Input Technology

http://wiki.arcadecontrols.com/wiki/Main_Page

Topics

Keys and Keyboards

Pointing

- Digital joystick
- D-pad
- Trackball
- Mouse
- Optical mouse
- Analog joystick

Game controllers

http://wiki.arcadecontrols.com/wiki/Main_Page
Keyboards

Reverse Engineering a Keyboard

http://pupp.edgeemu.com/kbhack.com
2D Array of Switches

http://pupp.edgeemu.com/kbhack.com

Keyboard Matrix

<table>
<thead>
<tr>
<th></th>
<th>a1</th>
<th>a2</th>
<th>a3</th>
<th>a4</th>
<th>a5</th>
<th>a6</th>
<th>a7</th>
<th>a8</th>
<th>a9</th>
<th>a10</th>
<th>a11</th>
<th>a12</th>
<th>a13</th>
<th>a14</th>
<th>a15</th>
<th>a16</th>
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<tr>
<td>b1</td>
<td>esc</td>
<td>F4</td>
<td>G</td>
<td>F5</td>
<td>H</td>
<td>F6</td>
<td>&quot;</td>
<td>%</td>
<td>#0</td>
<td>.</td>
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<td>#</td>
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<tr>
<td>b2</td>
<td>L</td>
<td>Tab</td>
<td>Cap</td>
<td>Lock</td>
<td>F3</td>
<td>T</td>
<td>Blk</td>
<td>Y</td>
<td>F7</td>
<td>#4</td>
<td>#5</td>
<td>#6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b3</td>
<td>L</td>
<td>Ctrl</td>
<td>~</td>
<td>F1</td>
<td>F2</td>
<td>5</td>
<td>F9</td>
<td>6</td>
<td>=</td>
<td>-</td>
<td>F8</td>
<td>Del</td>
<td>Ins</td>
<td>Page Up</td>
<td>Home</td>
<td></td>
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<tr>
<td>b4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>F10</td>
<td>7</td>
<td>8</td>
<td>0</td>
<td>9</td>
<td>F11</td>
<td>F12</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>b5</td>
<td>Q</td>
<td>W</td>
<td>E</td>
<td>R</td>
<td>U</td>
<td>I</td>
<td>P</td>
<td>O</td>
<td>#7</td>
<td>#8</td>
<td>#9</td>
<td>#+</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>b6</td>
<td>A</td>
<td>S</td>
<td>D</td>
<td>F</td>
<td>\</td>
<td>J</td>
<td>K</td>
<td>;</td>
<td>L</td>
<td>#1</td>
<td>#2</td>
<td>#3</td>
<td>#4</td>
<td>Enter</td>
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<tr>
<td>b7</td>
<td>R</td>
<td>Ctrl</td>
<td>Z</td>
<td>X</td>
<td>C</td>
<td>V</td>
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<td>,</td>
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<td>#</td>
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<tr>
<td>b8</td>
<td>B</td>
<td>Space</td>
<td>N</td>
<td>/</td>
<td>Arryw Down</td>
<td>Arnyw Right</td>
<td>Arnyw Left</td>
<td>R</td>
<td>Altr</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Scan Codes

Make (onPress) and Break (onRelease) codes

http://www.computer-engineering.org/ps2keyboard/

Keys and Characters are not the Same

Modifier keys
  [Shift] [Ctrl] [Alt/Option] [Cmd] [Fn]
Capslock and Numlock
Special keys
  F1, ..., F12, Insert, Delete, Home, ...
Duplicated keys
  Numbers on keypad vs. keyboard
  Left-shift, Right-shift, Left-cmd, Right-cmd, ...
GLUT Keyboard Interface

ASCI keys

    glutKeyboardFunc(func) // onDown
    glutKeyboardUpFunc(func) // onUp
    func(unsigned char key, int mousex, int mousey);

Non-ASCI keys (F1, ..., F12, INSERT, ...)

    glutSpecialKeyFunc(func) // onDown
    glutSpecialKeyUpFunc(func) // onUp
    func(unsigned char key, int mousex, int mousey);

    Int glutGetModifiers()

        GLUT_ACTIVE_SHIFT|GLUT_ACTIVE_CTRL|GLUT_ACTIVE_ALT

N.B. Need to track key state

Flash Keyboard Interface

Key class

    addListener(proc) - call onUp and onDown
    getAscii() - return ASCII for the last key pressed
    getCode() - return virtual key code for last key
    isDown(key) - return state of key
    isToggled(key) - return change in state of key

Note difference between

    state (Up, Down) vs. transition (onDown, onUp)
Position

D-pad

Famicom Controller (1983)
Atari CX40 Joystick

Just 5 switches!

\ o5 o4 o3 o2 o1/
\ o9 o8 o7 o6 /
\___________/

<table>
<thead>
<tr>
<th>pin #</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Up</td>
</tr>
<tr>
<td>2</td>
<td>Down</td>
</tr>
<tr>
<td>3</td>
<td>Left</td>
</tr>
<tr>
<td>4</td>
<td>Right</td>
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<tr>
<td>6</td>
<td>Button</td>
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<td>7</td>
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</tr>
<tr>
<td>8</td>
<td>Ground</td>
</tr>
<tr>
<td>9</td>
<td>unused</td>
</tr>
</tbody>
</table>

4-way and 8-way Joystick
Encoder - Relative Angular Pos/Velocity

Quadrature Encoder
Trackball

Douglas Engelbart Mouse (1964)
Mechanical Mouse

http://computer.howstuffworks.com/mouse2.htm

Mouse Interface (PS/2)

Encoding method (microcontroller sums movement)

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y overflow</td>
<td>X overflow</td>
<td>Y sign bit</td>
<td>X sign bit</td>
<td>Always 1</td>
<td>Middle Btn</td>
<td>Right Btn</td>
<td>Left Btn</td>
</tr>
</tbody>
</table>

| Byte 2 | | | |
|--------|----------------|
|        | X Movement     |

| Byte 3 | | | |
|--------|----------------|
|        | Y Movement     |

Specifications

- Rate: 100 samples per second
- Resolution: 4 counts per mm

http://computer.howstuffworks.com/mouse2.htm
Optical Mouse

1st generation (Xerox)
- Led + photosensor over a grid of lines

2nd generation (Agilent)
- CMOS imager + DSP
  - 1500 frames per second
  - 16 x 16 pixel resolution
  - 300 counts per inch

Anoto Pen

http://www.tomshardware.co.uk/2005/12/19/pentop_computing_is_more_than_a_kidsuk/page2.html
Analog Joystick

Gamepads

SONY Playstation 3

Microsoft XBOX 360
Nintendo Wii Controller

Sensors
Accelerameters
IR sensor

Things to Remember

Keys and keyboards
- Just switches
- Keys are not ASCII
- Keyboard event model
- Dpad and digital joysticks are just switches

Position
- Quadrature encoding
- Mechanical mice and trackballs
- Emerging devices: Anoto, Wii, iPhone, …