Development of Parallel Tether Control System

Report 2023

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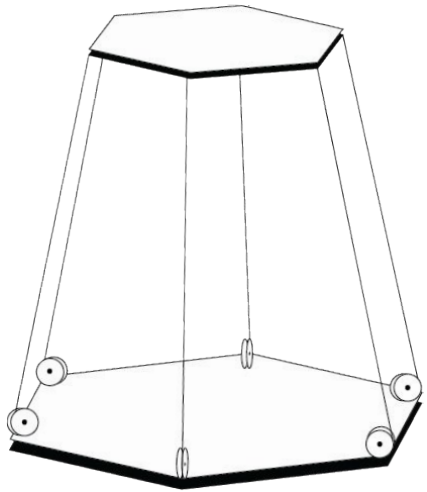
Concept

- The main idea of this project is to control a sensor-base attached to a drone using tethers.
- Six tethers are employed to control the angle and elevation of the sensor-base.
- Each control module comprises a motor, an encoder, and a processing board.



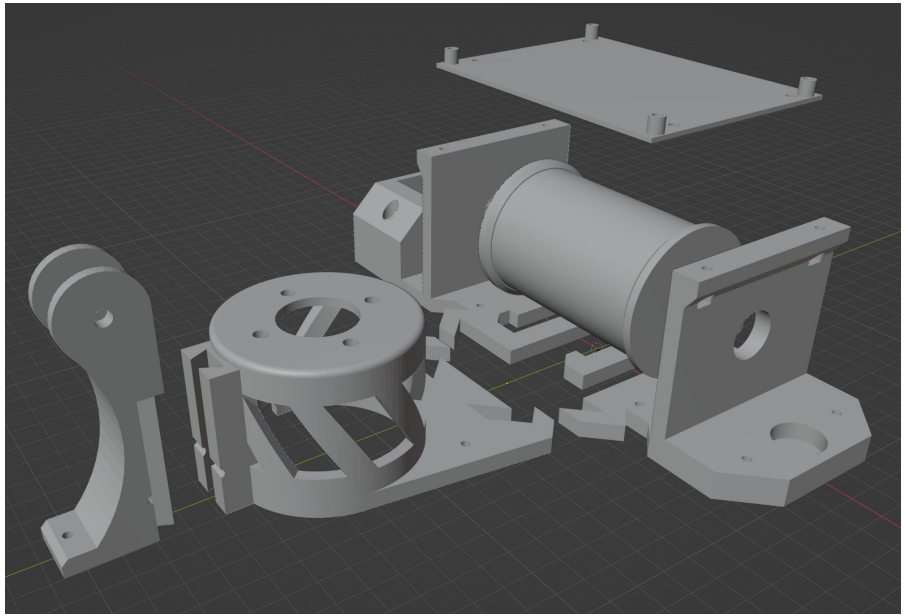
Sketch of the parallel tether system

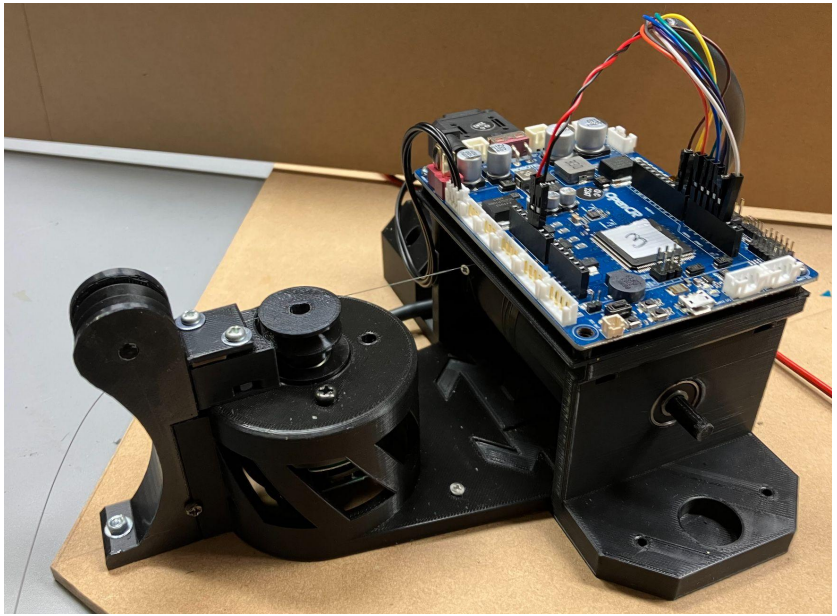
Specifications of a single reel

- Dynamixel (XL430-W250-T) powered reel with max torque 1.4Nm
- Open CR processing board
  - Input voltage: 12V
  - Communication interface: UART
- Bobbin radius: 25mm
- Bobbin length: 70mm
- Module dimensions:
  - Width: 180mm
  - Length: 190mm
  - Height: 100mm

3D Assembly of single reel in Blender

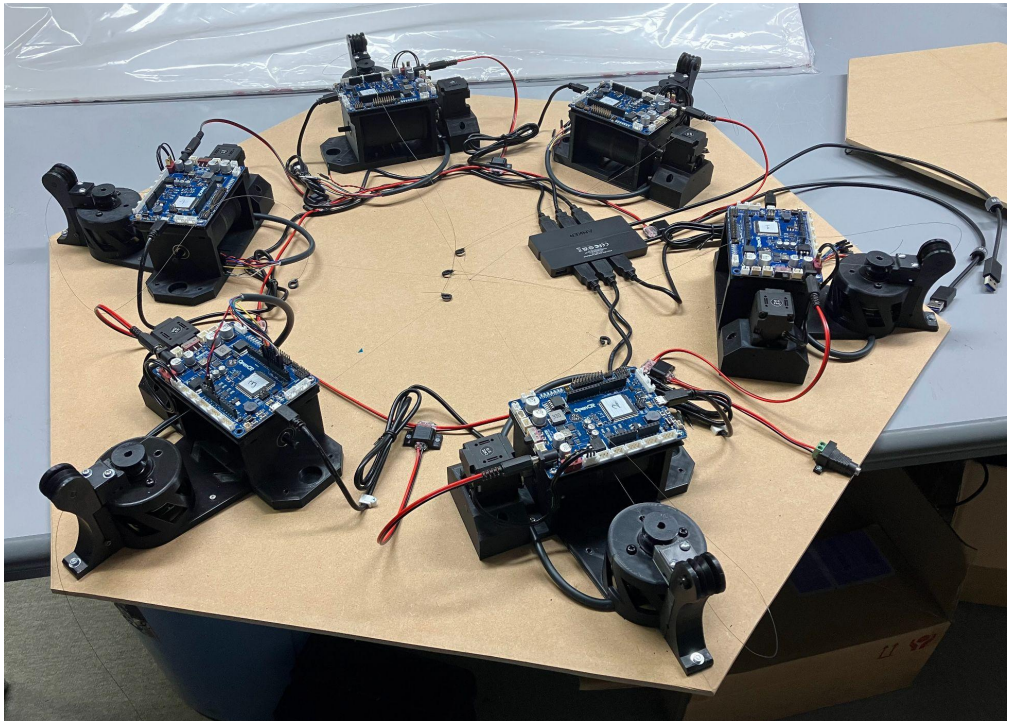
- 3D printable parts were designed using FreeCAD software.





Complete assembly

- All modules were connected to the PC using USB hub and can be controlled individually.



Control interface

- This program scans all connected serial ports and assigns reel ID hard coded in the processing board.
- Six modules (reels) can be controlled individually and all together from the GUI.

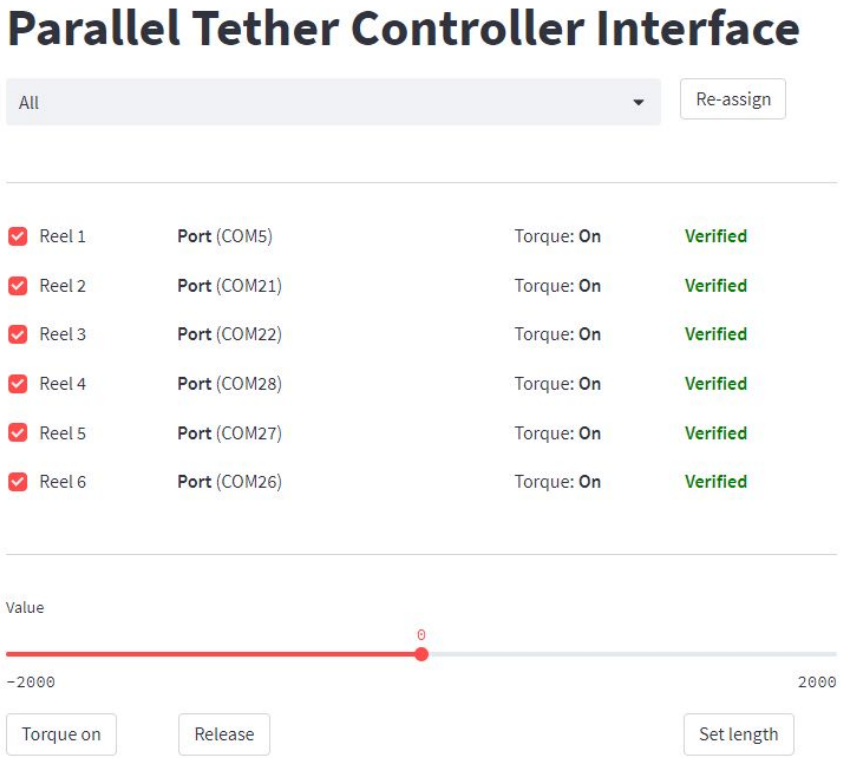
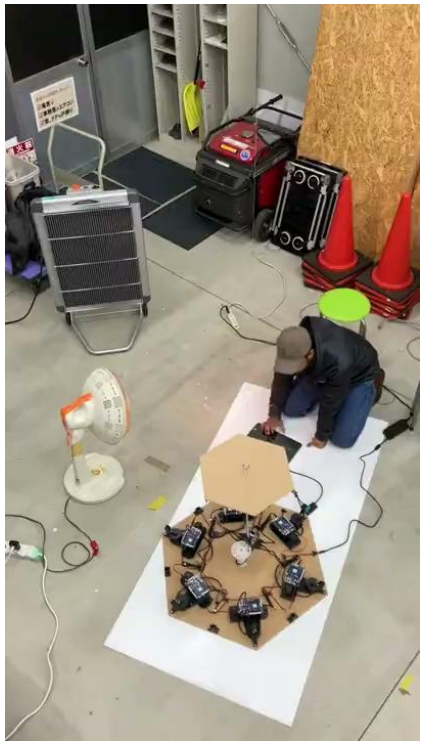
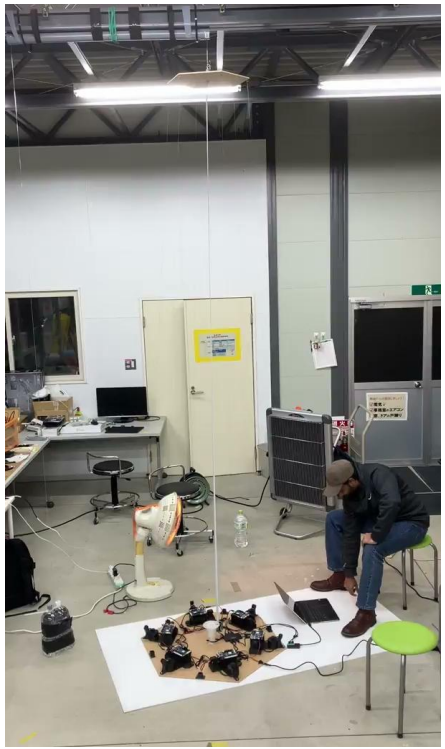


Figure 4: Control interface (web based)

Vertical movement test

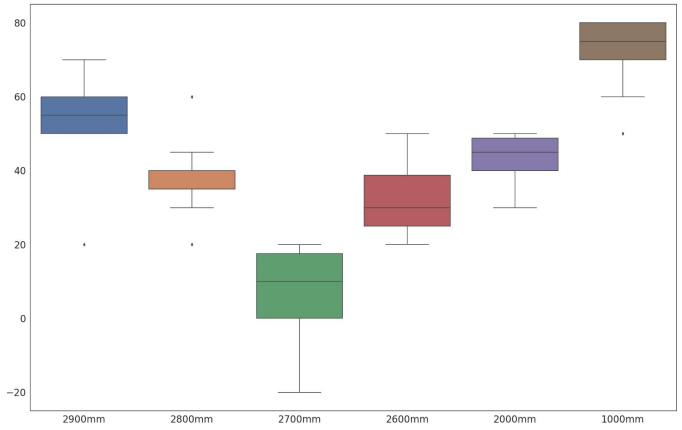
- Developed system was tested for vertical movements first



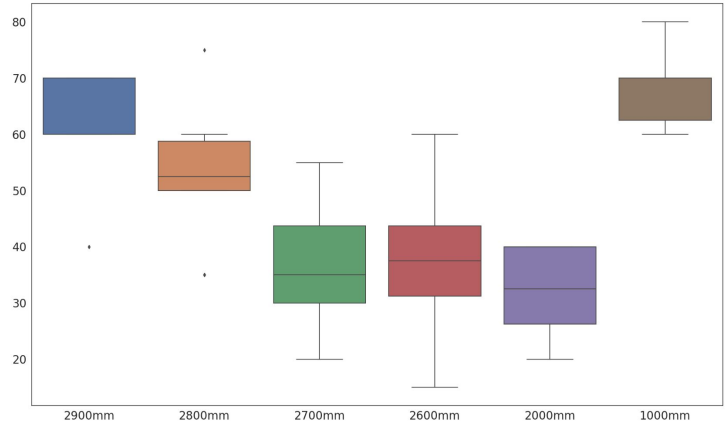


Results for vertical movement

- Vertical movement was tested for 6 test cases (1000mm, 2000mm, 2600mm, 2700mm, 2800mm, 2900m).
- Also, the system was test for pushing and pulling the tether.
- Maximum error was around 80mm for 1000mm, pulling case.



Vertical movement accuracy (pull)



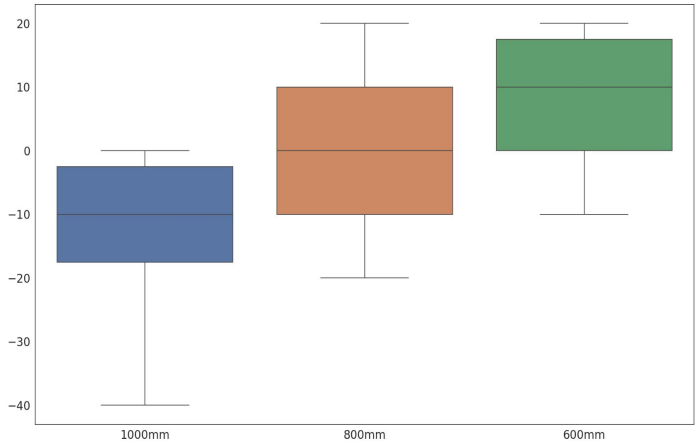
Vertical movement accuracy (push)

Horizontal movement test

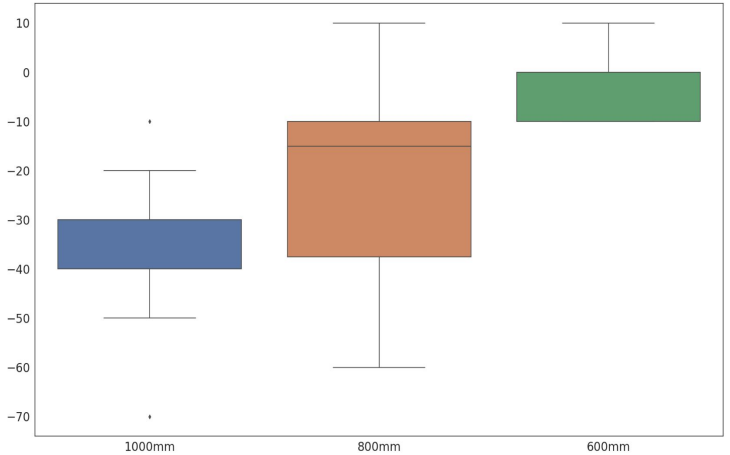
- Developed system was tested for horizontal movements as well

Results for horizontal movement

- Horizontal movement was tested for 3 test cases (1000mm, 800mm, 600mm).
- Also, the system was test for pushing and pulling the tether.
- Maximum error was -60mm for 800mm, pushing case.



Horizontal movement accuracy (pull)



Horizontal movement accuracy (push)

Thank you.