Torque Calculation for Robotic Arm

This report presents the torque calculations required for each joint in a robotic arm to lift a load of 1 kg, as shown in the provided diagram. The robotic arm consists of two segments: the first is 10 cm and the second is 15 cm long, resulting in a total reach of 25 cm from the base to the gripper.

# Parameters:

- Length of first arm segment: 10 cm = 0.1 m  
- Length of second arm segment: 15 cm = 0.15 m  
- Total reach from base to end effector: 25 cm = 0.25 m  
- Load weight: 1 kg  
- Gravitational acceleration: 9.81 m/s²  
- Force due to load: F = m \* g = 1 \* 9.81 = 9.81 N

# Torque Calculations:

## 1. Torque at Joint 1 (Base):

This joint supports the entire arm and the 1 kg load.  
Distance from base to the load: 0.25 m  
Torque = Force × Distance = 9.81 N × 0.25 m = 2.4525 Nm

## 2. Torque at Joint 2 (Elbow):

This joint only supports the load at the end of the second segment.  
Distance from joint to the load: 0.15 m  
Torque = Force × Distance = 9.81 N × 0.15 m = 1.4715 Nm

# Discussion:

- What if we replace the 1 kg load with a 2 kg load?  
 - The required torque would double at each joint, becoming 4.905 Nm at Joint 1 and 2.943 Nm at Joint 2.  
- Potential drawbacks of using this arm design for heavier loads:  
 - Overloading the motors.  
 - Decreased precision and stability.  
 - Increased power consumption.  
- Possible solutions:  
 - Use gear reduction to increase torque.  
 - Choose motors with higher torque ratings.  
 - Reduce the arm length or use lighter materials.

# Notes:

- Document your torque calculation method clearly.  
- Include purchase links and specifications for each motor you plan to use.  
- Share your calculations and motor choices on GitHub.