness, large IR signature.</td>
</tr>
</tbody>
</table>
## Touch Panel Technologies

<table>
<thead>
<tr>
<th>Touch-input Technology</th>
<th>Positive Attribute</th>
<th>Negative Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infra red</td>
<td>No luminance loss.</td>
<td>IR emission.</td>
</tr>
<tr>
<td></td>
<td>No additional reflection.</td>
<td>Low resolution.</td>
</tr>
<tr>
<td></td>
<td>No environmental limitations.</td>
<td></td>
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</tbody>
</table>
Display Architecture

Standard Display Heads

<table>
<thead>
<tr>
<th>Display Head</th>
<th>LCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Backlight</td>
<td></td>
</tr>
<tr>
<td>• Microcontroller</td>
<td></td>
</tr>
<tr>
<td>• Video I/F (LVDS)</td>
<td></td>
</tr>
<tr>
<td>• Adapted for each specific LCD</td>
<td></td>
</tr>
<tr>
<td>• 8.4” VGA</td>
<td></td>
</tr>
<tr>
<td>• 10.4” SVGA</td>
<td></td>
</tr>
<tr>
<td>• 13.0” SXGA</td>
<td></td>
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</table>

Common Hardware Modules

<table>
<thead>
<tr>
<th>Video Module</th>
<th>Keypad/Touchscreen</th>
</tr>
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<tbody>
<tr>
<td>• General Purpose Video I/F</td>
<td></td>
</tr>
<tr>
<td>• LVDS</td>
<td></td>
</tr>
<tr>
<td>• RGB Analog</td>
<td></td>
</tr>
<tr>
<td>• Separate Hsync &amp; Vsync</td>
<td></td>
</tr>
<tr>
<td>• Composite TTL Sync</td>
<td></td>
</tr>
<tr>
<td>• Sync on Green (RS-170)</td>
<td></td>
</tr>
<tr>
<td>• NTSC/PAL/SECAM</td>
<td></td>
</tr>
<tr>
<td>• Frame rate/Scan converter/Scale</td>
<td></td>
</tr>
<tr>
<td>• Standard LVDS output</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Supply Module</th>
<th>Video Multiplexor</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mil-Std-1275 compliant input</td>
<td></td>
</tr>
<tr>
<td>• Heater Power @ 150W</td>
<td></td>
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</tbody>
</table>

Optional Modules

<table>
<thead>
<tr>
<th>AC-DC Power</th>
<th>Single Board Computer</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>cPCI+PMC</td>
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</tbody>
</table>
Display Architecture - Exploded View

- Display Head
- Video Module
- Power Module
Display Head - Exploded View

- Touchscreen
- AMLCD
- Backlight
Common Display Characteristics

♦ Optical Characteristics
  • Brightness \(>250 \text{ fL (856 cd/m}^2\)\)
  • Brightness control \(<0.5\) to \(>250 \text{ fL (1.7 to 856 cd/m}^2\)\)
  • Contrast Ratio \(>10:1 \) @1000 fc (10,764 lux)

♦ Environmental Specifications
  • Operating Temperature -40°C to +60°C
  • Storage Temperature -55°C to +85°C
  • Relative Humidity up to 100%
  • Shock MIL-STD-810E, Method 516.4, Procedure 1, Functional Shock
  • Vibration MIL-STD-810E, Method 514.4, Category 8, Ground Mobile
  • EMI/EMC MIL-STD-461D
  • Nuclear hardened design utilising a Nuclear Event Detector

♦ MTBF \(>7500\) hours at 60 °C MIL-STD-217(AIC)
8.4” IVD Characteristics

Optical Characteristics
- Display Area 6.73” (170.9 mm) x 5.10” (129.6 mm)
- Matrix 640 x 480 (VGA)
- Pixel Size 0.267 mm x 0.27 mm (94dpi)
- 18 bit color (262144 colors)
- Viewing Angles:
  - Horizontal >50°
  - Vertical >45° up, 35° down

Physical Characteristics
- Height 7.62” (193.0 mm)
- Width 8.82” (223.5 mm)
- Depth 2.79” (70.9 mm)
- Weight 6.0 lbs max (2.73 kg)
13.0” IVD Characteristics

**Optical Characteristics**
- Display Area 10.13” (257.3 mm) x 8.14” (206.8 mm)
- Matrix 1280 x 1024 (SXGA)
- Pixel Size 0.20 mm x 0.20 mm (127 dpi)
- 24 bit color (16.8 million colors)
- Viewing Angles:
  - Horizontal >100°
  - Vertical > 20° up, 25° down

**Physical Characteristics**
- Height 11.11” (282.2 mm)
- Width 13.83” (351.3 mm)
- Depth 3.00 (76.2 mm)
- Weight 15 lbs max (6.8 kg)
10.4” MFD (Landscape) Characteristics

Optical Characteristics

- Display Area 8.31” (211.2 mm) x 6.24” (158.4 mm)
- Matrix 800 x 600 (SVGA)
- Pixel Size 0.26 mm x 0.26 mm (98dpi)
- 18 bit colour (262144 colours)
- Viewing Angles:
  - Horizontal >100°
  - Vertical > 45° up, 20° down

Physical Characteristics

- Height 9.00” (228.6 mm)
- Width 11.50” (292.1 mm)
- Depth 3.00” (76.2 mm)
- Weight 11 lbs max (5.0 kg)
10.4” MFD (Portrait) Characteristics

**Optical Characteristics**

- Display Area 6.24”(158.4 mm) x 8.31” (211.2 mm)
- Matrix 600 x 800 (SVGA)
- Pixel Size 0.26 mm x 0.26 mm (98dpi)
- 18 bit colour (262144 colours)
- Viewing Angles:
  - Horizontal > 45° left, 20° right
  - Vertical >100°
Conclusions

- AMLCD remains the technology of choice for AFV Applications (for now ...)
- Modular architecture successfully met the TACOM requirement
  - Minimized development & lifecycle cost
  - Minimized obsolescence risk
  - Maximized flexibility

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