

A Soft Drone For whole Body Perching

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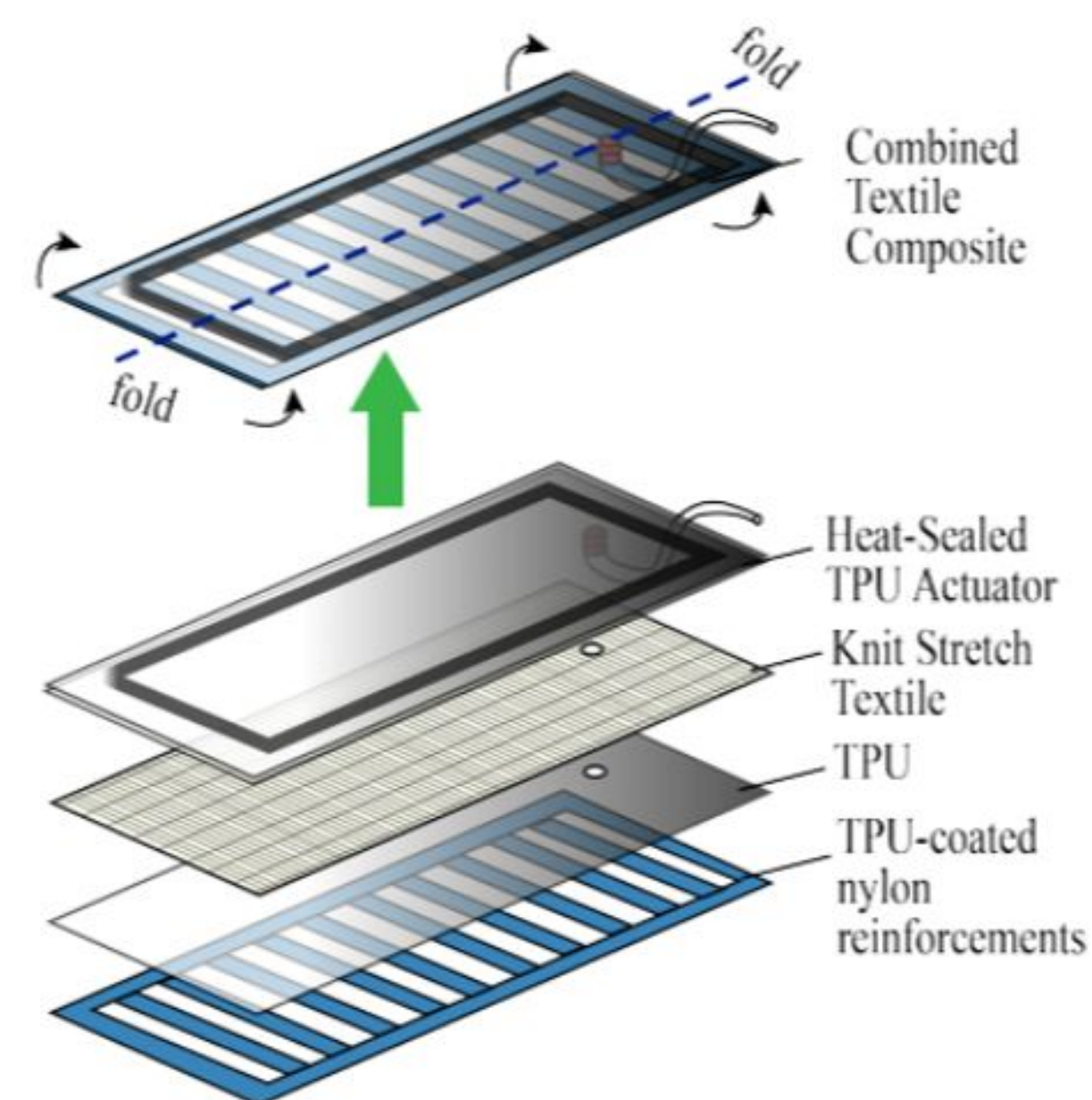
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Research Statement

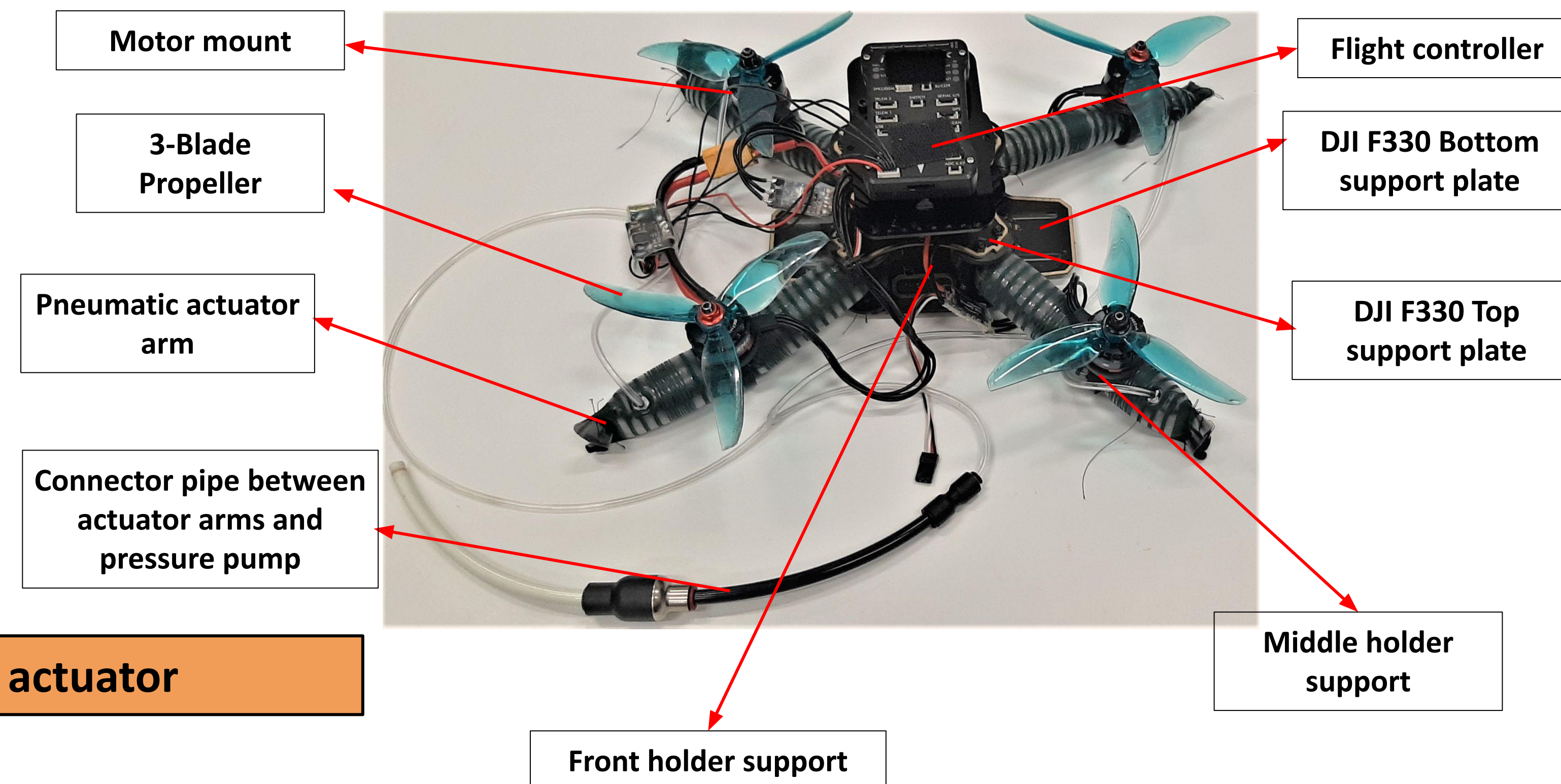
- The performance of multirotor aerial vehicles is limited by their endurance times when employed for surveillance missions.
- Instead of hovering, perching is used for drones to improve the endurance by placing the drone at a vantage point
- Perching based drones offer low power to weight ratio and hence affect the flight durations adversely
- The design of pneumatic actuator arms for full body perching of the drone is presented.

Design and Fabrication of pneumatic actuator

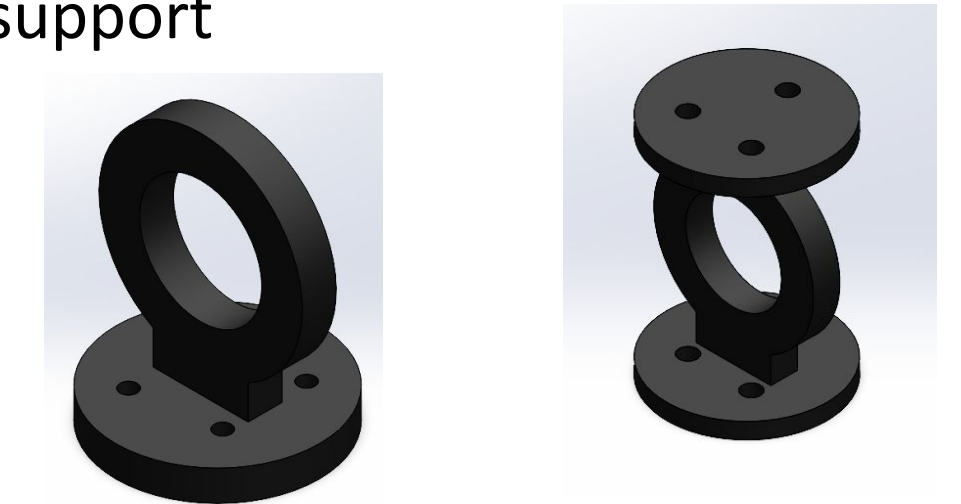
- Solidworks is used to create a 2D sketch for the seam,TPU,and elastic spandex fabric
- All these fabric layers are further laser printed and then heat sealed at 315°F for 60 sec
- Textile composite so obtained was sewed on the two side ends to obtain a pneumatic actuator pocket
- TPU Actuator was fit inside the pneumatic actuator pocket such that the nozzle and pipe attached pops out of the holes on the actuator
- Water bed test is performed on the TPU actuator to check for any leaks before adding it inside the pneumatic actuator pocket
- The two remaining horizontal ends of pneumatic actuator are then sewed such that the sew doesn't interfere with the TPU pockets



Assembly of the full body perching drone



- Four pneumatic actuator arms are integrated with the DJI F330 Quadcopter top and bottom frame using the front holder support
- To stabilize the drone during flight, the motor-propeller mount is integrated to the middle holder support



- For autonomous control of the drone, a flight controller is integrated to the top support plate such that it connects with all the motor propeller mounts
- The connector pipe is attached to the pressure pump to allow for the flow of compressed air.
- For the purpose of this project, the pressure control would be manually operated.

Testing and Evaluation



Pneumatic Actuator in ideal state(P=atm)



Pneumatic actuator when P=20psi

- Pressure test is conducted on the pneumatic actuator arm before assembly, to collect data points on the pressure applied and their respective change in angle
- It was observed that at about 30 psi the pneumatic actuator overinflated and blasted
- Optimization analysis can be further performed on the seam shape,size and shaping with design constraints on achieving 180° - 270° maximum bend and minimizing radial strain upon inflation.