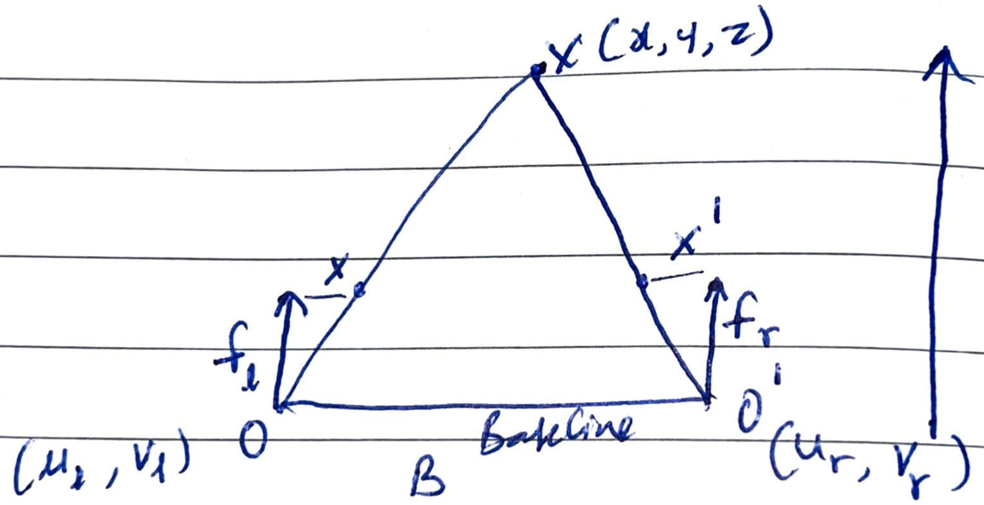
HW3

4) Depth estimation in Stereo Vision Theory

The main goal of this experiment is to understand how depth is related to disparity and derive an expression for calculating depth from disparity.
The below figure helps to visualize the derivation of the expression.




Let us assume that the translation is performed horizontally.

i.e. $(v_l) = (v_r)$

And we also know that

$$f_l = f_r = f$$

Let us place the object at a distance of 'D'

From the figure we see that

$$(u_l) = \frac{(f_l * x_l)}{D} \quad -① $$

$$(u_r) = \frac{(f_r * x_l - B)}{D} \quad -② $$

By solving Eq ① & ② we get

$$x_l = \frac{u_l * D}{f_l} \quad -③ $$

By substituting Eq ③ in Eq ② we get

$$D = \frac{B * f_l}{u_l - u_r} \quad -④ $$

Here we define $(u_l - u_r)$ as disparity. 'B' as Baseline measured in meters / centimeters 'f' as focal length measured in pixel units.

The marker is placed at 'D' = 12cm distance from the camera center 'O'.

Baseline 'B' is the translated distance noted to be 35cm

'B' = 35cm

The focal length 'f' of the camera considered is 'f = 0.337 cm

from this equation (4) disparity can be calculated as follows

$$u_1 - u_2 = \frac{B * f}{D}$$

$$= \frac{35 \cdot 0.337}{12}$$

$$= 2.88 \text{ cm}$$