AnimCube Storage Definition

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1 File format

In a parallelepiped *(I,J,K)*, each LED is numbered as follow:

$$LED_{\#}(x,y,z) = x + yI + zIJ \ \in [0, IJK-1] \quad \forall (x,y,z) \in [0, I-1] \times [0, J-1] \times [0, K-1]$$

It is also possible to get an LED coordinates from its number:

$$\begin{cases} z = LED_{\#} \ // \ IJ \\ y = (LED_{\#} \ \% \ IJ) \ \% \ J \\ x = (LED_{\#} \ \% \ IJ) \ // \ J \end{cases} \qquad \text{where \% is the modulus operator and // the Euclidian division.}$$

```
@<I><J><K>#<N>
\1[<led(0)><led(1)> ... <led(IJK-1)>]
\2[<led(0)><led(1)> ... <led(IJK-1)>]
\3[<led(0)><led(1)> ... <led(IJK-1)>]
.
.
.
\<N>[<led(0)><led(1)> ... <led(IJK)>]
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Listing 1: Animation file example *(N frames)*

2 2D Representation – Cube *(N)*

2.1 From bottom to top *(sliced along z-axis)*

$$\begin{array}{cc} & \xrightarrow{\textit{y-axis}} \\ \textit{x-axis}\,\Big\downarrow & \begin{bmatrix} 0 & N & \cdots & (N-1)N \\ 1 & N+1 & \cdots & (N-1)N+1 \\ \vdots & \vdots & \ddots & \vdots \\ N-1 & 2N-1 & \cdots & N^2-1 \end{bmatrix} \end{array}$$

$$\downarrow \textit{z-axis}$$

$$\underbrace{\begin{bmatrix} iN^2 & iN^2+N & \cdots & iN^2+(N-1)N \\ iN^2+1 & iN^2+N+1 & \cdots & iN^2+(N-1)N+1 \\ \vdots & \vdots & \ddots & \vdots \\ iN^2+N-1 & iN^2+2N-1 & \cdots & iN^2+N^2-1 \end{bmatrix}}_{\textit{layer } \#i,\quad i\in[0,N-1]}$$

2.2 From left to right *(sliced along y-axis)*

$$\begin{array}{cc} \textit{z-axis}\,\Big\uparrow & \begin{bmatrix} (N-1)N^2 & (N-1)N^2+1 & \cdots & (N-1)N^2+N-1 \\ \vdots & \vdots & \ddots & \vdots \\ 2N^2 & 2N^2+1 & \cdots & 2N^2+N-1 \\ N^2 & N^2+1 & \cdots & N^2+N-1 \\ 0 & 1 & \cdots & N-1 \end{bmatrix} \\ & \xrightarrow{\textit{x-axis}} \end{array}$$

$$\downarrow \textit{y-axis}$$

$$\underbrace{\begin{bmatrix} (N-1)N^2+iN & (N-1)N^2+iN+1 & \cdots & (N-1)N^2+iN+N-1 \\ \vdots & \vdots & \ddots & \vdots \\ N^2+iN & N^2+iN+1 & \cdots & N^2+iN+N-1 \\ iN & iN+1 & \cdots & iN+N-1 \end{bmatrix}}_{\textit{layer } \#i,\quad i\in[0,N-1]}$$

2.3 From back to front *(sliced along x-axis)*

$$\begin{array}{cc} \textit{z-axis}\,\Big\uparrow & \begin{bmatrix} (N-1)N^2 & (N-1)N^2+N & \cdots & (N-1)N^2+(N-1)N \\ \vdots & \vdots & \ddots & \vdots \\ 2N^2 & 2N^2+N & \cdots & 2N^2+(N-1)N \\ N^2 & N^2+N & \cdots & N^2+(N-1)N \\ 0 & N & \cdots & (N-1)N \end{bmatrix} \\ & \xrightarrow{\textit{y-axis}} \end{array}$$

$$\downarrow \textit{x-axis}$$

$$\underbrace{\begin{bmatrix} (N-1)N^2+i & (N-1)N^2+N+i & \cdots & (N-1)N^2+(N-1)N+i \\ \vdots & \vdots & \ddots & \vdots \\ N^2+i & N^2+N+i & \cdots & N^2+(N-1)N+i \\ i & N+i & \cdots & (N-1)N+i \end{bmatrix}}_{\textit{layer } \#i,\quad i\in[0,N-1]}$$

3 2D representation – Parallelepiped *(I,J,K)*

Let the dimensions following x,y and z respectively be I,J and K.

3.1 From bottom to top *(sliced along z-axis)*

$$\begin{array}{cc} & \xrightarrow{\textit{y-axis}} \\ \textit{x-axis}\Bigg\downarrow & \begin{bmatrix} 0 & I & \cdots & (J-1)I \\ 1 & I+1 & \cdots & (J-1)I+1 \\ \vdots & \vdots & \ddots & \vdots \\ I-1 & 2I-1 & \cdots & IJ-1 \end{bmatrix} \end{array}$$

$$\downarrow \textit{z-axis}$$

$$\underbrace{\begin{bmatrix} IJk & IJk+I & \cdots & IJk+(J-1)I \\ IJk+1 & IJk+I+1 & \cdots & IJk+(J-1)I+1 \\ \vdots & \vdots & \ddots & \vdots \\ IJk+I-1 & IJk+2I-1 & \cdots & IJk+(J-1)I+(I-1) \end{bmatrix}}_{\textit{layer } \#k,\ k\in[0,K-1] \quad (J*I \textit{ matrix})}$$

3.2 From left to right *(sliced along y-axis)*

$$\begin{array}{cc} \textit{z-axis}\Bigg\uparrow & \begin{bmatrix} (K-1)IJ & (K-1)IJ+1 & \cdots & (K-1)IJ+I-1 \\ \vdots & \vdots & \ddots & \vdots \\ 2IJ & 2IJ+1 & \cdots & 2IJ+I-1 \\ IJ & IJ+1 & \cdots & IJ+I-1 \\ 0 & 1 & \cdots & I-1 \end{bmatrix} \\ & \xrightarrow{\textit{x-axis}} \end{array}$$

$$\downarrow \textit{y-axis}$$

$$\underbrace{\begin{bmatrix} jI+(K-1)IJ & jI+(K-1)IJ+1 & \cdots & jI+(K-1)IJ+I-1 \\ \vdots & \vdots & \ddots & \vdots \\ jI+IJ & jI+IJ+1 & \cdots & jI+IJ+I-1 \\ jI & jI+1 & \cdots & jI+I-1 \end{bmatrix}}_{\textit{layer } \#j,\ \ j\in[0,J-1] \quad (I*K \textit{ matrix})}$$

3.3 From back to front *(sliced along x-axis)*

$$\begin{array}{cc} \textit{z-axis}\Bigg\uparrow & \begin{bmatrix} (K-1)IJ & (K-1)IJ+I & \cdots & (K-1)IJ+(J-1)I \\ \vdots & \vdots & \ddots & \vdots \\ 2IJ & 2IJ+I & \cdots & 2IJ+(J-1)I \\ IJ & IJ+I & \cdots & IJ+(J-1)I \\ 0 & I & \cdots & (J-1)I \end{bmatrix} \\ & \xrightarrow{\textit{y-axis}} \end{array}$$

$$\downarrow \textit{x-axis}$$

$$\underbrace{\begin{bmatrix} i+(K-1)IJ & i+(K-1)IJ+I & \cdots & i+(K-1)IJ+(J-1)I \\ \vdots & \vdots & \ddots & \vdots \\ i+IJ & i+IJ+I & \cdots & i+IJ+(J-1)I \\ i & i+I & \cdots & i+(J-1)I \end{bmatrix}}_{\textit{layer } \#i,\ \ i\in[0,I-1] \quad (J*K \textit{ matrix})}$$