Pan-Tilt Remote Control Station Design and Fabrication

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Abstract

Pan-Tilt system is an electromechanical mechanism that gives the ability to direct the mounted load in two directions which are horizontal direction (panning) and vertical direction (tilting). This project aims to design and fabricate a heavy-duty Pan-Tilt system that is used in the military field, it has consisted of many requirements, and specifications to reach the suitable model. The most important point in any mechanical device is to select the mechanical components that depend on certain specifications. The main components such as gears, motors, and bearings are chosen by a matrix that compares the different types that are commonly used.

Objectives

- Understanding the Pan-Tilt mechanism based on the components used and selecting the suitable components for this project.
- Study the design constraints and start on designing all the parts and assemble, also make an animation of Pan-Tilt system by using SOLIDWORKS program.
- Simulation the design and apply the stress and endurance by using ANSYS workbench.
- Searching about the suitable material used for this application based on our specifications.
- Searching about the methods that are commonly used to manufacture this type of product and select the suitable method.

Project Motivation

The current pan tilt devices has some limitations related to the functionality and the performance of the device such as:

- Device flexibility to mount multi devices
- Backlash problems,
- Device stability.
- Power losses
- Cable Connections problems
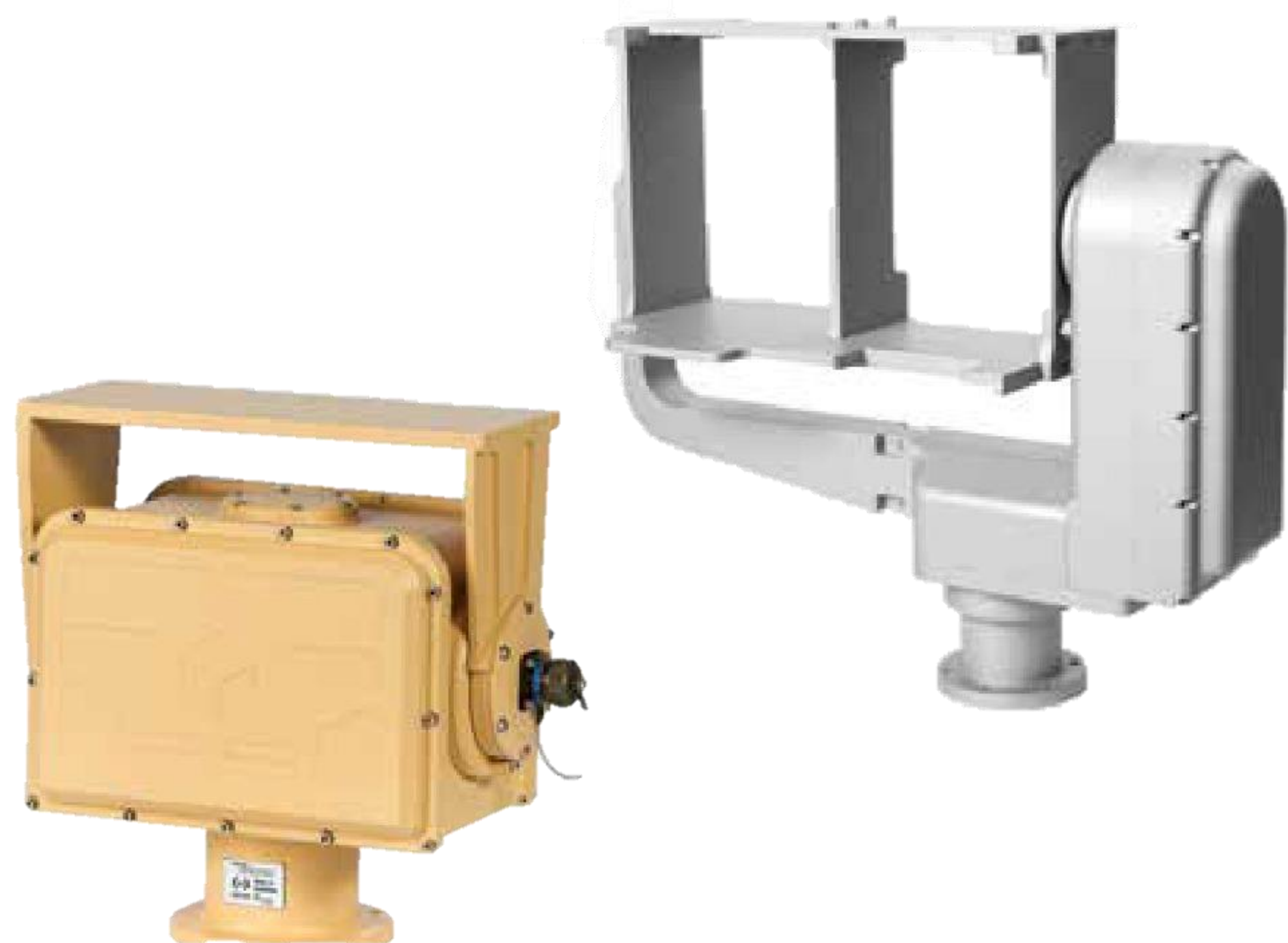
Different Configuration of Pan-Tilt system

Device Components Selection Criteria

Where: 4: Excellent   ,   3: Good   ,   2: Moderate ,   1: Poor

Gear Selection

Selection Factors	Types of gear			
	Spur	Worm	Planetary	Harmonic
Dynamic load	2	2	4	4
Flexibility and Installation	4	3	2	2
Backlash	1	2	3	4
Case Size	3	4	2	4
Cost	4	3	2	1
Total	14	14	13	15

Motor Selection

Selection Factors	Types of motors	
	Stepper	Servo
Torque	2	3
Speed	3	4
Noise	1	4
Resolution	2	4
Cost	4	2
Total	12	17

Bearing Selection

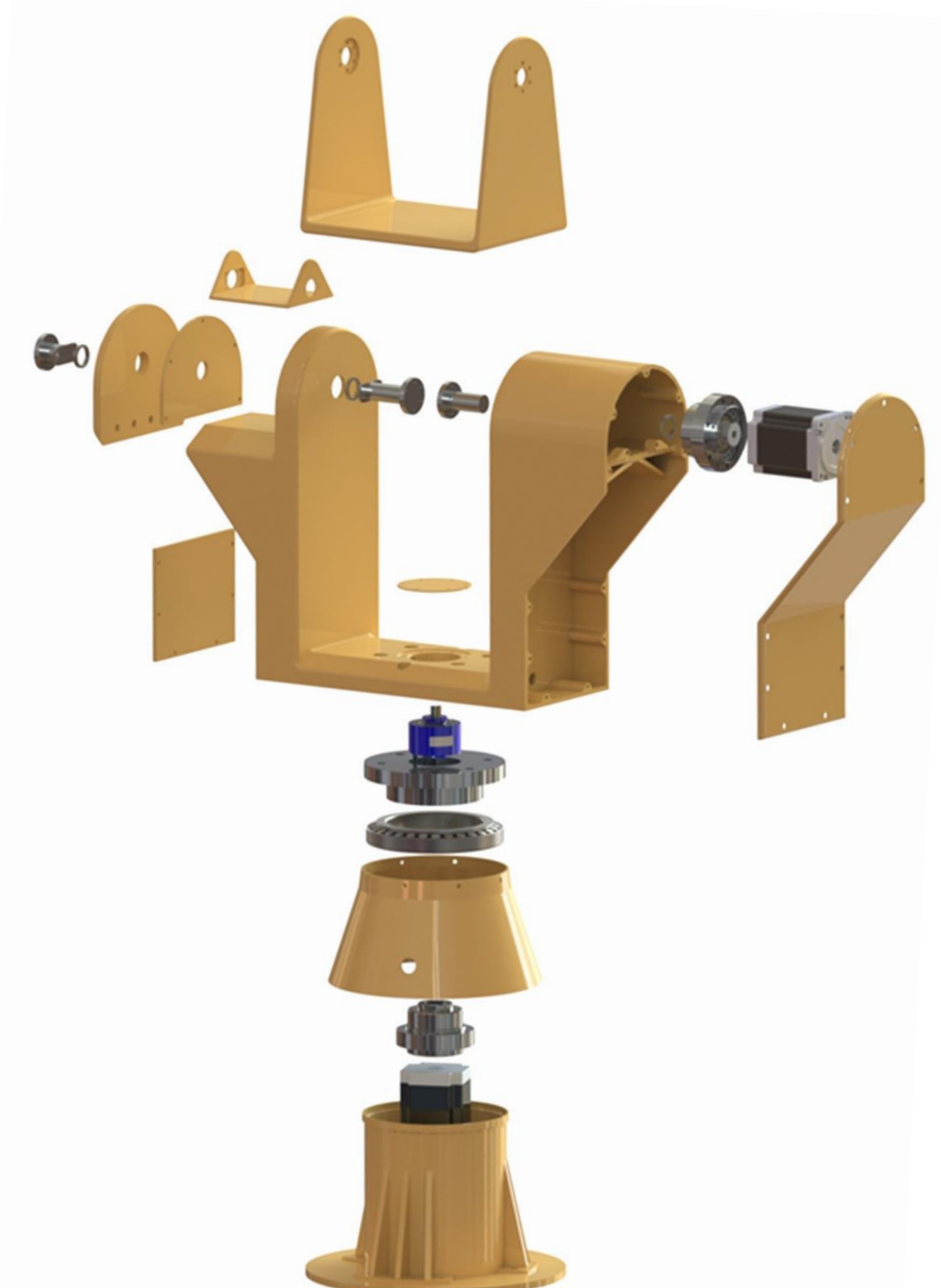| Selection Factors	Bearing Type			
	Ball		Roller	
	Deep groove (Single)	Angular contact	Cylindrical	Tapered
Radial load	2	2	3	4
Stiffness	2	3	3	3
Run at low speed	4	2	3	4
Accuracy of shaft alignment	3	4	3	4
Cost	4	2	2	1
Total	15	13	14	16

Pan-Tilt with the Equipment

Pan-Tilt Proposed Design Assembly

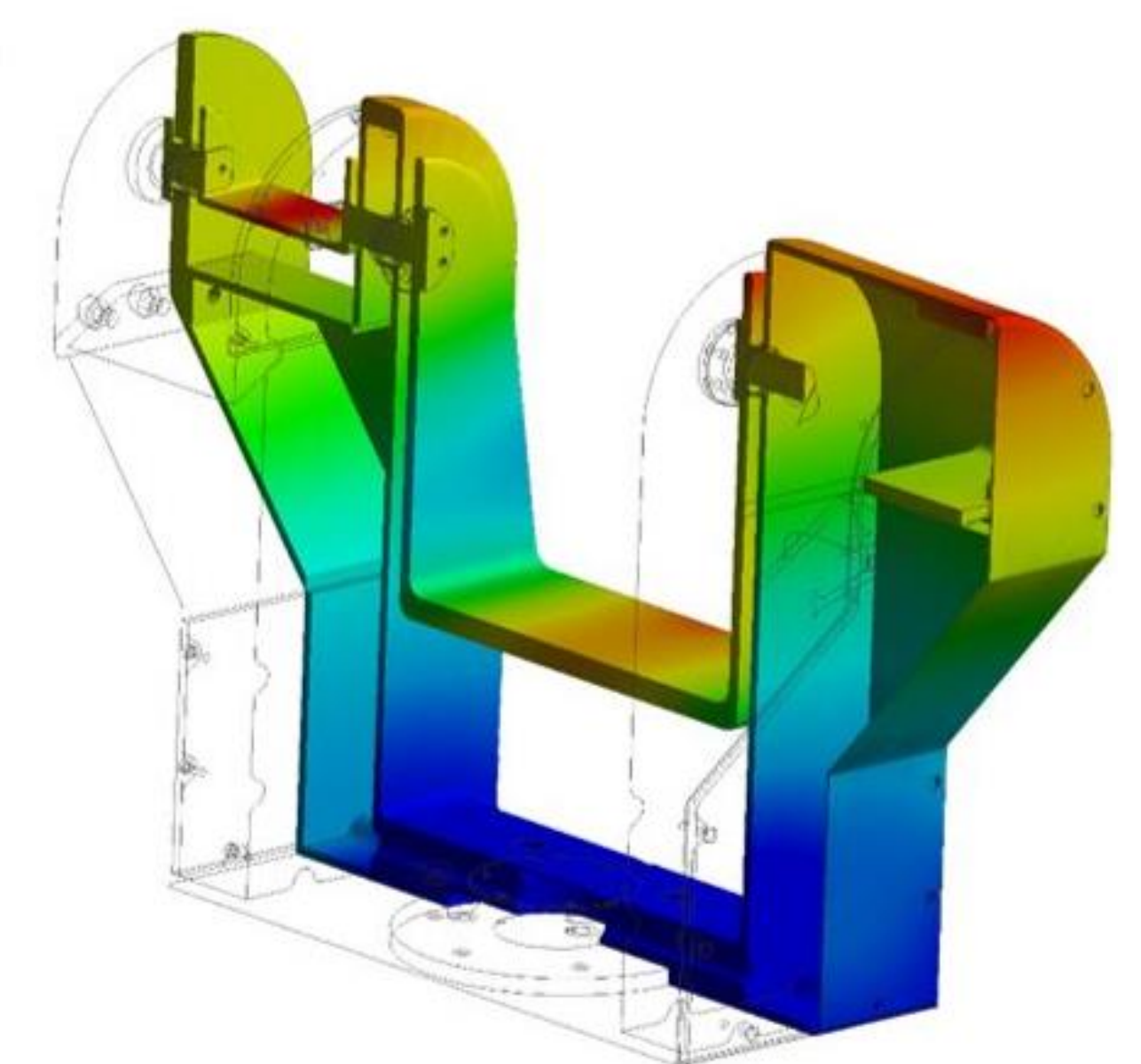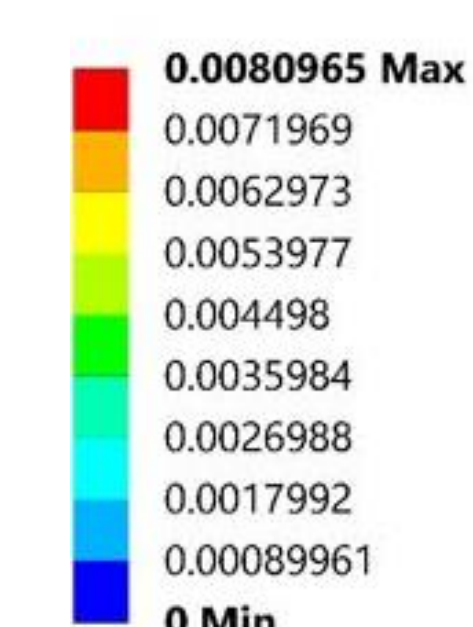**Assembly View**

Exploded View

Future Work

Pre-analysis of the model

Initial model analysis using ANSYS software has been created to determine the required torque and power for the motor to rotate either the pan or the tilt at any angle.

- **Buying Standard components**
- **Device Parts Fabrications**

Analysis structure of the model