task 1

1a

We use equation (1) and (2) given in the assignment with the two points v_1 and v_0 which is chosen such that $v_1 - v_0 = 220$ px. We then get

$$220 = \frac{f_y}{Z} \Rightarrow Z = 5 \tag{1}$$

1b

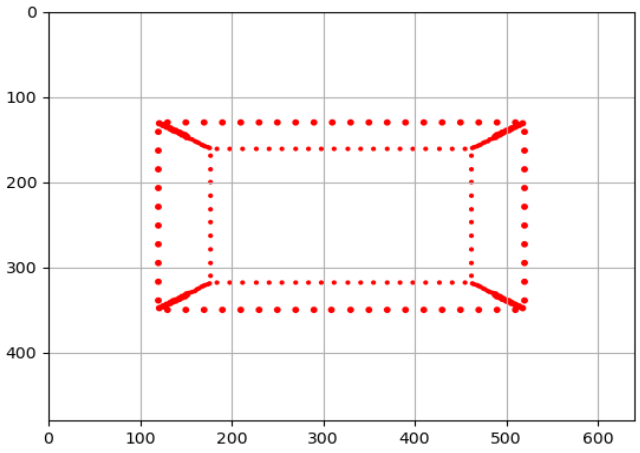

Figure 1: Simulated pinhole camera

1c

Looking at the figure we see a correct transformation would be to first translate the box 5 meters along z, then rotate it about x by θ, then about y with θ degrees.

$$T_o^c = T_z(z_m)R_x(\theta)R_y(\theta) \tag{2}$$

1d

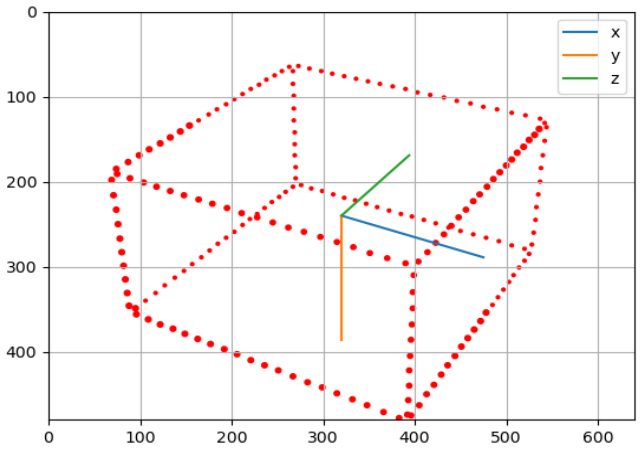

Figure 2: Rotated box

Task 2

2a

We define four points in the coordinates (0,0), (0,0.1145),(0,1145,0.1145),(0.1145,0) in the platform frame.

2b

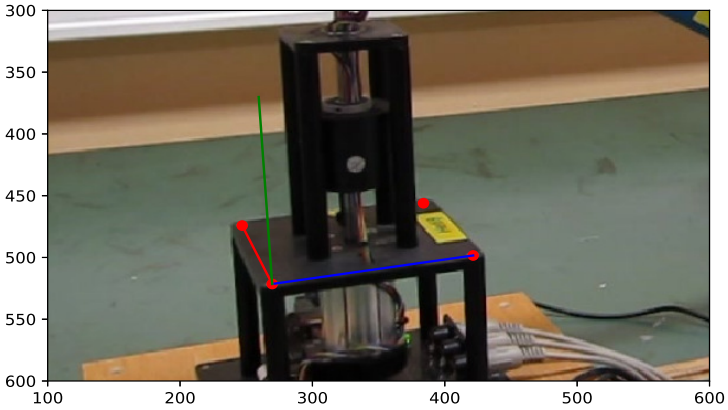

Figure 3: Platform coordinate frame

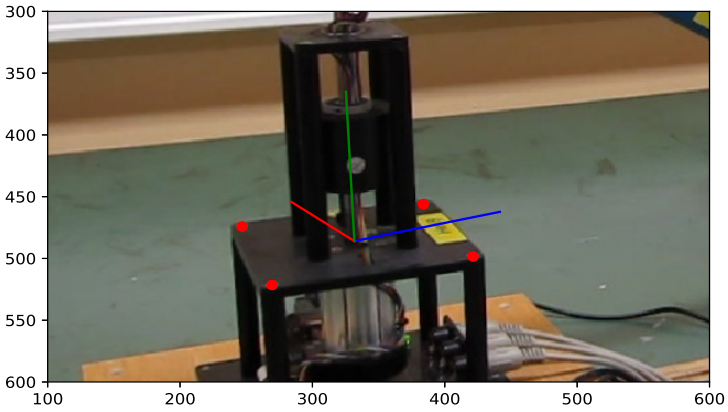

Figure 4: Base coordinate frame

2c

$$T_{base}^{platform} = T_x(t_x)T_y(t_y)R_z(\psi) \tag{3}$$

2d

$$T_{base}^{hinge} = T_z t_z R_y(\theta) \tag{4}$$
$$T_{arm}^{hinge} = T_z(-5.52) \tag{5}$$

2e

$$T_{rotors}^{arm} = T_x(t_x) T_z(-3.12) R_x(\theta) \tag{6}$$

Values are given in the task and are used in the recreation of figure 7.

2f

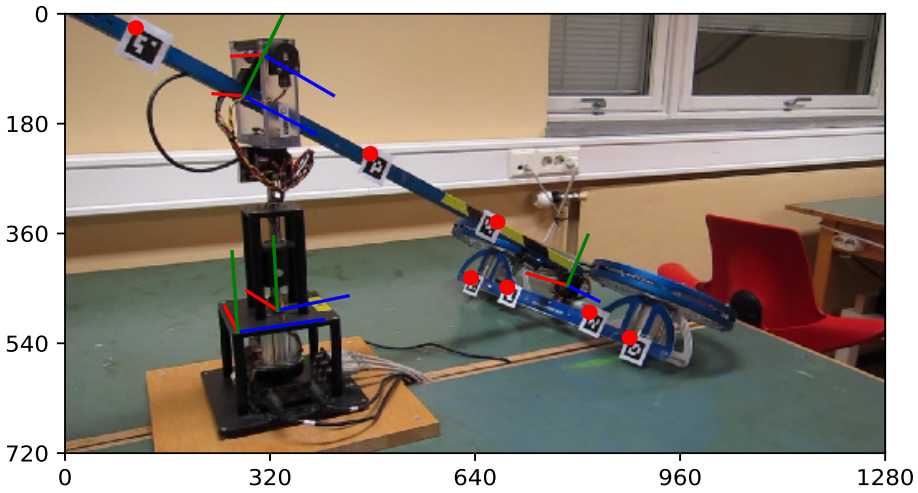

Figure 5: All coordinate frames on helicopter