**Positional Feedback Mechanisms**

Brainstorm

1. Rotary Encoder

* Encoder wheel could be attached to the stepper shaft to detect and measure rotation
* Not feasible due to the price and limited availability

1. Distance Sensor (Ultrasound, IR)

* IR sensor could be used to detect the presence of the cube corner. In the case of over-rotation or under-rotation, the cube corner will be closer / farther than the flat position
* Mechanism requires an ADC, as well as the IR sensor totalling ~$25 (Lee’s)
* Calculated precision would be 0.66MM using a 10bit ADC which is more than sufficient
* Not feasible because limited space exists under the clasper during rotation

1. Optical Switch

* Attach fringes to the stepper shaft that interrupt an optical switch every 90 degrees. Thickness of the fringes should be equal to the switch lens diameter.
* How to attach the fringes to the shaft? – If set screws can still be removed, a sort of encoder wheel could be glued to the shaft.
* Extremely cheap at $3 (Lee’s)
* Cut out circular cardboard pieces. Drill 4 holes in each at 90-degree increments. Cut the pieces diagonally. Reassembly using glue around the shaft. Central shaft hole should be small enough to be self-retaining under low loads. Manually test alignment before epoxying to the shaft. Line the discs up with the claspers using the screw holes!
* Optical switch is not feasible because there isn’t enough room on the shaft.

1. IR Reflective Sensor

* Shaft is metallic and reflective, could color the shaft black, then make markings every 90 degrees

Transfer

* The challenge being addressed is: **How can I consistently turn the claspers 90 degrees?**