

Pan-Tilt Remote Control Station Design and Fabrication

Abstract

- Pan-Tilt system is an electromechanical mechanism that directs the mounted load in two directions which are horizontal (panning) and vertical (tilting).
- This project aims to design and fabricate a heavy-duty Pan-Tilt system that is used in the military field.
- The mechanical components such as gears, and motors was chosen by a matrix.
- The design process includes load analysis, torque and rotational speed calculations.
- The parts are fabricated by different ways then assembling them to form the complete device.

Objectives

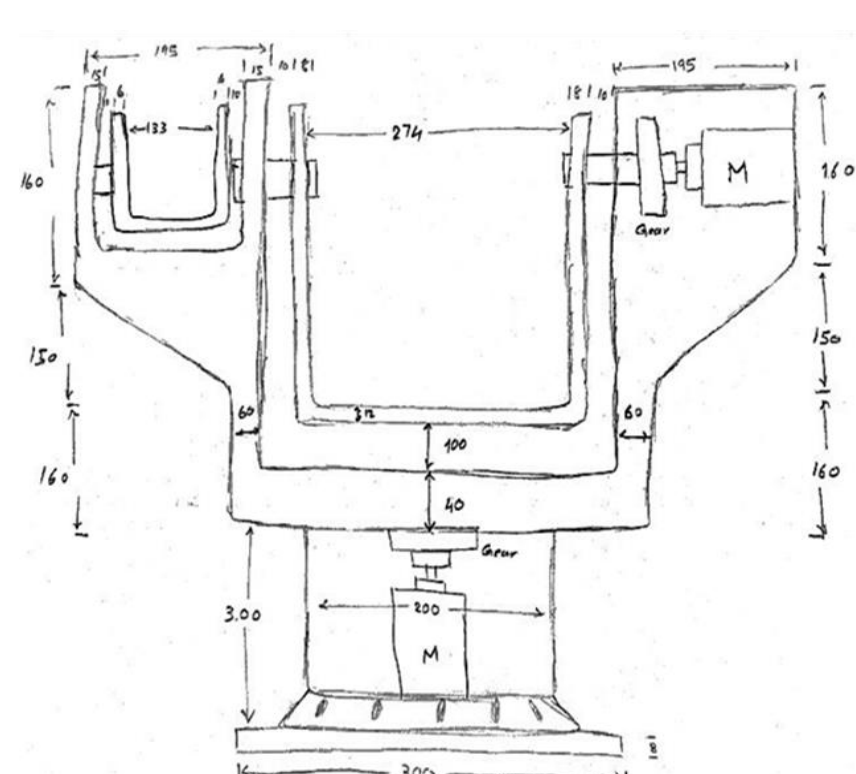
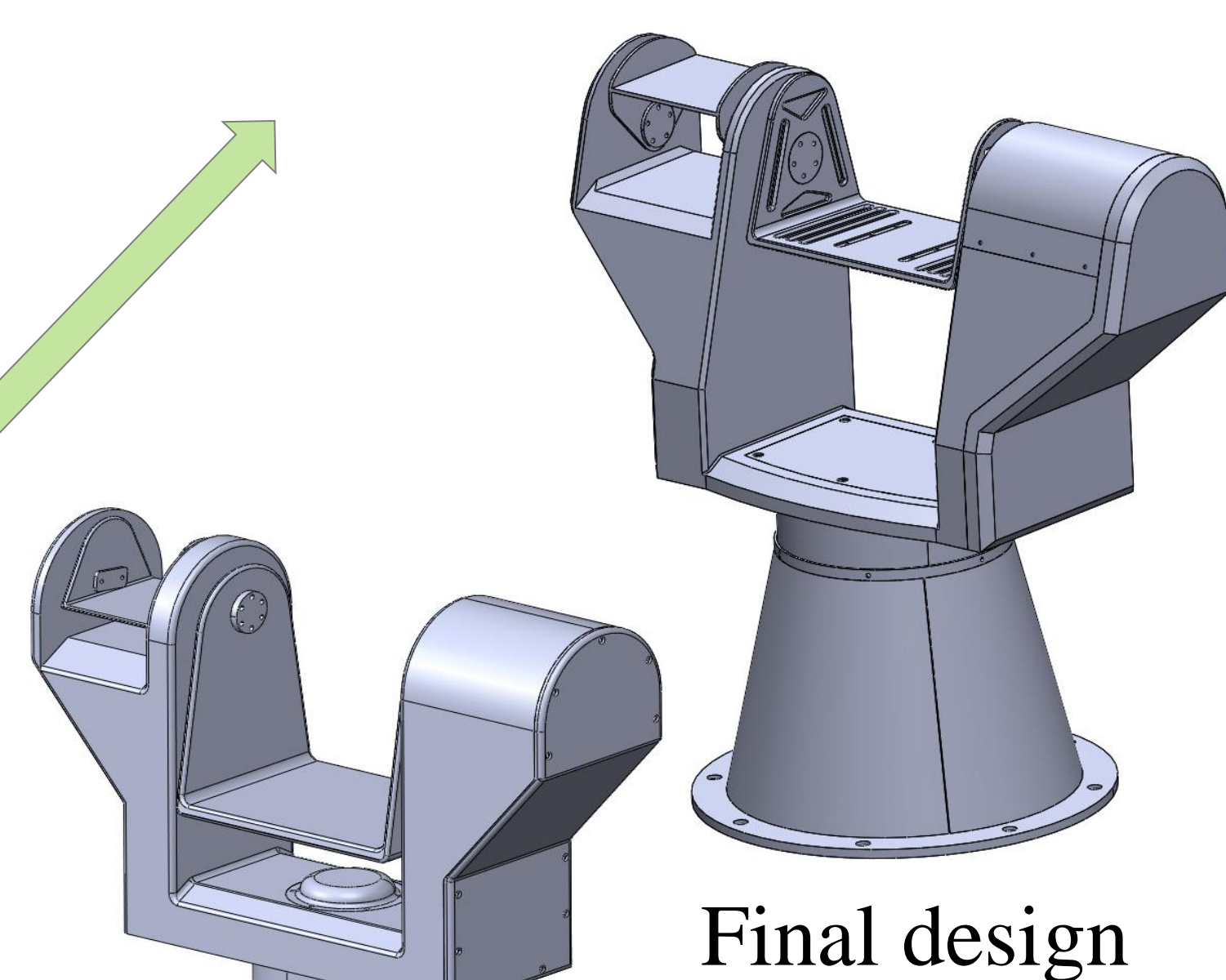
- Optimization of the final design
- Mathematical modeling and motion analysis of the Pan-Tilt
- Purchase the standard mechanical and electrical parts
- Manufacturing of the device components
- Assembly of all components
- Test and verification of the Pan-Tilt

Project Motivations

The current Pan-Tilt devices in the market has some limitations related to the functionality and the performance of the Pan-Tilt such as:

- Pan-Tilt flexibility to mount multi equipment
- Backlash problems
- Pan-Tilt stability
- Power losses
- Cable Connections problems

Design Development Sequences



Specifications of the Pan-Tilt

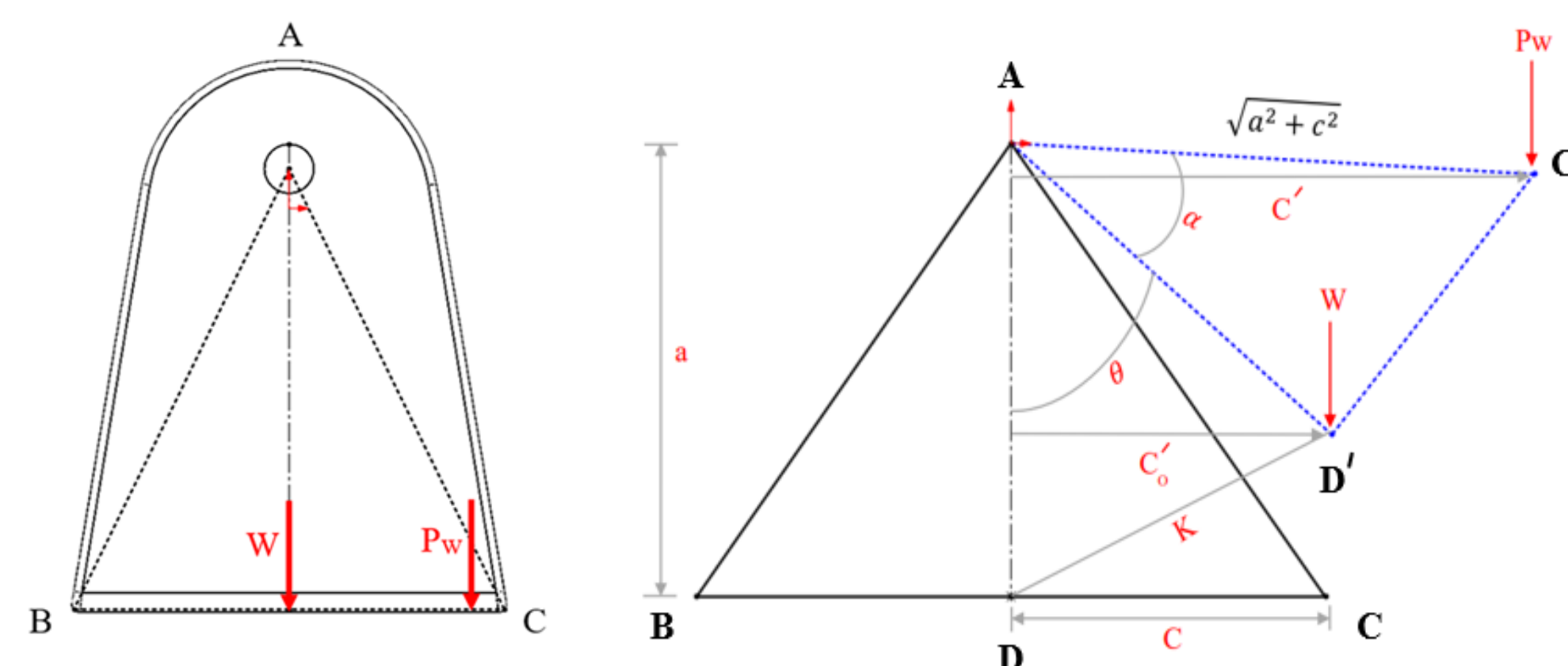


Criteria	Objective
Pan movement	
Range of motion	360° (continuous rotation)
Maximum angular speed	45°/sec
Minimum angular speed	0.01°/s
Acceleration	0.5sec to reach maximum speed
Tilt movement	
Range of motion	-30° to +60°
Maximum angular speed	30°/sec
Minimum angular speed	0.01°/s
Acceleration	0.5sec to reach maximum speed
Additional requirements	
Payload	25kg
Shape platform	Gimbal shape
Voltage supply	220V DC

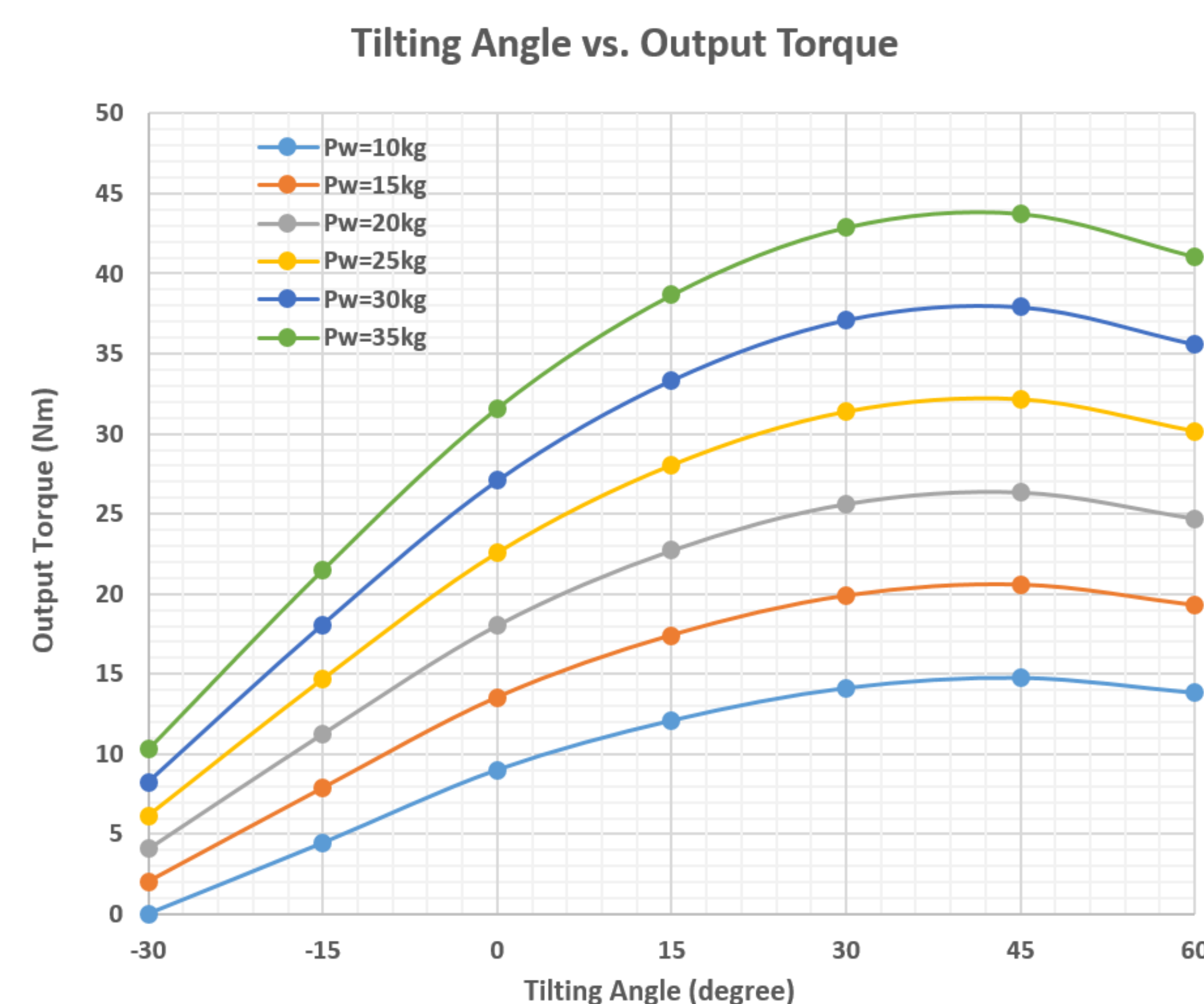
Motion Analysis

The analysis of motion done to evaluate the required output torque for motor and gear.

- For the positive range of angle $0^\circ \leq \theta \leq 60^\circ$:



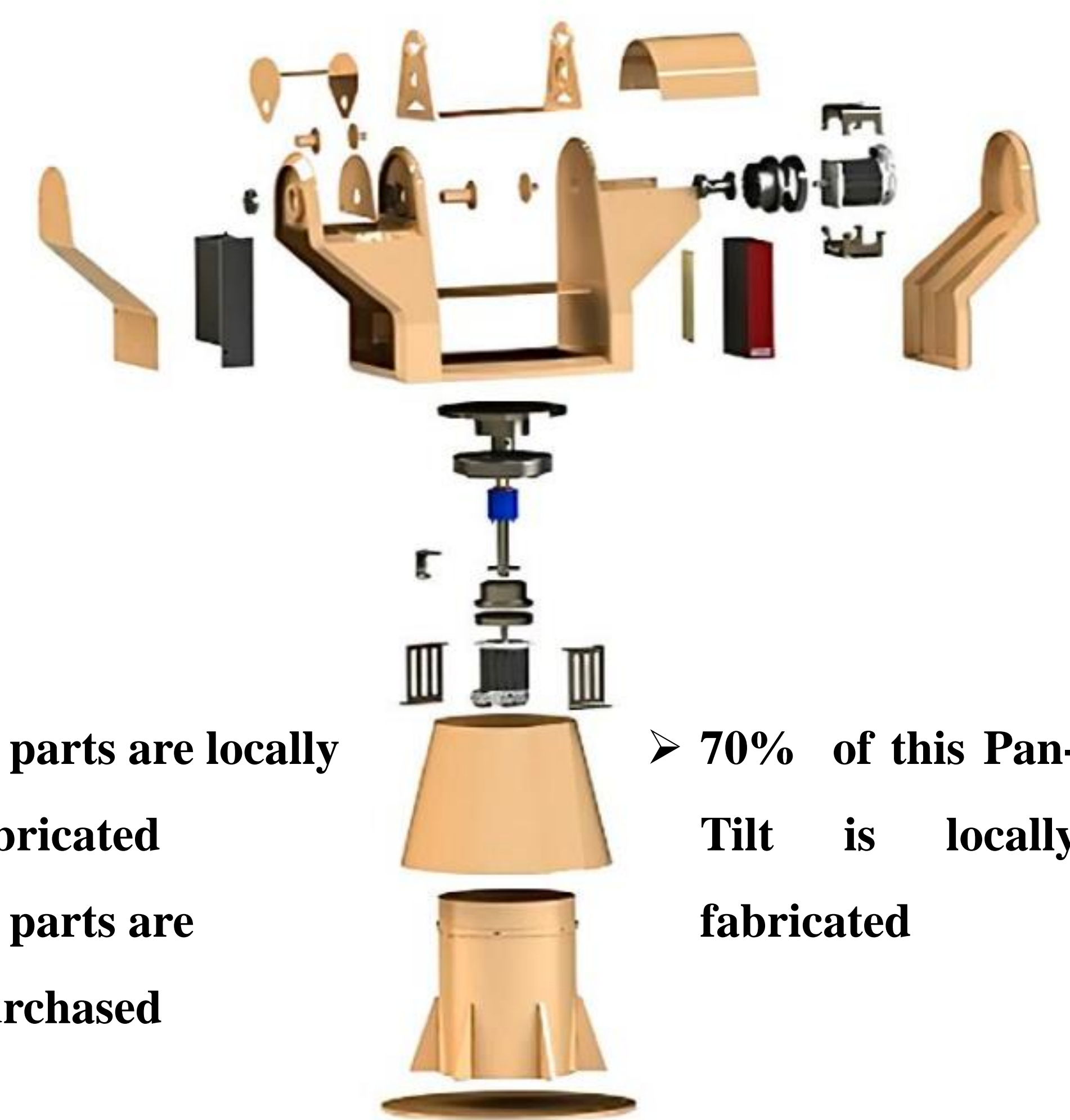
- Variation of output torque as function of tilting angle with different mounted loads:



Conclusion

- A new design of the Pan-Tilt device that is completely different than that available in the market has been synthesized and developed
- This new design of the Pan-Tilt has been locally manufactured resulted in a Saudi Made Product for the first time of this device.

Exploded View of the Pan-Tilt



Fabrication of the Pan-Tilt

The Pan-Tilt is fabricated by using different ways such as turning, sheet metal working, and welding.



Pan-Tilt Mounted on the Army Vehicle

