

Gripper Design Document

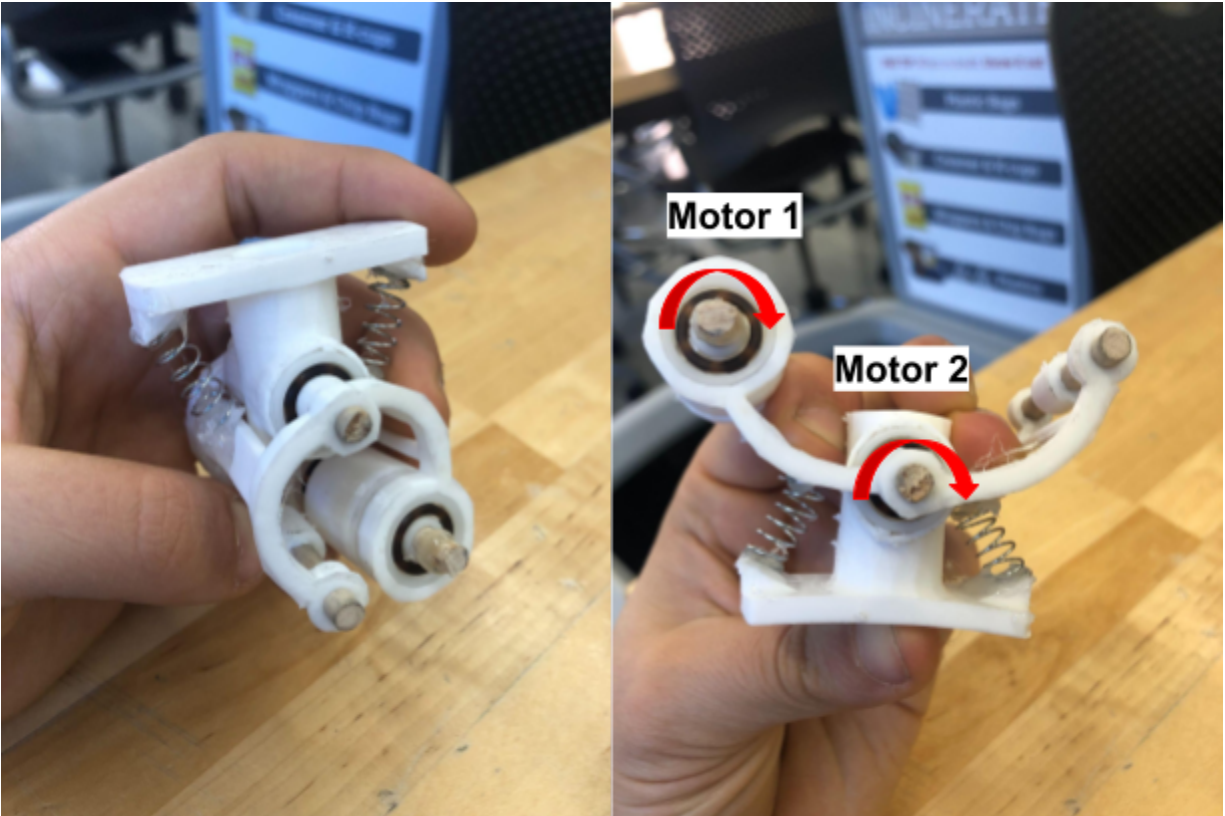


Figure 1a (Left) Gripper suture management prototype in the closed configuration. 1b (right) Gripper suture management prototype in the open configuration.

The cylinder in the center of this design encloses the suturing arm of the STAR robot. As the arm is inserted into the body, the suture management device (SMD) will be in the configuration seen in figure 1a attached to the suturing arm. This configuration minimizes the diameter of the device. Then, once the SMD is inside of the body, motor 2 will drive a cable mechanism which will apply a force in opposition to the spring force which keeps the SMD in its closed configuration. This will cause the SMD to move into its open configuration (Fig. 1b). The STAR arm will then approach the tissue and the end effector will place a stitch.

Once the stitch is placed, the motor will release the tension on the cable which will cause the SMD to move back into its closed position. Due to the design of the SMD, the thread will be caught between the two rollers on the gripper when the SMD is closed. Both rollers will be covered in a high-friction rubber material so that when one of the rollers is driven and the other remains free-spinning, we can move the thread either towards or away from the end effector. In

the closed position, motor 1 will actuate the driven roller to push all of the loose towards the end effector until a certain current is read on the motor which is associated with a force of adequate tension on the sutures. When this force is detected, motor 1 will stop moving and then motor 2 will actuate to return the gripper to its open configuration (Fig. 1a) and allow the STAR to place the next stitch.