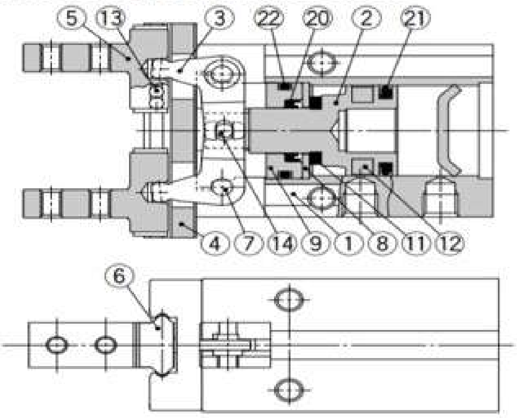
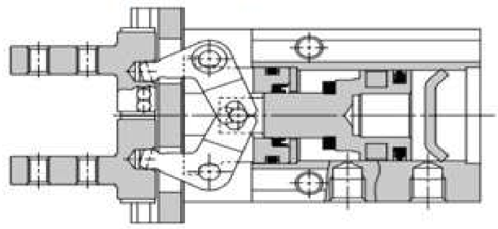
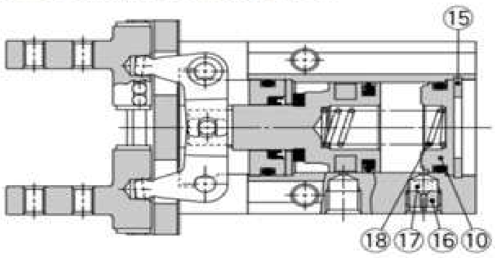
Double acting/With fingers open



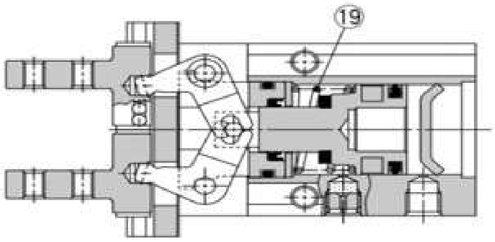
Double acting/With fingers closed



Single acting/Normally open



Single acting/Normally closed

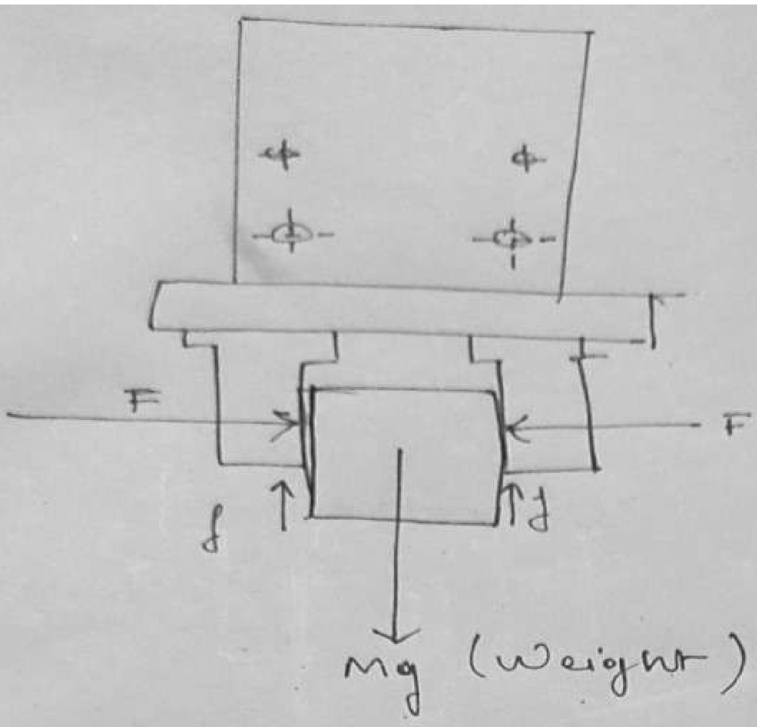


Component Parts

No.	Description	Material	Note
1	**Body**	Aluminum alloy	Hard anodized
2	**Piston**	ø10, ø16: Stainless steel ø20, ø25: Aluminum alloy	ø20, ø25: Hard anodized
3	**Lever**	Stainless steel	Nitriding
4	**Guide**	Stainless steel	Heat treated
5	**Finger**	Stainless steel	Heat treated
6	**Roller stopper**	Stainless steel	
7	**Lever shaft**	Stainless steel	Nitriding
8	**Seal support**	Stainless steel	
9	**Rod cover**	Synthetic resin	
10	**Cap**	Synthetic resin	Single acting/Normally open only
11	**Bumper**	Urethane rubber	

Component Parts

No.	Description	Material	Note
12	**Rubber magnet**	Synthetic rubber	
13	**Steel balls**	High carbon chrome bearing steel	
14	**Needle roller**	High carbon chrome bearing steel	
15	**Type C retaining ring**	Carbon steel	Phosphate coated Single acting/Normally open only
16	**Exhaust plug A**	Brass	Electroless nickel plated
17	**Exhaust filter A**	Polyvinyl formal	
18	**N.O. spring**	Stainless steel spring wire	
19	**N.C. spring**	Stainless steel spring wire	
20	**Rod seal**	NBR	
21	**Piston seal**	NBR	
22	**Gasket**	NBR	



MECHANICS OF GRIPPING FORCE

$f = \mu F$. μ = coefficient of friction.

$F \longrightarrow$ gripping Force.

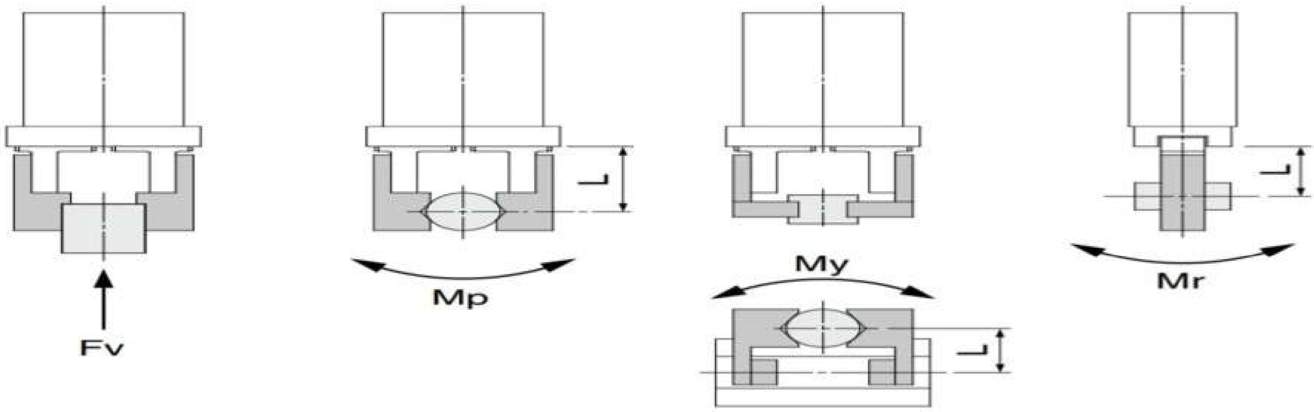
conditions when the workpiece will not drop :—

$2 \times \mu F > mg$.

$F > \dfrac{mg}{2 \times \mu}$.

Now replacing g with a ;

$F > \dfrac{ma}{2 \times \mu}$.



L: Distance to the point at which the load is applied (mm)

Model	Allowable vertical load **Fv** (N)	Maximum allowable moment		
		Pitch moment: **Mp** (N·m)	Yaw moment: **My** (N·m)	Roll moment: **Mr** (N·m)
MHZ□2-6	10	0.04	0.04	0.08
MHZ□2-10	58	0.26	0.26	0.53
MHZ□2-16	98	0.68	0.68	1.36
MHZ□2-20	147	1.32	1.32	2.65
MHZ□2-25	255	1.94	1.94	3.88
MHZ□2-32	343	3	3	6
MHZ□2-40	490	4.5	4.5	9

Note) Values for load and moment in the table indicate static values.

Calculation of allowable external force (when moment load is applied)	Calculation example
Allowable load F (N) = $\dfrac{\textbf{M (maximum allowable moment)(N·m)}}{\textbf{L} \times \underset{*}{\textbf{10}^{-3}}}$ (*: Constant for unit conversion)	When a static load of f = 10 N is operating, which applies pitch moment to point L = 30 mm from the MHZ□2-16D guide. Therefore, it can be used. **Allowable load F =** $\dfrac{\textbf{0.68}}{\textbf{30} \times \textbf{10}^{-3}}$ **= 22.7 (N)** **Load f = 10 (N) < 22.7 (N)**

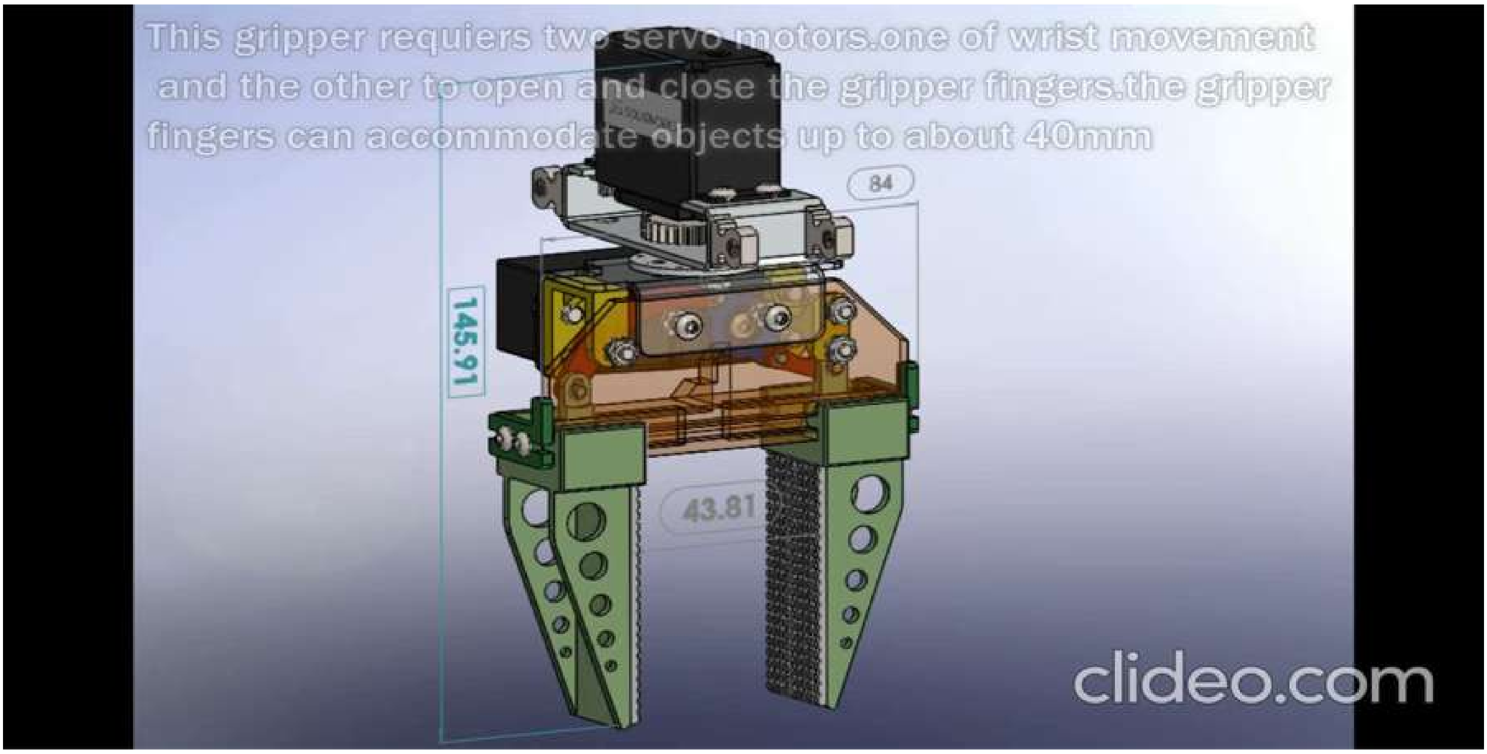
Gripping force

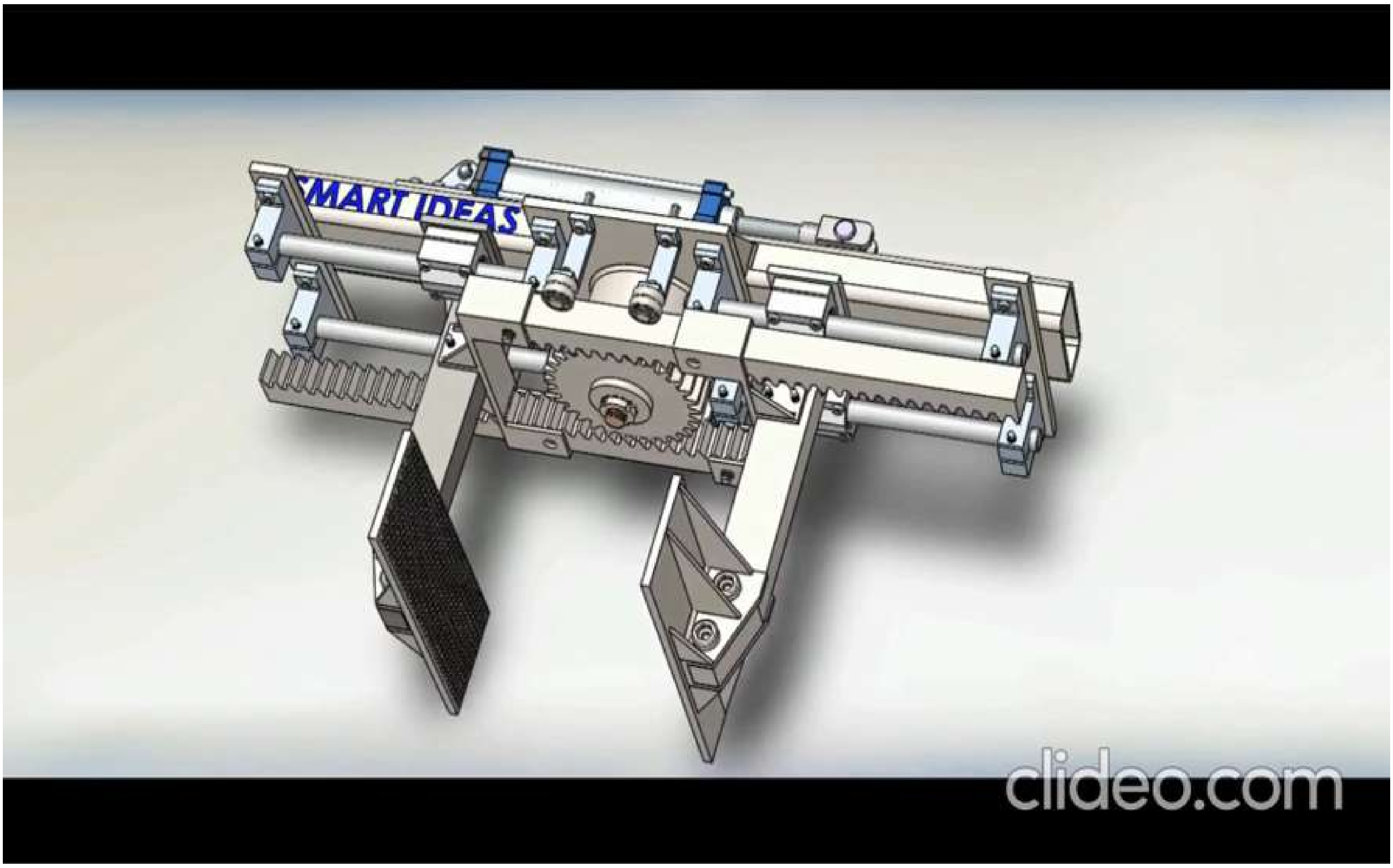
Gripping force is the force exerted by the gripper fingers on the workpiece. This force can differ depending upon the air pressure, coefficient of friction and gripping conditions between fingers and the work piece. The gripping force for just frictional holding when the work piece does not drop when gripped is calculated as:

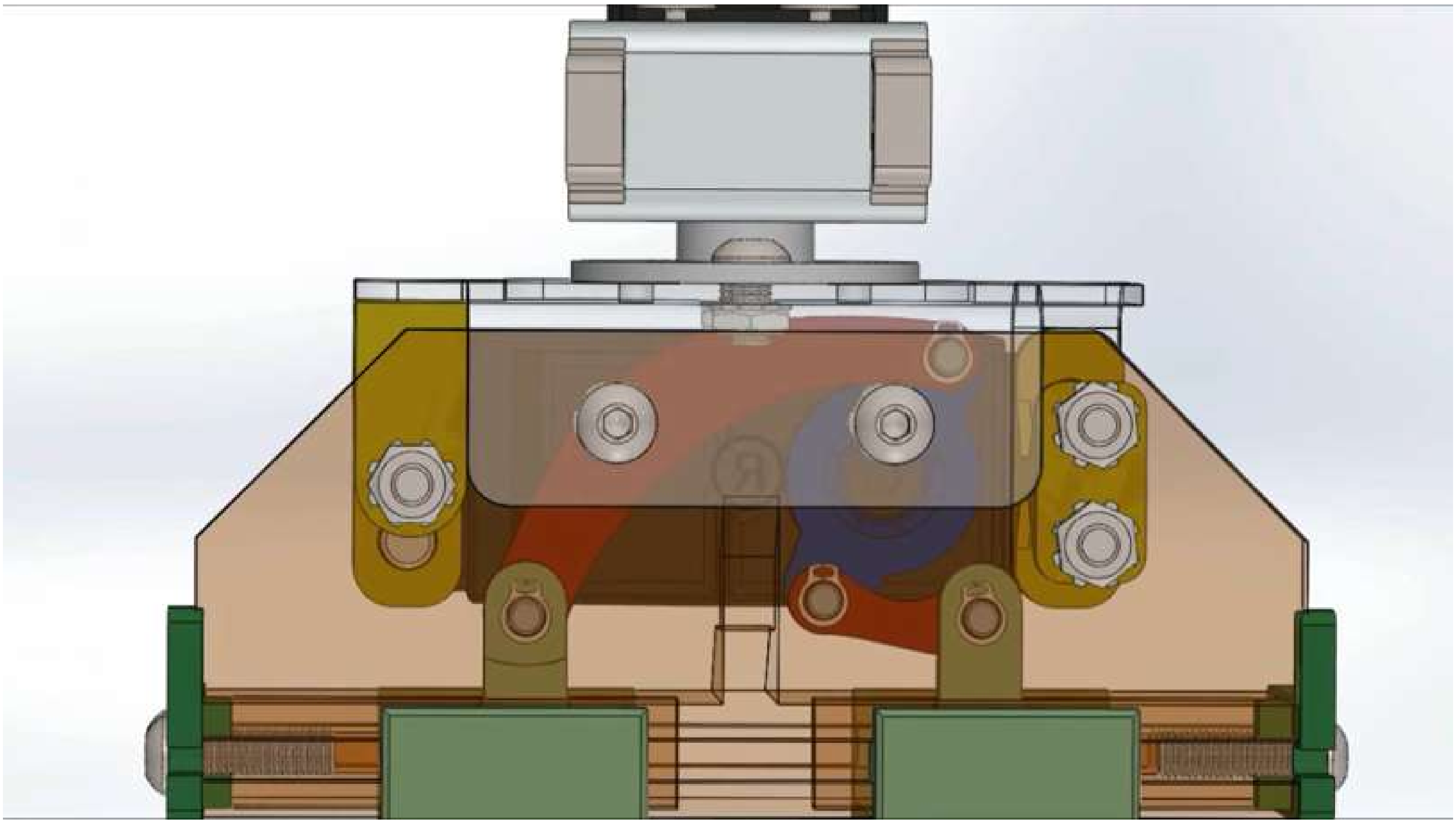
$$F \geq \frac{m \times g \times a}{n \times \mu} \times S$$

Where:

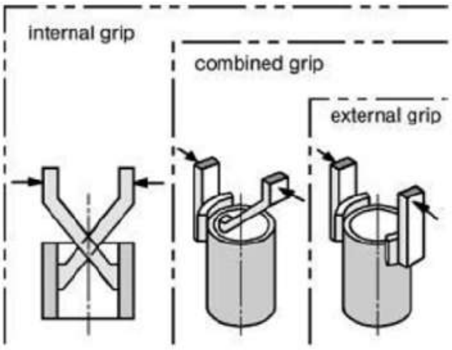
- F = Gripping force of a single finger (N)
- m= Mass of the workpiece (kg)
- g = Gravitational acceleration (9.81 m/s^2)
- a = Acceleration from dynamic movement (m/s^2)
- n = Number of fingers (n=2 for two-finger gripper; n=3 for three finger gripper)
- μ = Coefficient of friction
- S = Safety factor


This gripper requiers two servo motors.one of wrist movement
and the other to open and close the gripper fingers.the gripper
fingers can accommodate objects up to about 40mm
84
145.91
43.81
clideo.com


SMART IDEAS
clideo.com



The beauty about Adaptive Grippers is the fact that there is no need to adapt the gripper to the applications. In fact, as most of the grippers out there need to have custom fingers created for each object they grasp. The Adaptive Grippers can generally use the same fingertips for any grasping position. All the Grippers can perform internal, external and combined grasping manipulations. An external grip would take hold of a box by its outside surfaces or geometries. The internal grip is usually used when a cylinder is grasped by its internal surface or diameter. A combined grip would be a combination of internal and external contact.



For example, a C-Channel rail might not be able to be grasped by its internal geometries, because this would be unstable and it might be too large to use the external grip. This is where the combined grasp is practical. In fact, the Adaptive Gripper can pick up even a thin wall surface and carry the C-Channel without any problem. Thanks to its slim fingers, it can go into a wide range of places and geometries.

External and internal gripping

Based on the type of grip, pneumatic grippers can be categorized as internal, external, or combined. Examples are discussed below and shown in Figure 4.

- Internal gripping: Internal grippers use opening force to hold the part and grips the object through its internal surface.
- External gripping: External grippers use the closing force to hold the work piece and grip the object from the outer surface. It is the most common gripping mechanism.
- Combined gripping: Uses a combination of external and internal gripping.

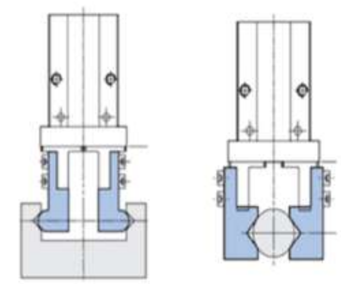


Figure 4: Types of pneumatic grippers based on gripping mechanism: internal gripping (left) and

Sensors

Sensors can be installed alongside pneumatic grippers to monitor and control the operating position of the fingers. Sensor switches or proximity sensors can be installed on the pneumatic grippers. They can be inserted into the grooves present in the body as seen in Figure 7. These sensors can detect the open or closed position of the fingers. Proximity sensors can detect the proximity by sensing the object and provide the information back to the controller.

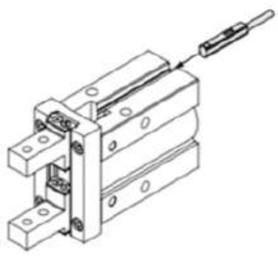
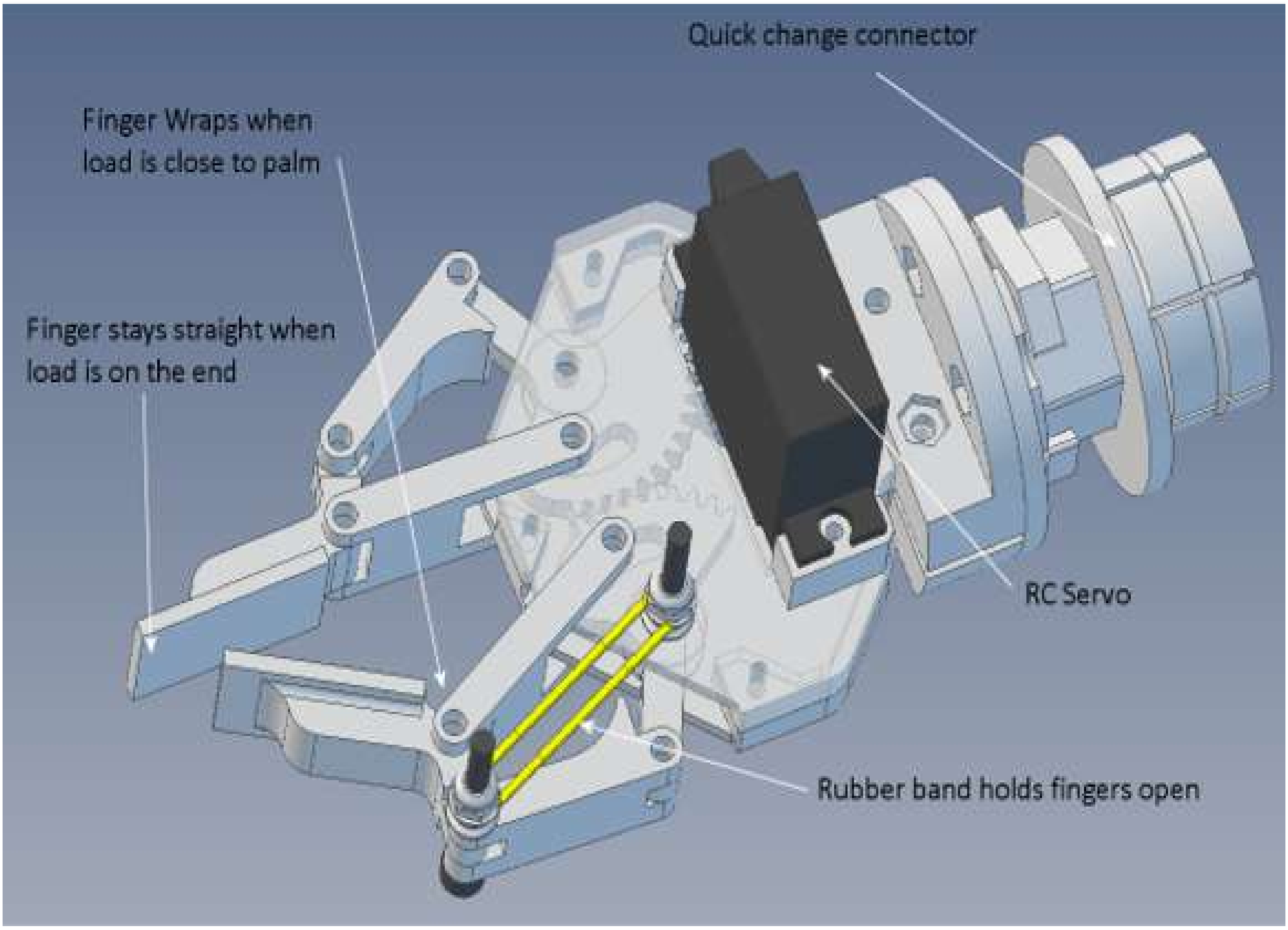
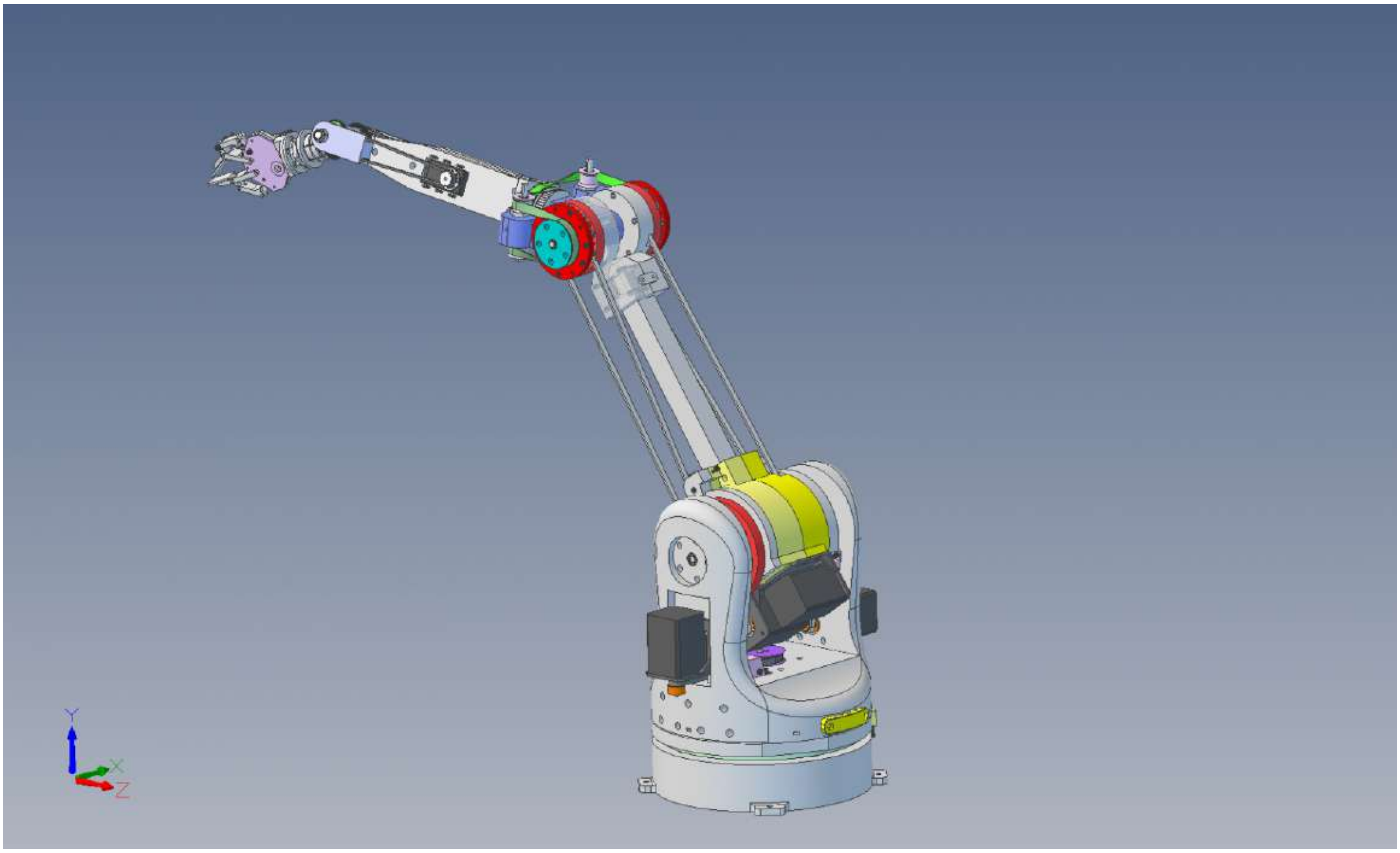


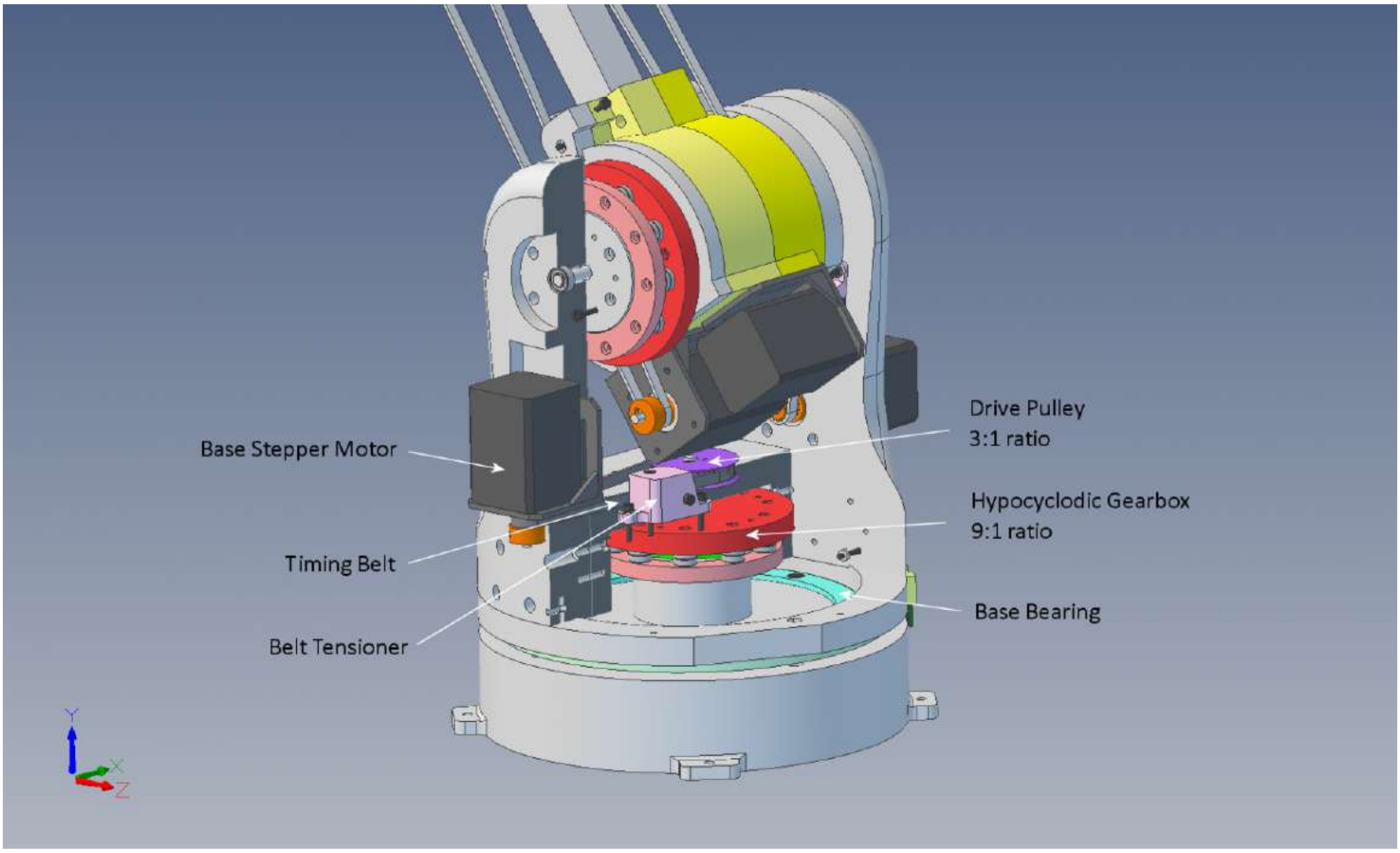
Figure 7: Installing sensor switch

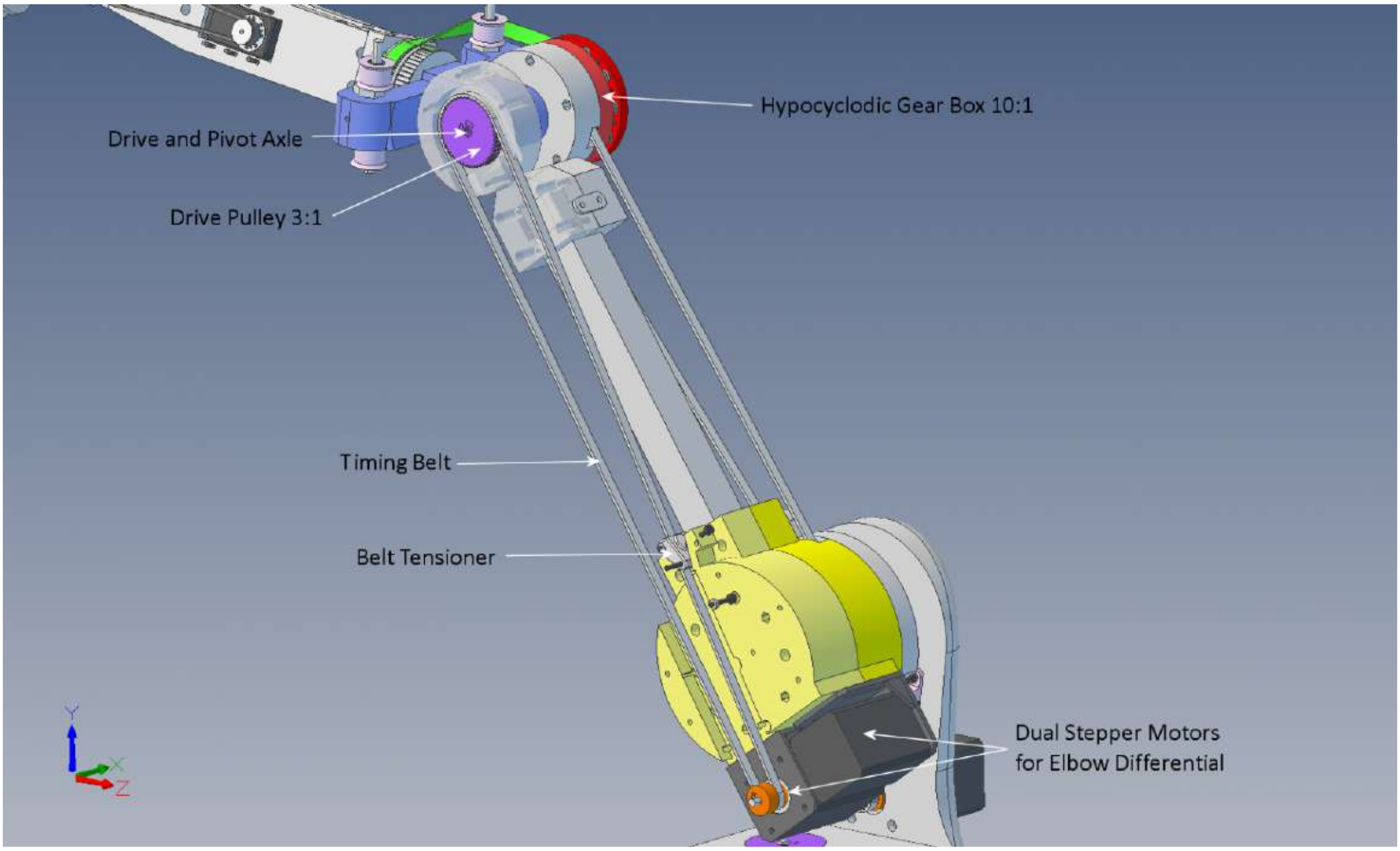
Selection criteria

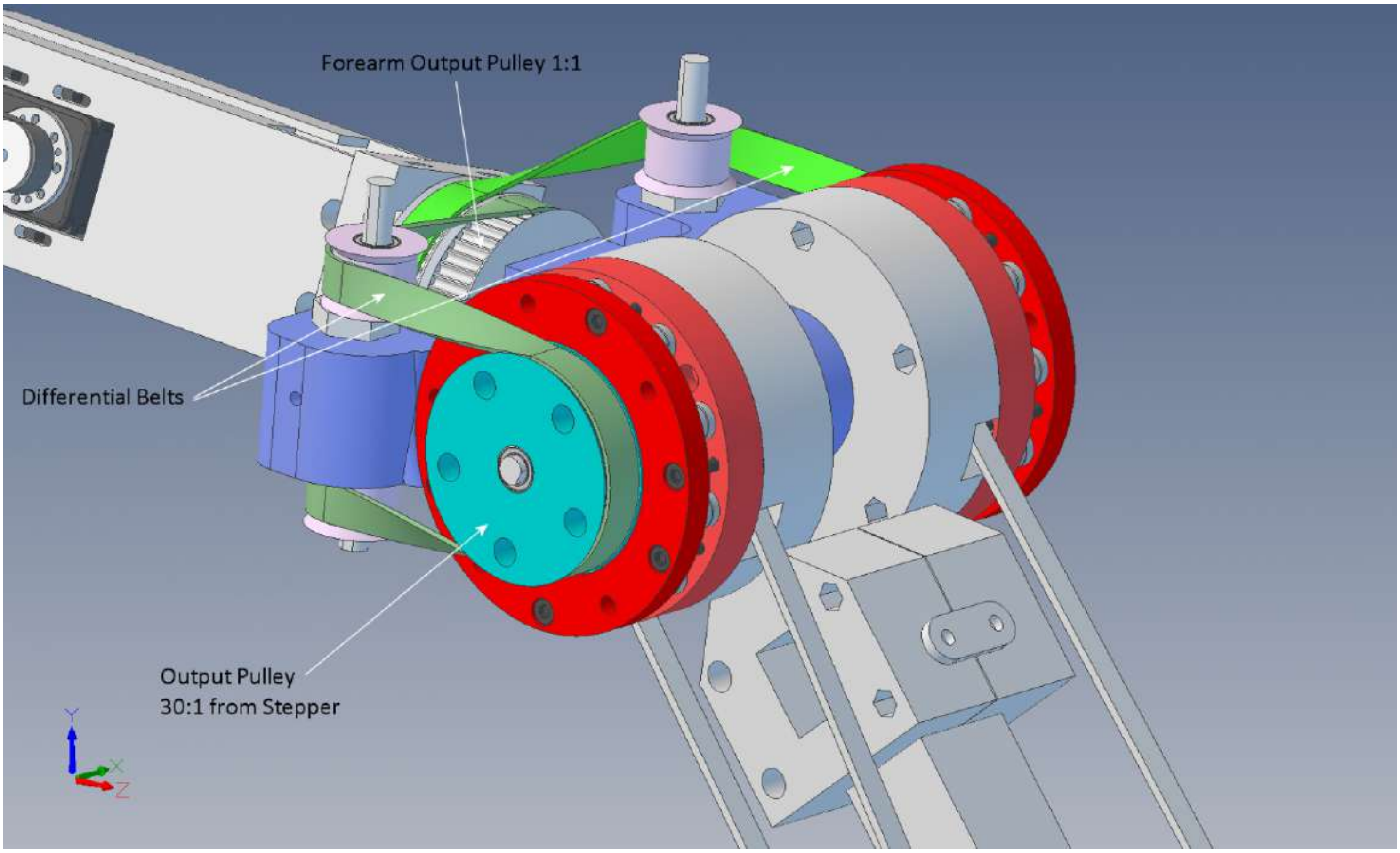
1) **Gripping force:** The effective gripping force can be calculated using the formula in this article.
2) **Workpiece weight:** The gripping force must be able to support the weight of the workpiece during the operation.
3) **Air pressure:** Air pressure should be considered as it has direct effect upon the gripping force and influences the gripper sizing.
4) **Configuration of work piece:** The shape of the work piece will help to determine whether 2 or 3 finger grippers can be used. 2 finger grippers are commonly used and can be used for wide variety of objects. 3 finger grippers are suitable for round or cylindrical objects.
5) **Type of gripper:** The gripper may have external or internal grip depending upon the workpiece.
6) **Environment:** Pneumatic grippers should be selected based on the operating environment. Grippers designed for clean environments may fail in harsh environments.

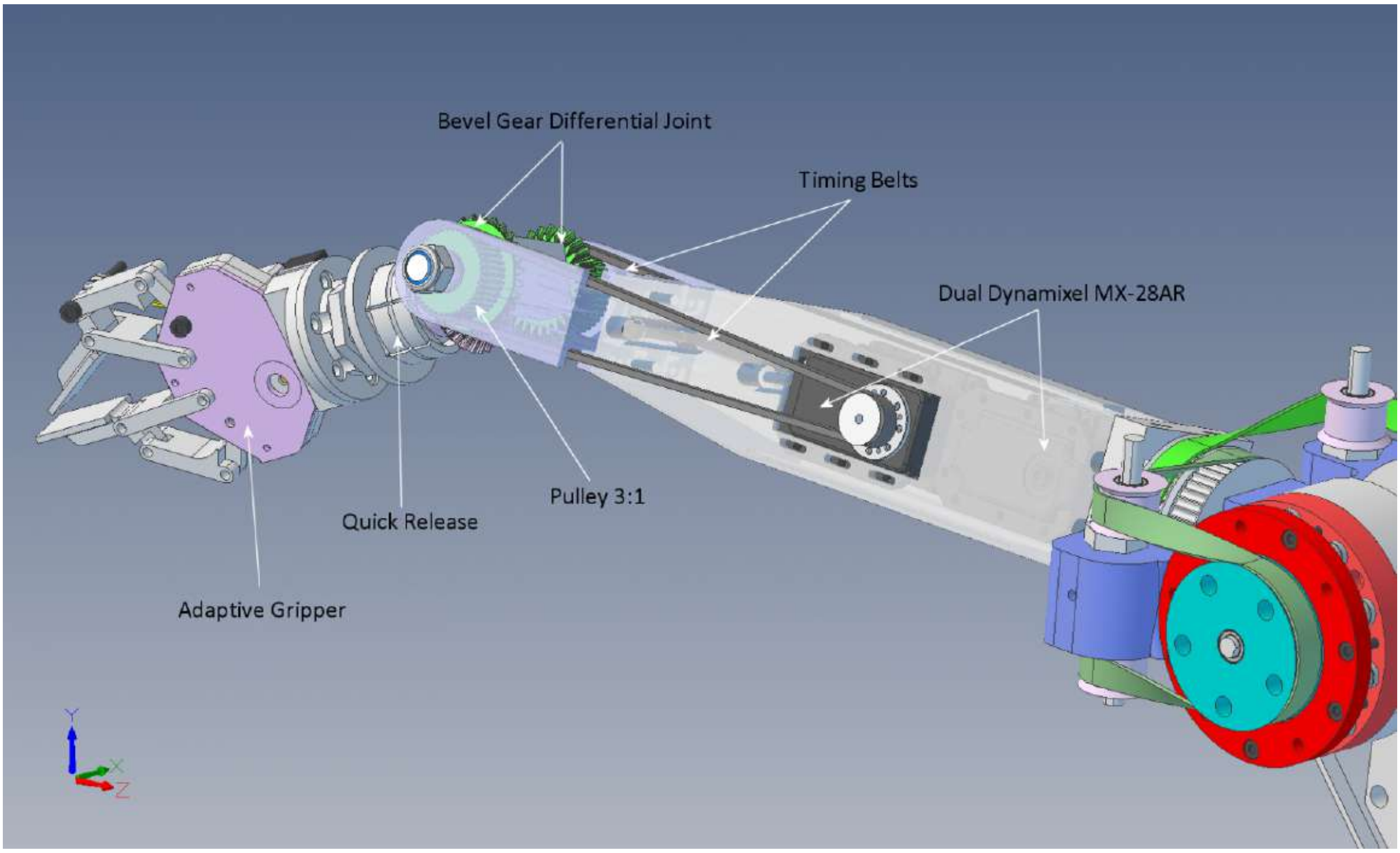

Quick change connector
Finger Wraps when
load is close to palm
Finger stays straight when
load is on the end
RC Servo
Rubber band holds fingers open

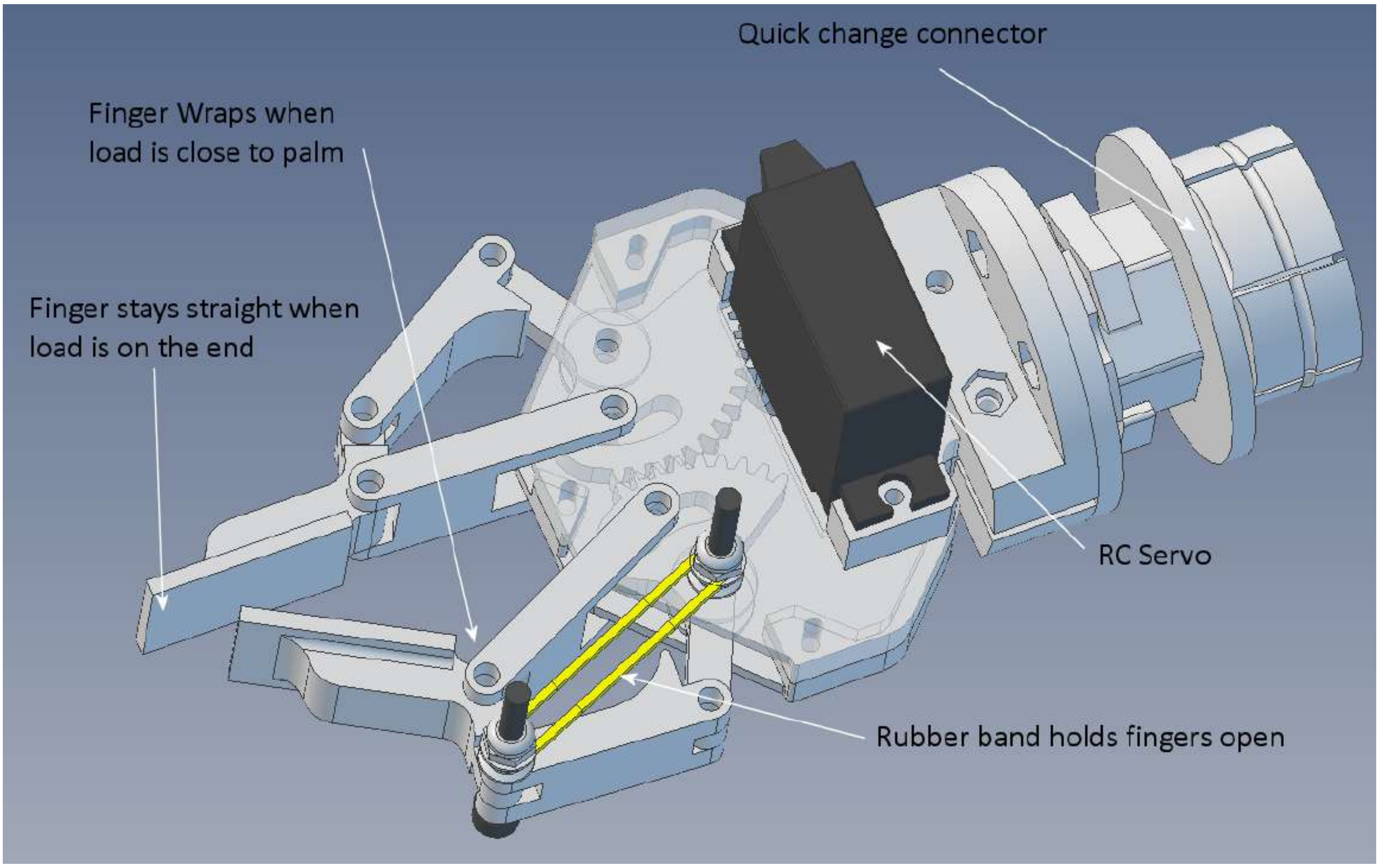

Y
X
Z


Drive Pulley
3:1 ratio
Base Stepper Motor
Hypocyclodic Gearbox
9:1 ratio
Timing Belt
Base Bearing
Belt Tensioner


Hypocyclodic Gear Box 10:1
Drive and Pivot Axle
Drive Pulley 3:1
Timing Belt
Belt Tensioner
Dual Stepper Motors
for Elbow Differential


Forearm Output Pulley 1:1
Differential Belts
Output Pulley
30:1 from Stepper
Y
X
Z


Bevel Gear Differential Joint
Timing Belts
Dual Dynamixel MX-28AR
Pulley 3:1
Quick Release
Adaptive Gripper



Quick change connector
Finger Wraps when
load is close to palm
Finger stays straight when
load is on the end
RC Servo
Rubber band holds fingers open