update

The vector describing the camera location is denoted by

$$Camera(x, y, z) = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$Object(x, y, z) = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

Translation is described using a matrix multiplication operation, where translation in each direction is denoted by t_x, t_y,and t_z

$$T(t_x, t_y, t_z) = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$Translated\ Camera = T(t_x, t_y, t_z)\ \star\ Camera$$

$$R_x(\alpha) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & cos(\alpha) & -sin(\alpha) & 0 \\ 0 & sin(\alpha) & cos(\alpha) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$R_y(\beta) = \begin{bmatrix} cos(\beta) & 0 & sin(\beta) & 0 \\ 0 & 1 & 0 & 0 \\ -sin(\beta) & 0 & cos(\beta) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$R_z(\theta) = \begin{bmatrix} cos(\theta) & -sin(\theta) & 0 & 0 \\ sin(\theta) & cos(\theta) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Full rotation

$$R(\alpha, \beta, \theta) = R_z(\theta) R_y(\beta) R_x(\alpha)$$

$$Rotated\ Camera = R(\alpha, \beta, \theta)\ \star\ Camera$$

The pose is achieved when the following operation results in the location of the object.

$$Pose = [\ T(t_x, t_y, t_z)\ \star\ R(\alpha, \beta, \theta)\ ]\ \star\ Camera$$