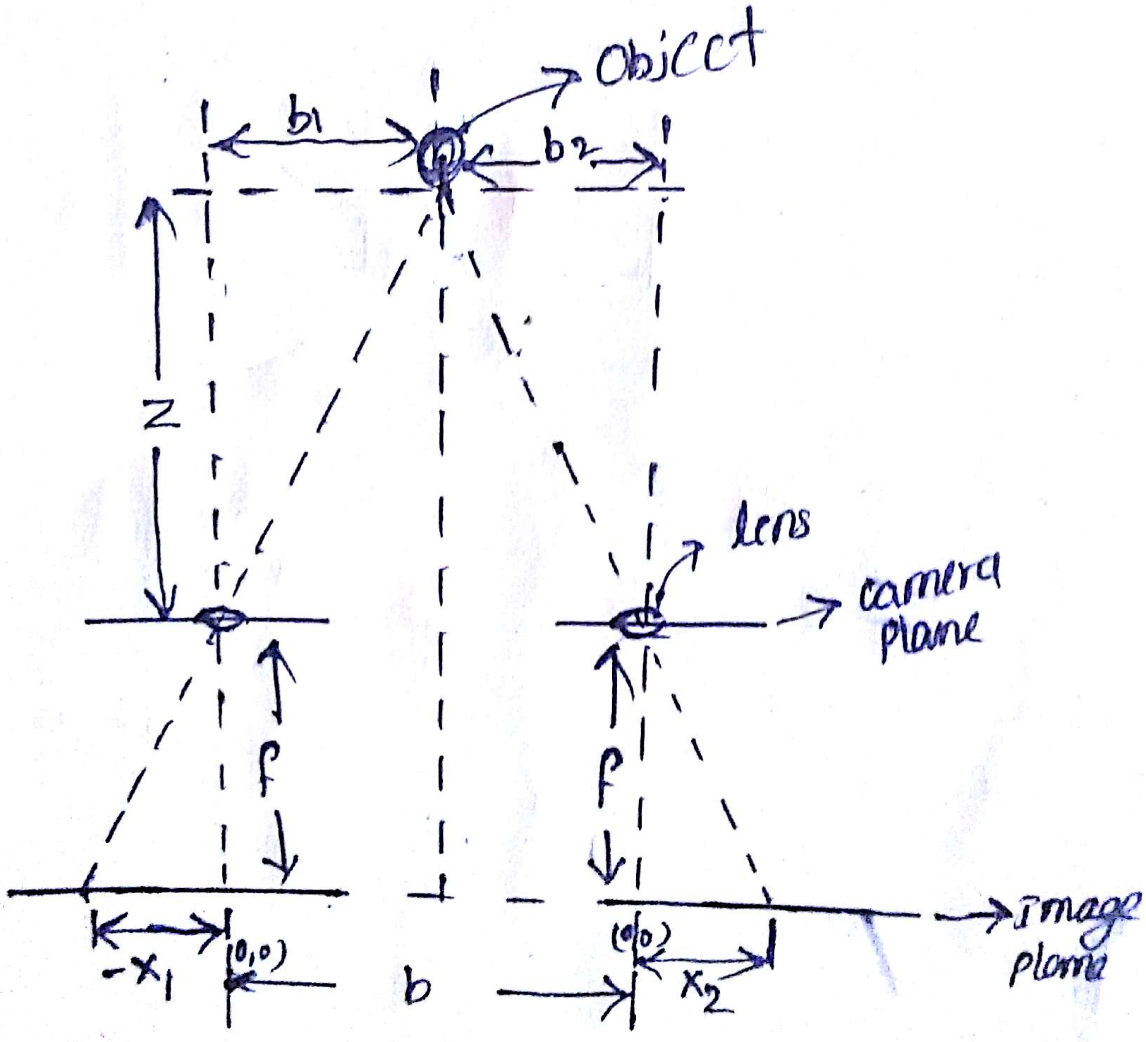
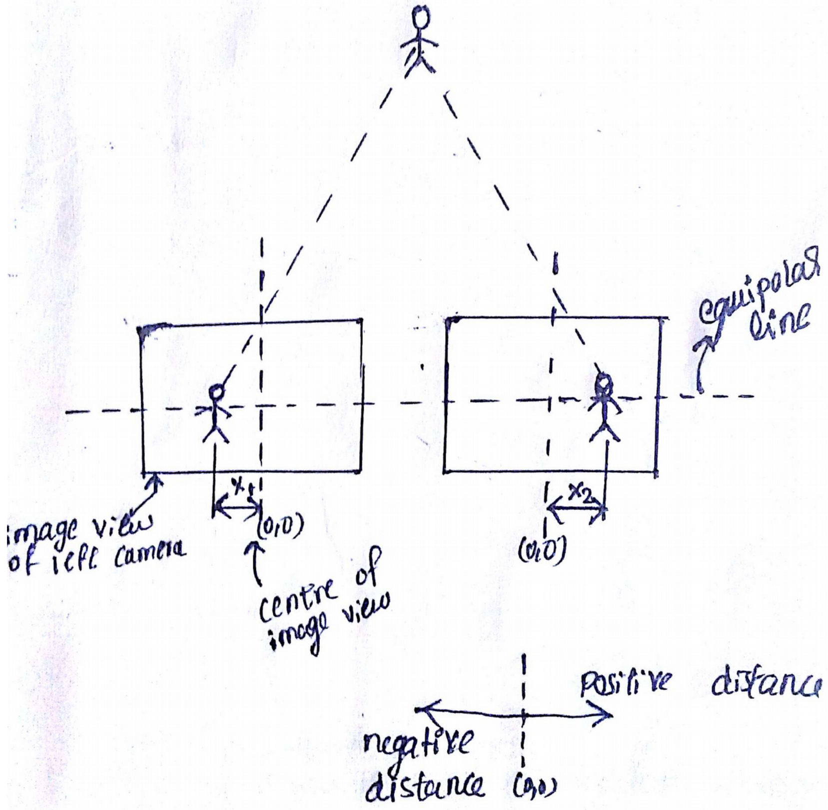
Stereo vision





$$\frac{b_1}{-x_1} = \frac{Z}{f} \qquad \frac{b_2}{x_2} = \frac{Z}{f}$$

$$b_1 = \frac{Z}{f}(-x_1) \qquad b_2 = x_2 \frac{Z}{f}$$

$$b = b_1 + b_2 = \frac{Z}{f}(-x_1) + \frac{Z}{f} x_2$$

$$= \frac{Z}{f}(x_2 - x_1)$$

$$\boxed{Z = \frac{bf}{(x_2 - x_1)}}$$

$(x_2 - x_1) \rightarrow$ disparity

$$Z \propto \frac{1}{\text{disparity}}$$

“Z” is the requied distance from the target object to the stereo camera system.Form the above equation it is clear that to determine the “Z” we need focal length(f) ,base distance between two cameras(b) and the disparity value(X2-X1).

Condition:
Cameras used for stereo vision should have same focal length and same field of vision. (Note: use same kind of cameras, otherwise result may be wrong).

Steps:

1.Arrange two cameras as shown in figure given below

2.To get focal length use the ROS based camera calibration method
http://wiki.ros.org/camera_calibration/Tutorials/StereoCalibration

3.Then isolate a particular object from the two images(left and right camera images) based on their colour by open cv threshold method.Then find their centre coordinates in both the images(assumption is that these two centres are in equipolar line).

4.These centres are X1 and X2 shown in the first image.Then find the disparity.

5. Use the equations described before to find “Z”.

(Note:The colour based isolating method won’t be working for all the cases.So we tried SIFT algorithm(available in open cv) to find the equiploar points in one pair of images but it was slow.)