

# Crazy Dog Report

Github: [https://github.com/alexlee511/crazydog\\_robot.git](https://github.com/alexlee511/crazydog_robot.git)

```
A_c = np.array([
    [0.0, 1.0,          0.0,          0.0],
    [0.0, 0.0, (m * g) / M,          0.0],
    [0.0, 0.0,          0.0,          1.0],
    [0.0, 0.0, g * (M + m) / (l * M), 0.0]
])
```

```
B_c = np.array([
    [0.0],
    [1.0 / M],
    [0.0],
    [1.0 / (l * M)]
])
```

```
# LQR weighting matrices (can be tuned further)
Q = np.diag([0.5, 0.1, 150.0, 20.0])    # x, x_dot, theta, theta_dot
R = np.array([[0.5]])
```

$g = 9.8$

```
Mw_single = 0.28      # Mass of a single wheel [kg]

m_body     = 7.08      # Body mass [kg]

l          = 0.37      # Distance from wheel axle to body COM [m]

r          = 0.07      # Wheel radius [m]

# Equivalent "base mass" (two wheels + rotational inertia equivalent)

#  $2*M + 2*(1/2*M) = 3M \approx 0.84 \text{ kg}$ 

M_base = 3.0 * Mw_single

M = M_base      # Cart mass

m = m_body      # Pendulum mass

# Euler discretization

A = np.eye(4) + dt * A_c

B = dt * B_c

K, P, eigVals = dlqr(A, B, Q, R)
```

