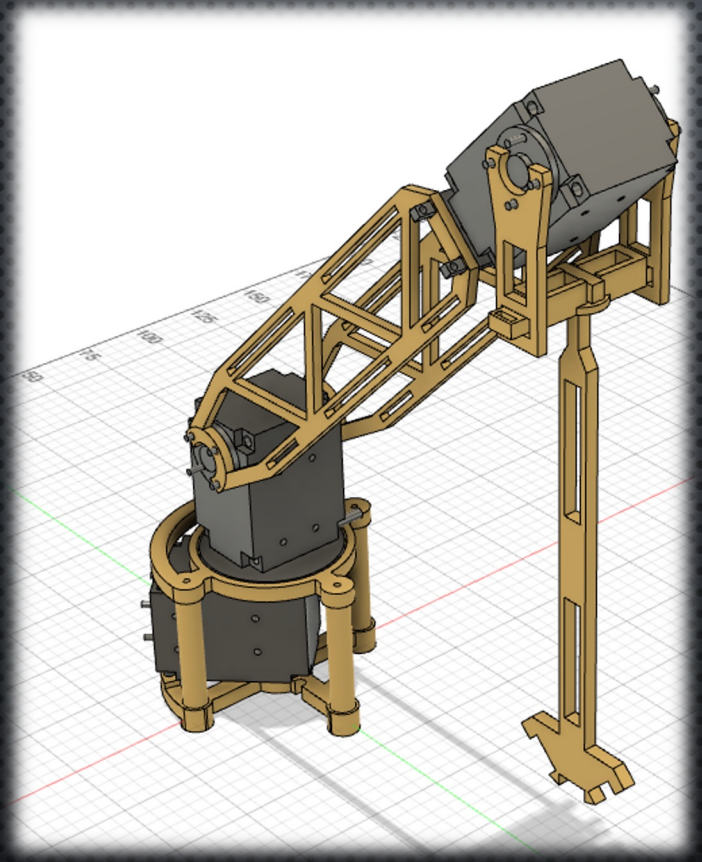
ROBOTSKA RUKA

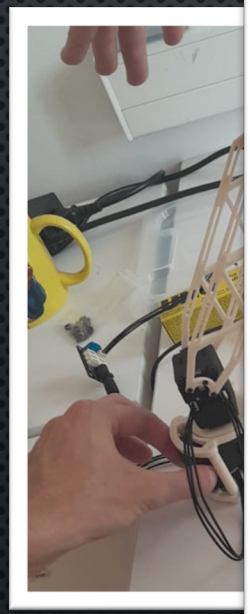
VIKTOR HORVAT

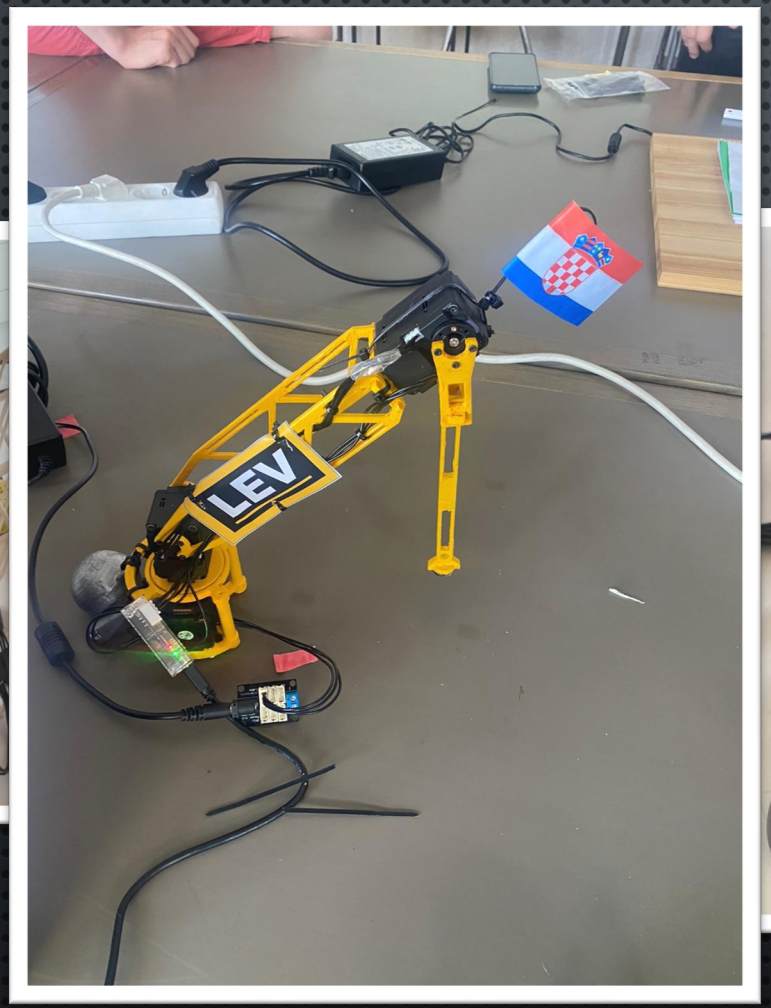
LOVRE GRAŠO

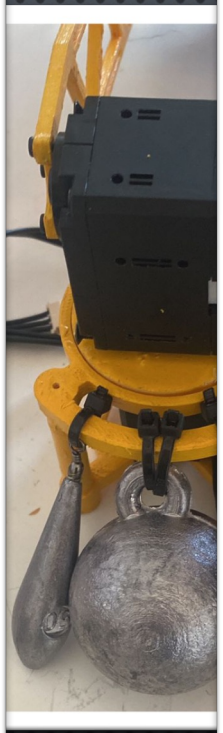
ENIO KRIZMAN

1. FAZA: IZRADA MODELA U FUSION 360



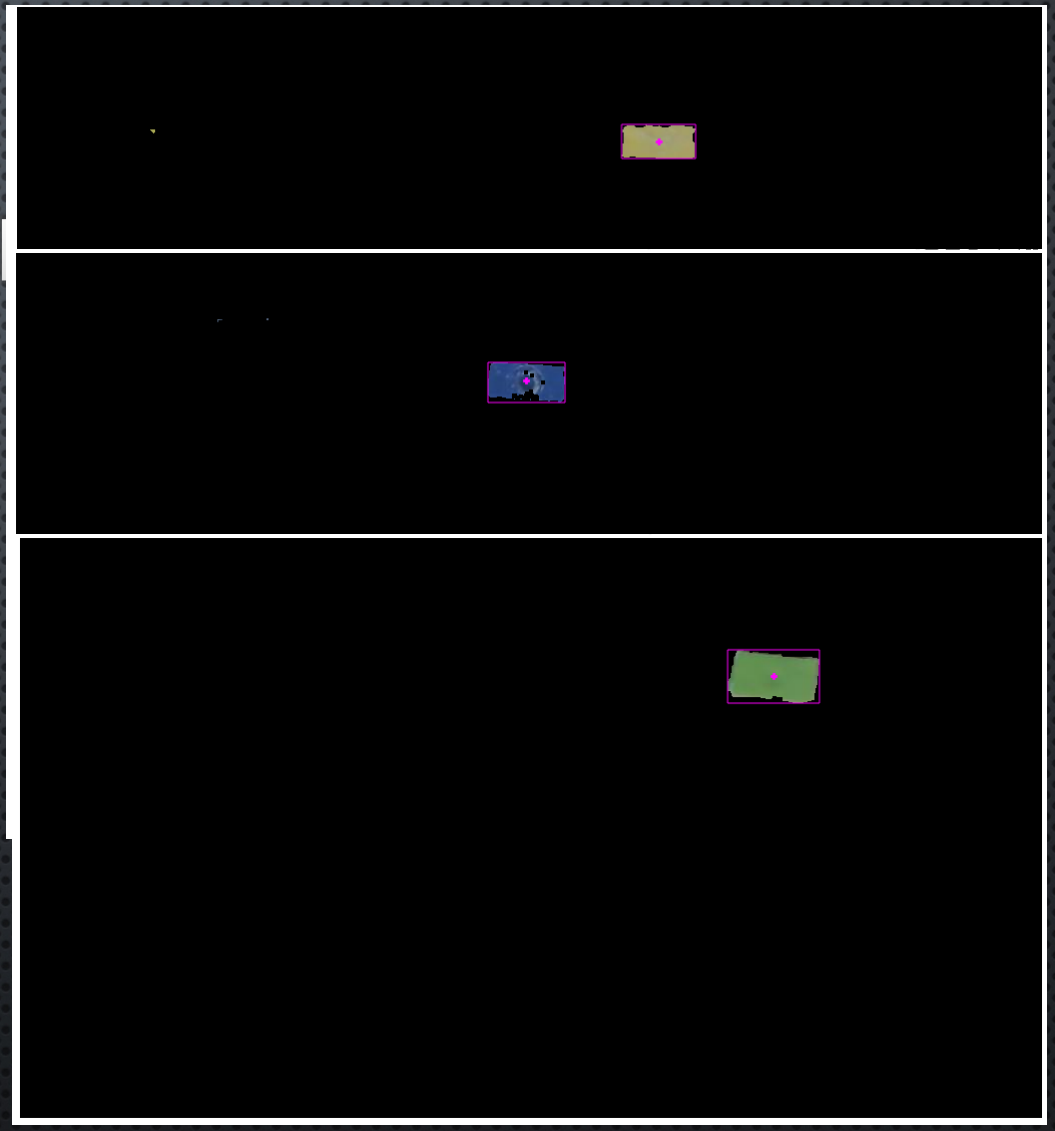



LEV

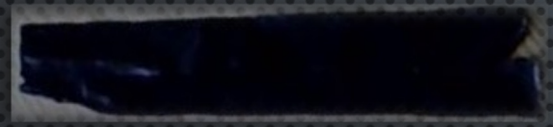



LEV

SEGMENTACIJA KOCKICA-

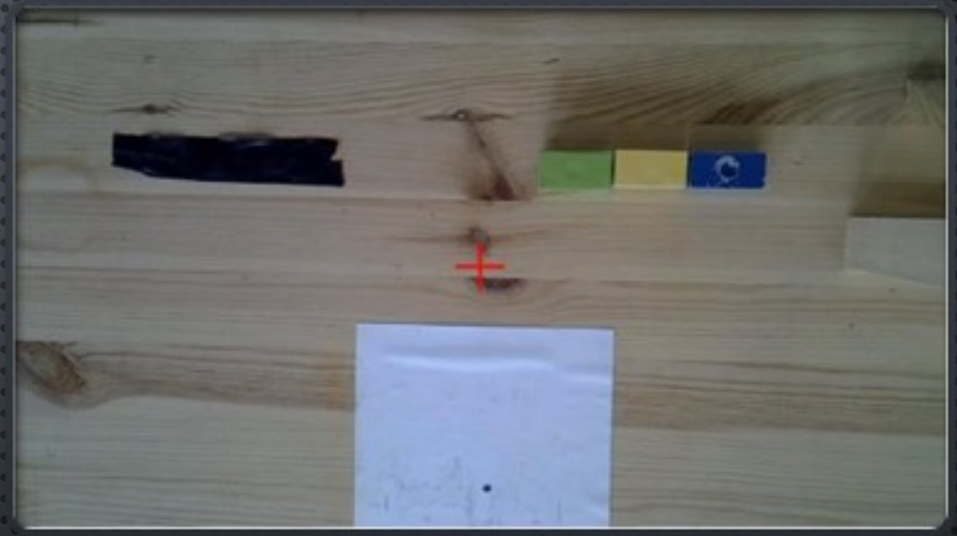


SEGMENTACIJA TRAKE-METODA REGISTRACIJE SLIKE



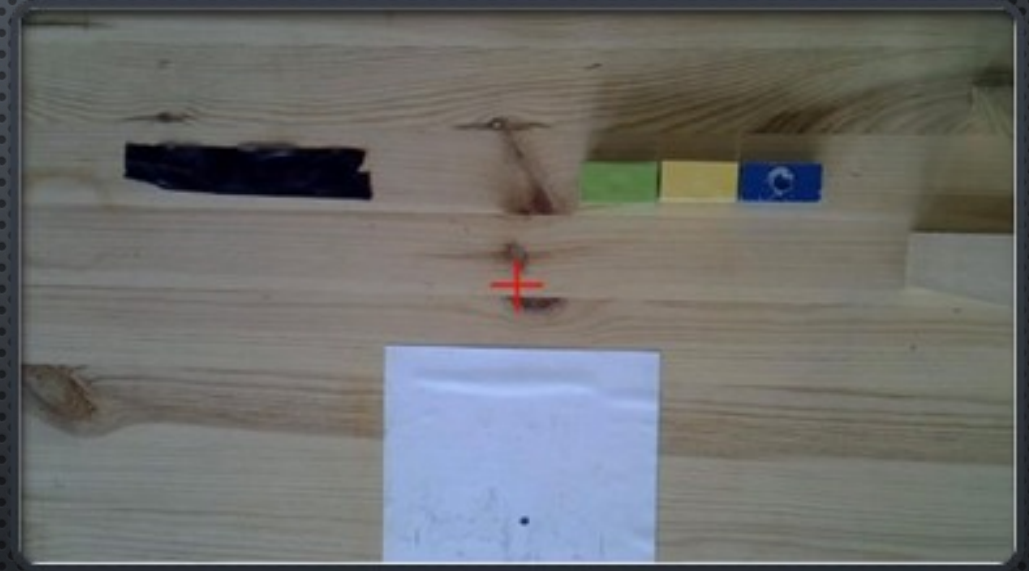
ROBOTSKA VIZIJA - RAČUNANJE INTRINZIČNIH PARAMETARA

- Kamera – Logitech C270 1024x576
- Cx = 1024/2, Cy = 576/2 = 288
- Xcam, Yxam – udaljenost objekta od kamere
- Z = 590 mm
- fx = (Z/Xcam)*(U – Cx), fy = (Z/Ycam)*(V-Cy)
- fx = 1154.087 fy = 1114.444



ROBOTSKA VIZIJA – MATRICA T_0^C

$$T_0^C = \begin{bmatrix} 1 & 0 & 0 & 10 \\ 0 & -1 & 0 & 130 \\ 0 & 0 & -1 & 590 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$



ROBOTSKA VIZIJA

- Centroid_camera_h - odnos između kamere i objekta
- T_world_camera – odnos između kamere i robota
- Centroid_world_h = odnos između robota i objekta
- $T_0^O = T_0^C * T_C^O$

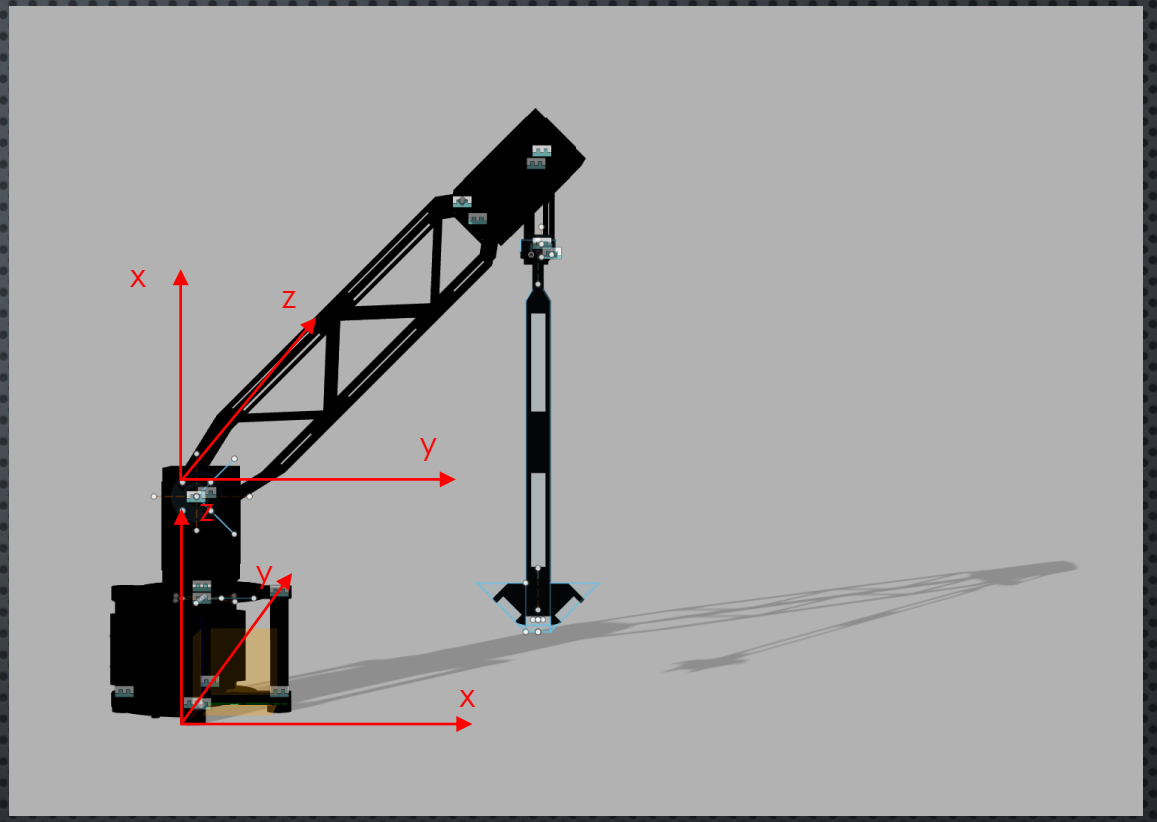
```
%%

cx = 512;
cy = 288;
fx = 1154.087;
fy = 1114.444;

z = 590;
x = (z/fx)*(u - cx);
y = (z/fy)*(v - cy);

x_camera = [x]
y_camera = [y]
z_camera = [z]
```

```
%%
% convert to homogeneous coordinates
centroid_camera_h = [x_camera; y_camera; z_camera; 1];

% calculate centroid in world coordinate frame
orientation_from_world = [1 0 0; 0 -1 0; 0 0 -1];
location_from_world = [10 130 590]
T_world_camera = [orientation_from_world, location_from_world'; 0 0 0 1];

centroid_world_h = T_world_camera * centroid_camera_h;
centroid_world = centroid_world_h(1:3,1)
```

DIREKTNA KINEMATIKA 1

- radi se o homogenoj transformaciji
- **T0T** = T01*T12*T2T
- **T01** =

$$\begin{array}{c} \\ x0 \\ y0 \\ z0 \end{array} \begin{array}{c} \begin{array}{cccc} x1 & y1 & z1 & \end{array} \\ \begin{bmatrix} 0 & C1 & -S1 & 0 \\ 0 & S1 & C1 & 0 \\ 1 & 0 & 1 & a1 \\ 0 & 0 & 0 & 1 \end{bmatrix} \end{array}$$

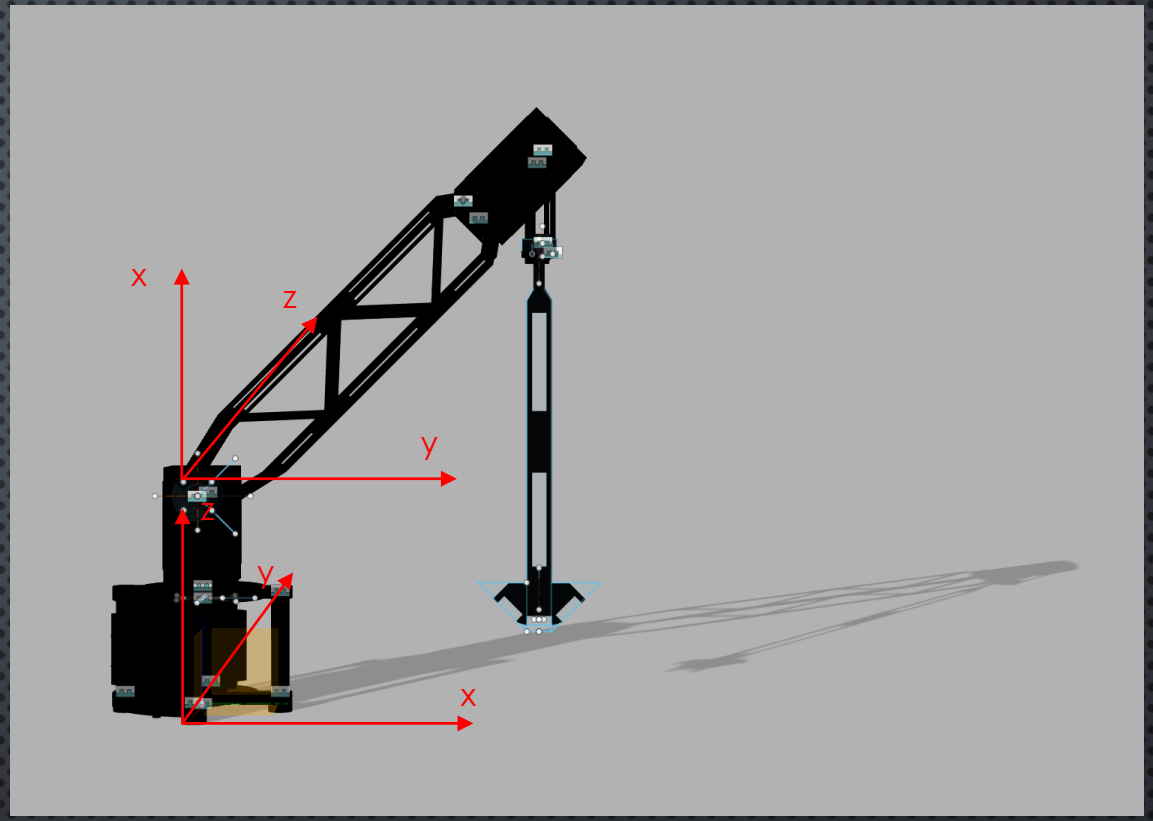


DIREKTNA KINEMATIKA 2

$$T12 = \begin{bmatrix} C2 & -S2 & 0 & a2C2 \\ S2 & S1 & 0 & a2S2 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

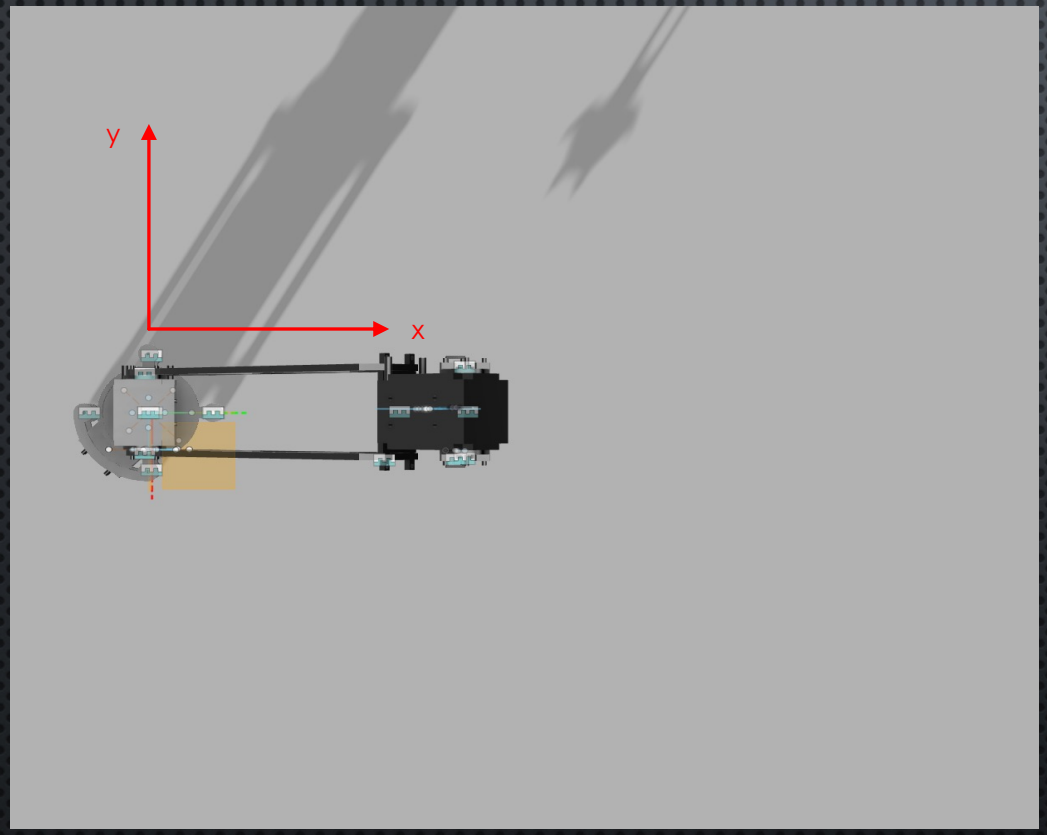
$$T2T = \begin{bmatrix} -S4 & 0 & C4 & a3C3 \\ C4 & 0 & S4 & a3S3 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

T0T = T01*T12*T2T



$$T0T = \begin{bmatrix} \boldsymbol{C23C1} & \boldsymbol{-S1} & \boldsymbol{S23C1} & \boldsymbol{C1(a3S23 + a2S2)} \\ \boldsymbol{C23S1} & \boldsymbol{C1} & \boldsymbol{S23S1} & \boldsymbol{S1(a3S23 + a2S2)} \\ \boldsymbol{-S23} & \boldsymbol{0} & \boldsymbol{C23} & \boldsymbol{a1 + a3C23 + a2C2} \\ \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{1} \end{bmatrix}$$

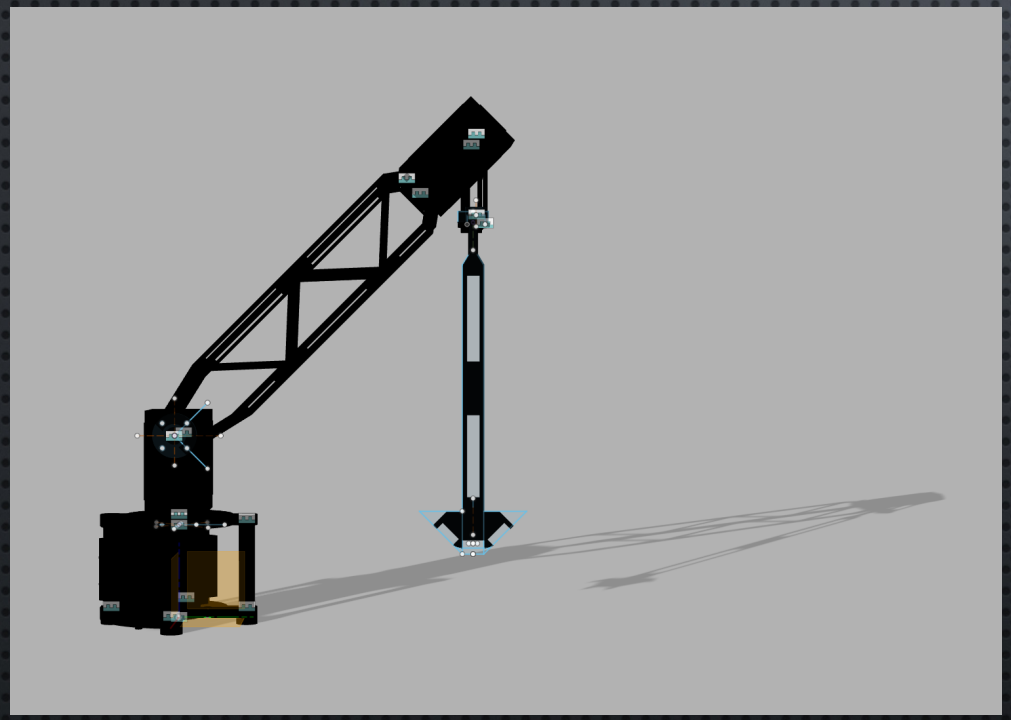
INVERZNA KINEMATIKA 1



- cilj je dobiti poziciju svakog od 3 motora, ovisno o zadanoj krajnjoj koordinati u 3D prostoru

```
q1 = atan2(y, x);
```

INVERZNA KINEMATIKA 2



```
r1 = sqrt(x^2+y^2)
r2 = z - a1

fi2 = atan2(r2, r1)
r3 = sqrt(r2^2+r1^2)

fi1 = acos((a3^2 - a2^2 -
r3^2)/(-2*a2*r3))
q2 = pi/2 - (fi1+fi2)

fi3 = acos((r3^2-a2^2 -a3^2)/(-
2*a2*a3))
q3=pi-fi3
```

GRAFIČKO SUČELJE

- jednostavno upravljanje robotom
- interaktivno