

# Increasing Precision on an Automated System for Optogenetic Experimentation

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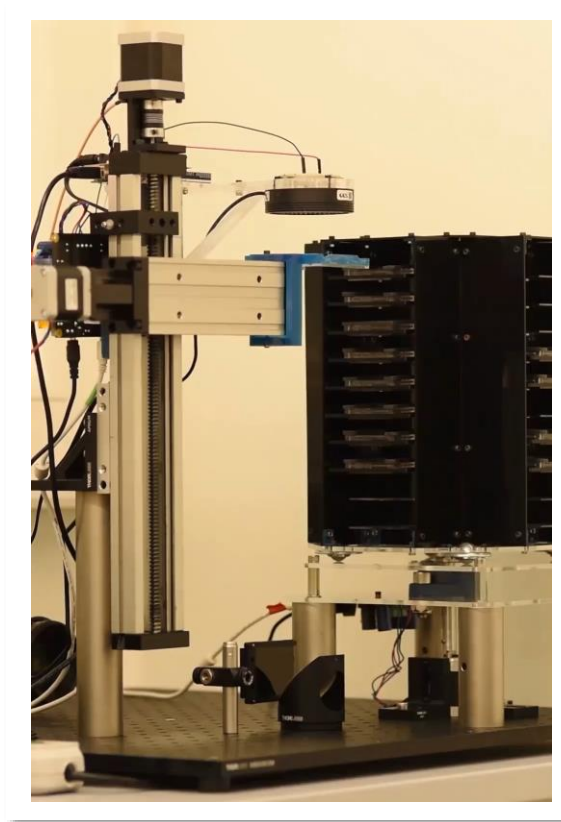


# Increasing Precision on an Automated System for Optogenetic Experimentation



Figure 1 Drosophila

Source: [epfl.ch/labs/ramdya-lab/](http://epfl.ch/labs/ramdya-lab/)



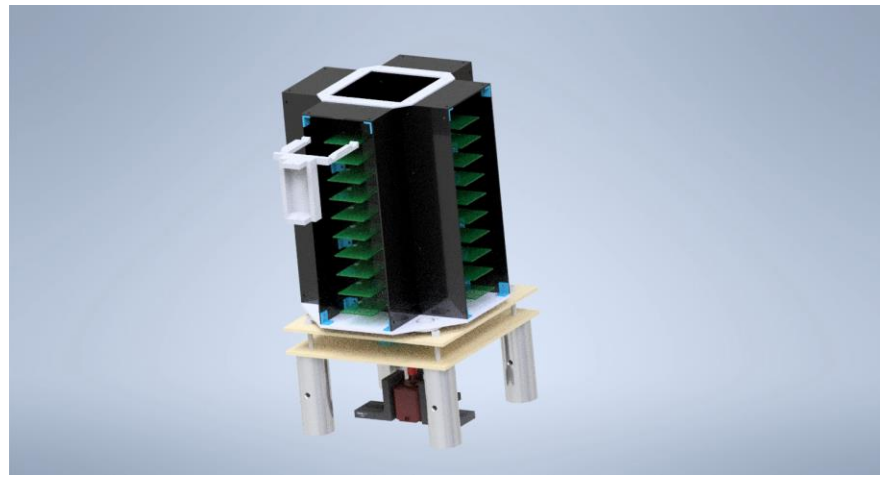
Video 1 Optobot

Source: [epfl.ch/labs/ramdya-lab/](http://epfl.ch/labs/ramdya-lab/)

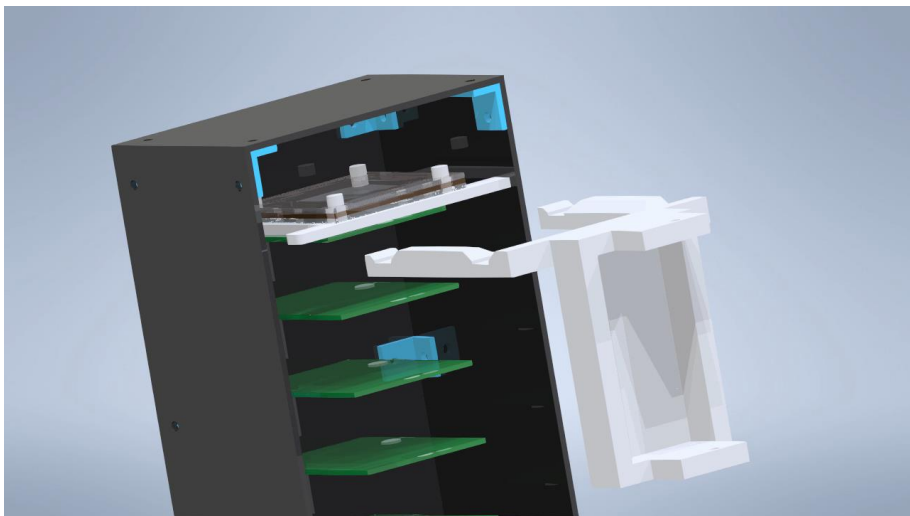


# Recap:

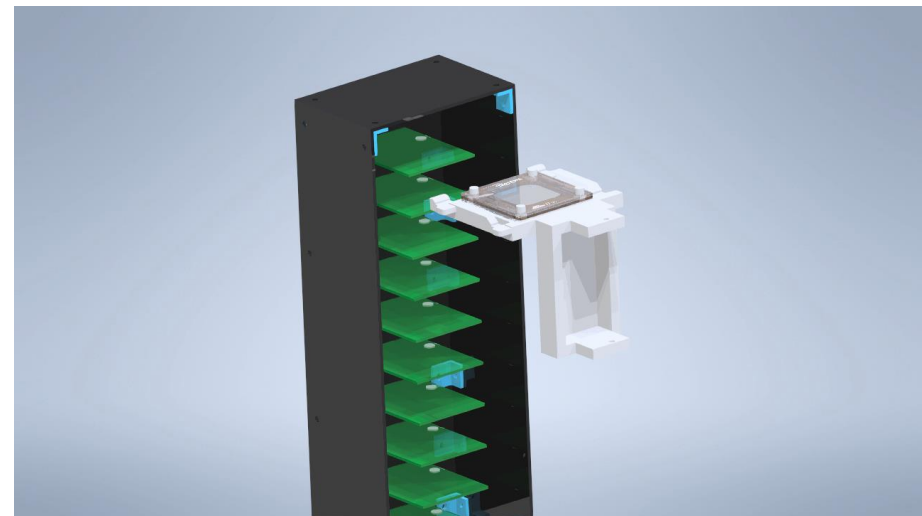
# the system



Video 2 Failure mode 1: Carousel motor failure



Video 3 Failure mode 2: Gripper failure (pick)



Video 4 Failure mode 2: Gripper failure (place)



# System overview

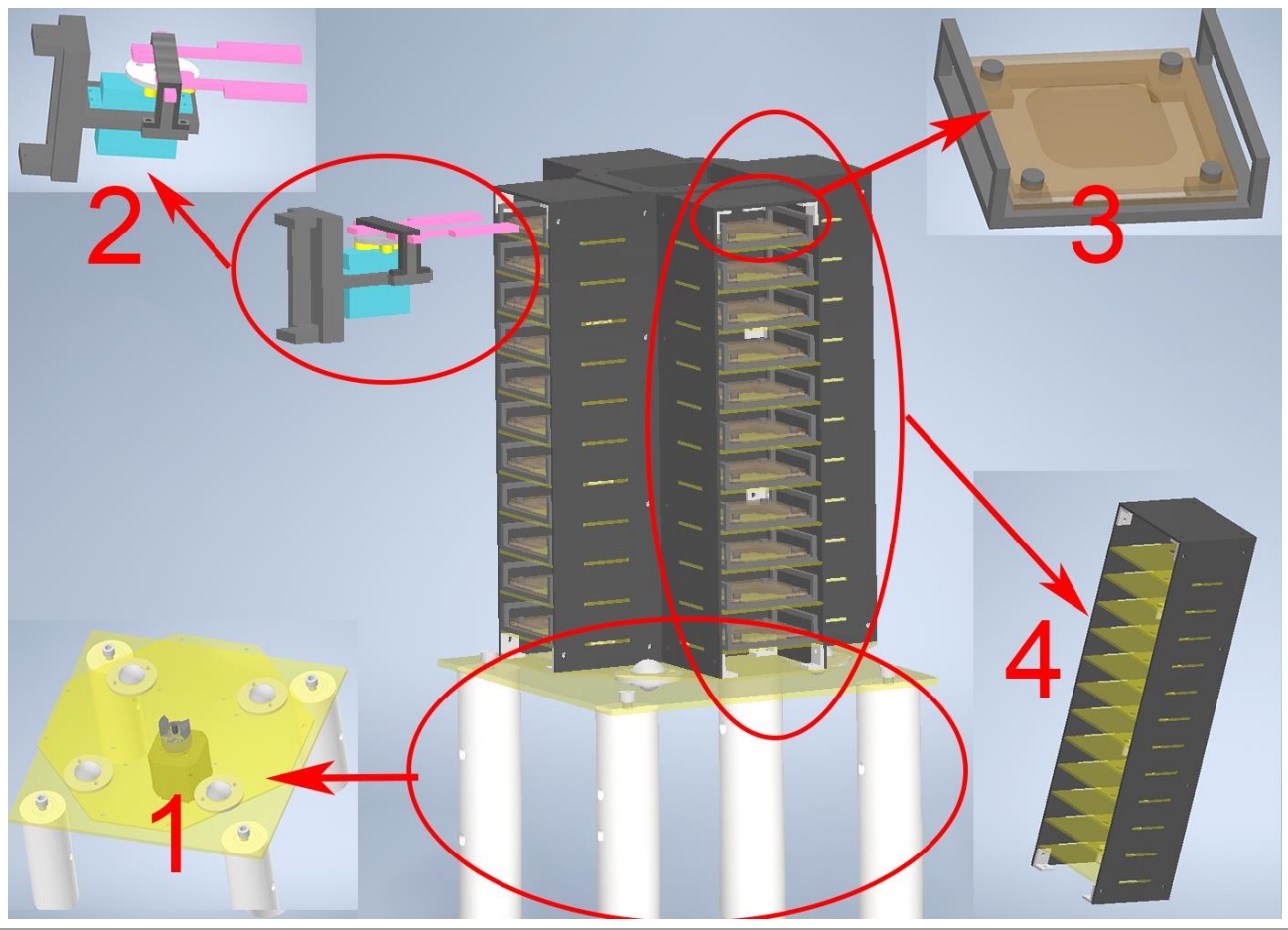
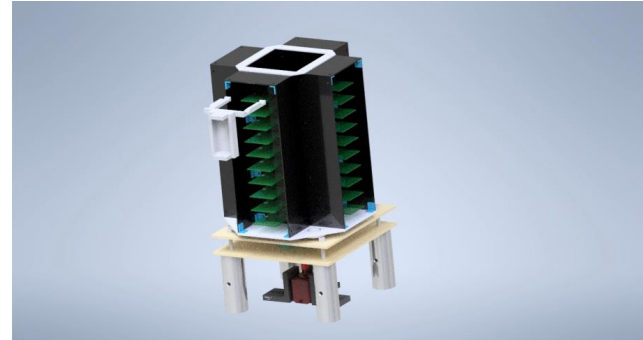


Figure 2 Overview of improved system



# Carousel module

1. Problem to solve:



2. Reasons for the problem: Stepper motor, step loss under heavy loads, open-loop control

3. Methods to solve the problem: use a stronger motor, close the control loop.

Serial	Holding torque	Rated current	Weight	Length	Shaft diameter
17h2a8413(old)	0.52Nm	1.3A	362g	72mm	5mm
42STH38(new)	1.8Nm	1.7A	457g	102mm	8mm



Table 1 Comparison of the carousel motor

Serial	Max speed	Resolution	Weight	Inner diameter
HKT22	6000RPM	300CPR	4g	4mm

Table 2 Specs of the encoder



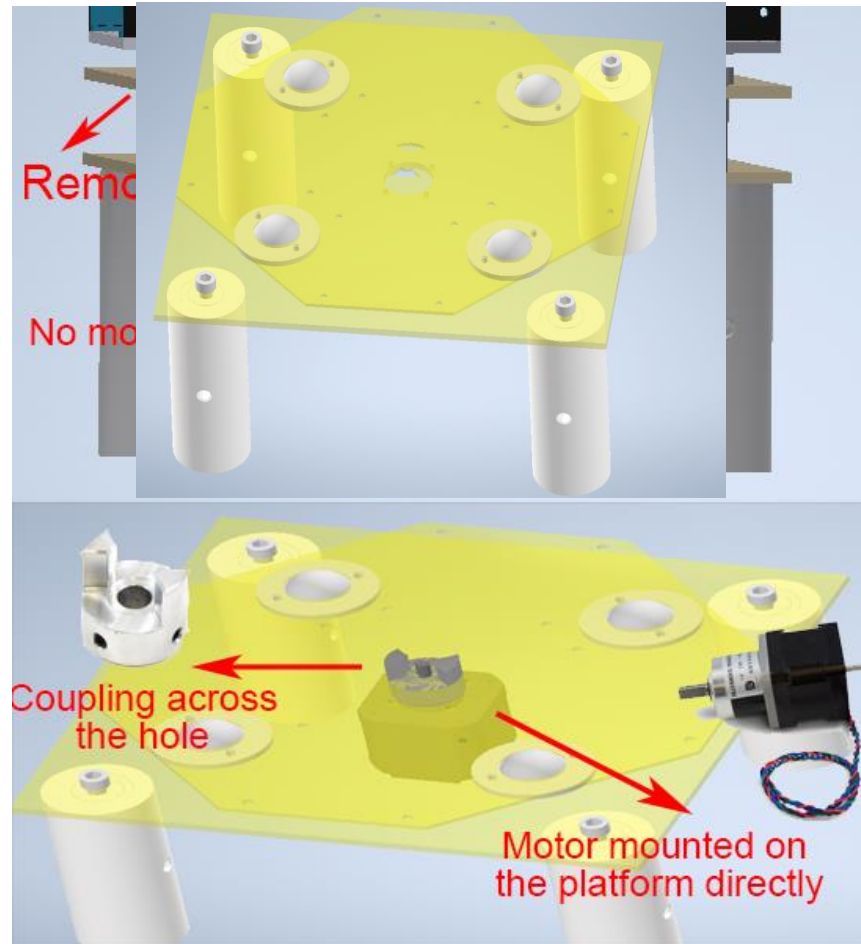


Figure 3 Mechanical change of carousel module in Optobot 2.0



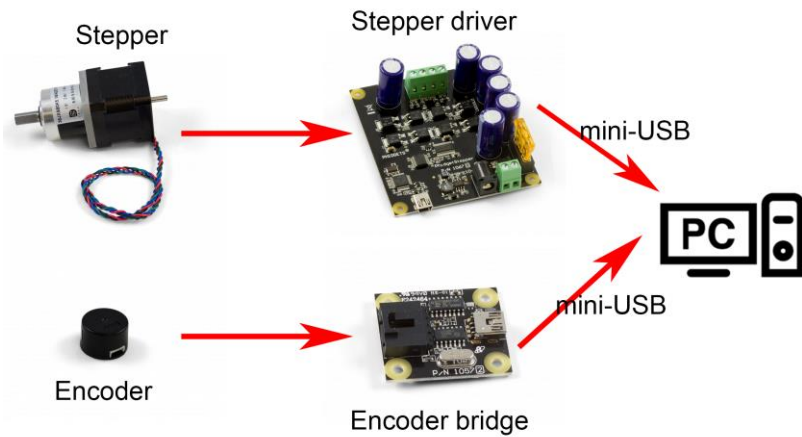


Figure 4 Connection logic of stepper and encoder

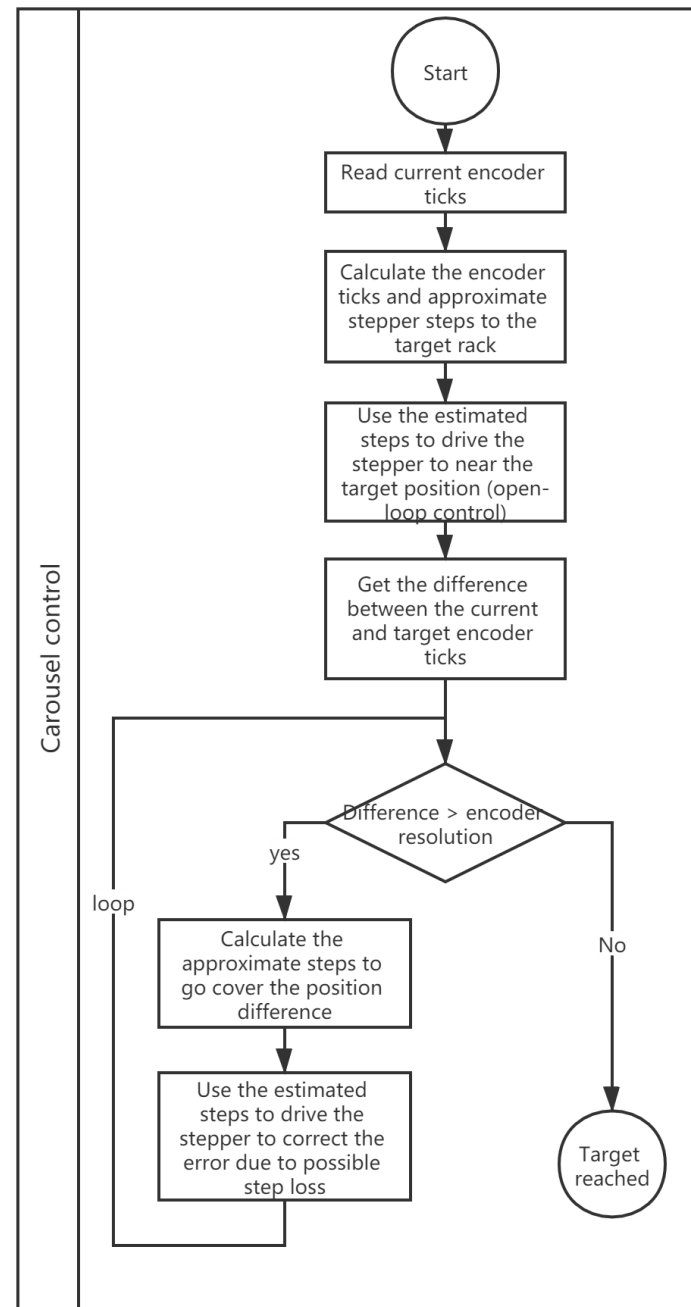
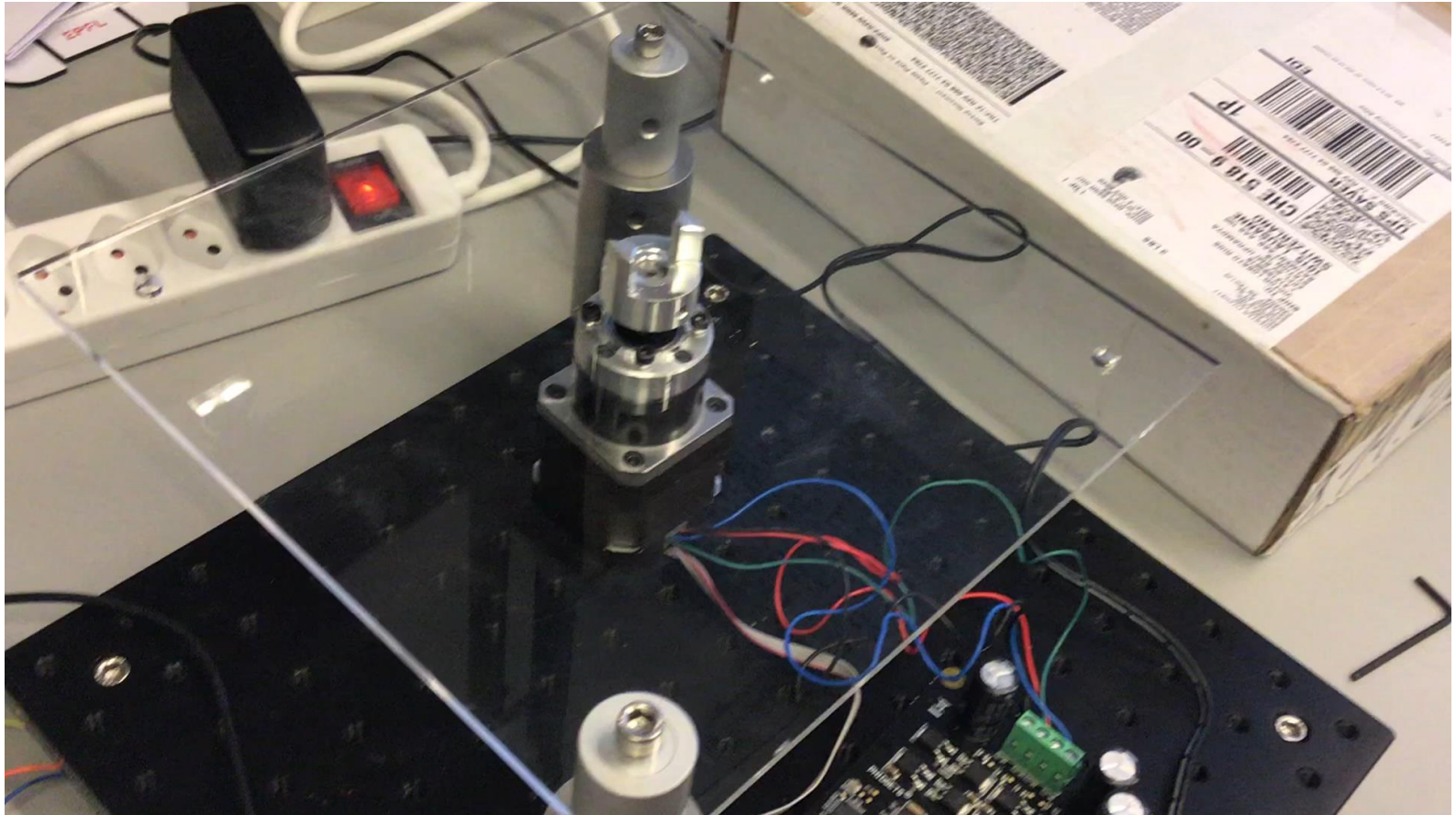


Figure 5 Control logic of stepper and encoder <sup>7</sup>

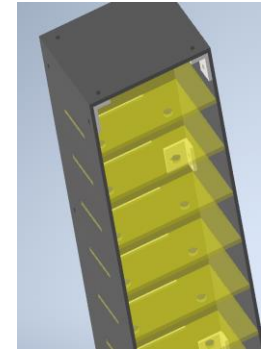
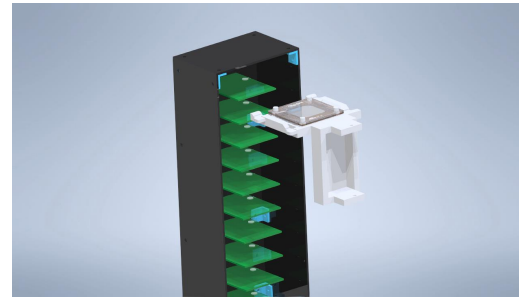
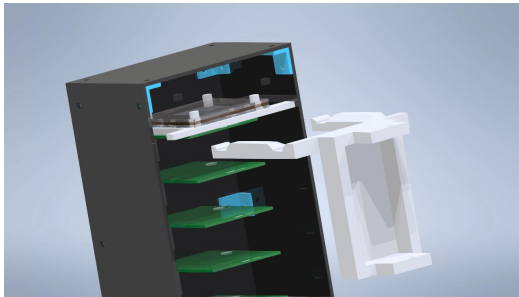
# Carousel module test





# Gripper and arena module

## 1. Problem to solve:



2. Reasons for the problem: Misalignment of gripper: arena holders bend over time, 1-side connection

3. Methods to solve the problem: Redesign the gripper and arena to enable more stable arena holder connection.



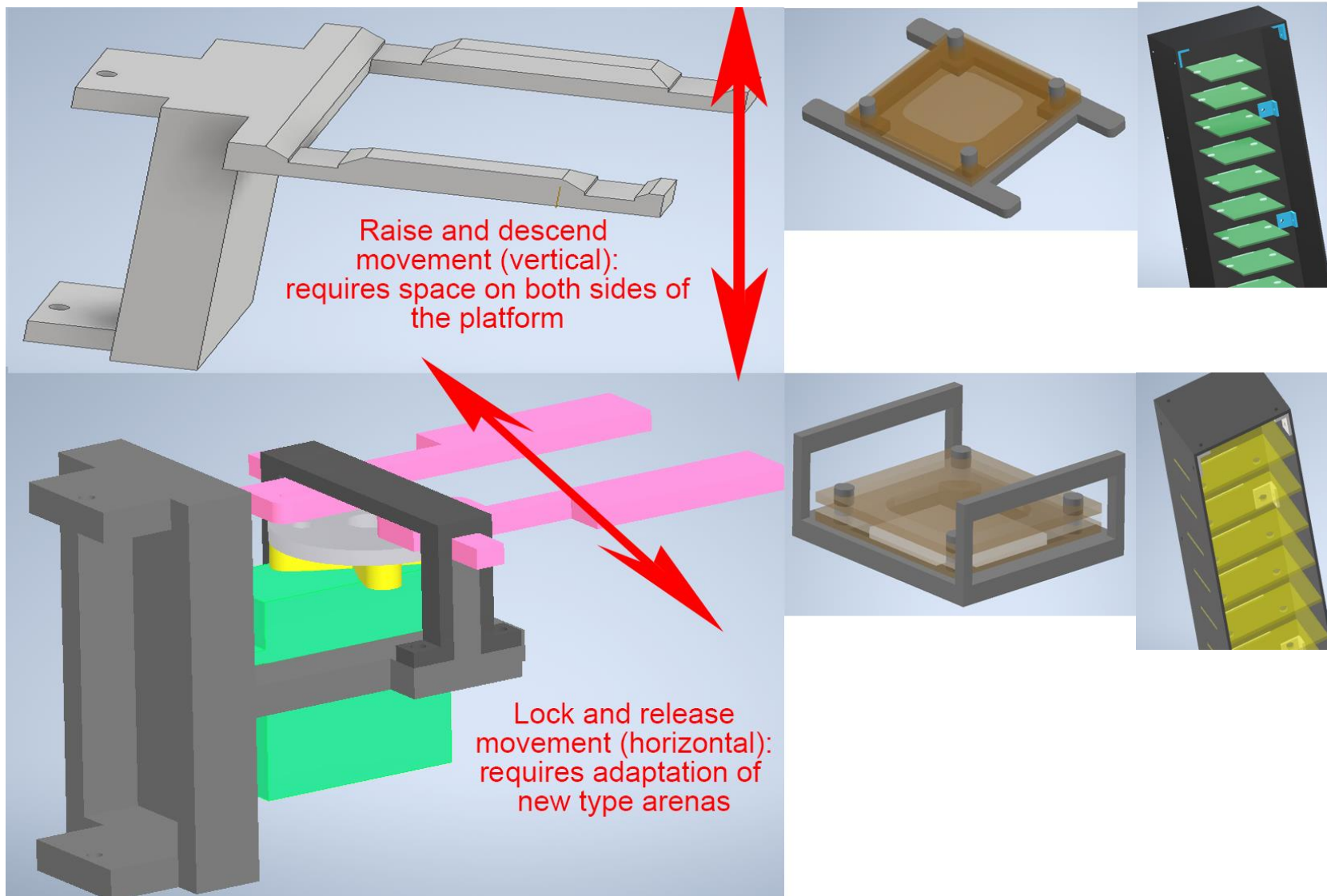


Figure 6 Redesign of gripper and arena modules



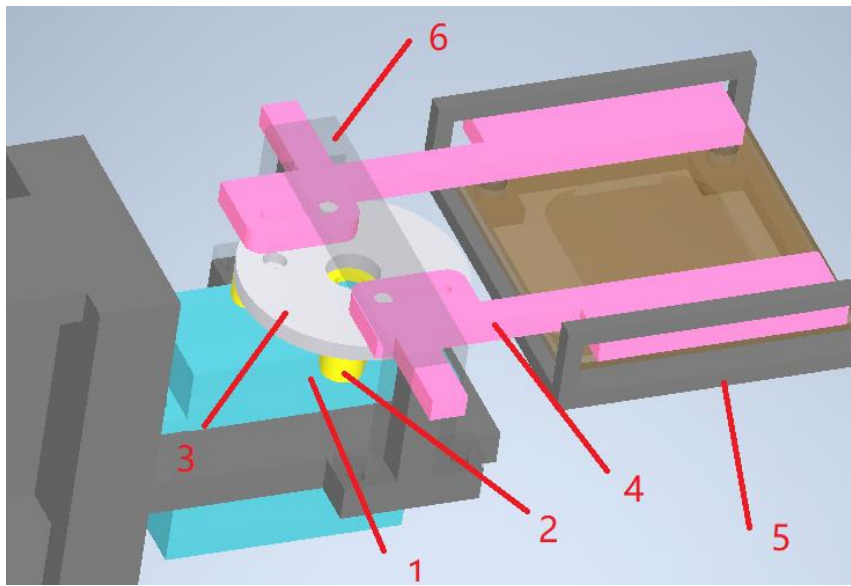


Figure 7 Gripper module overview

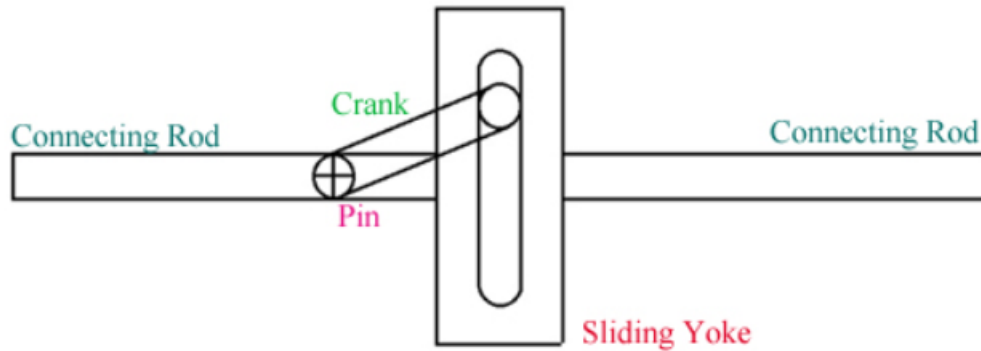


Figure 8 Scotch-yoke mechanism

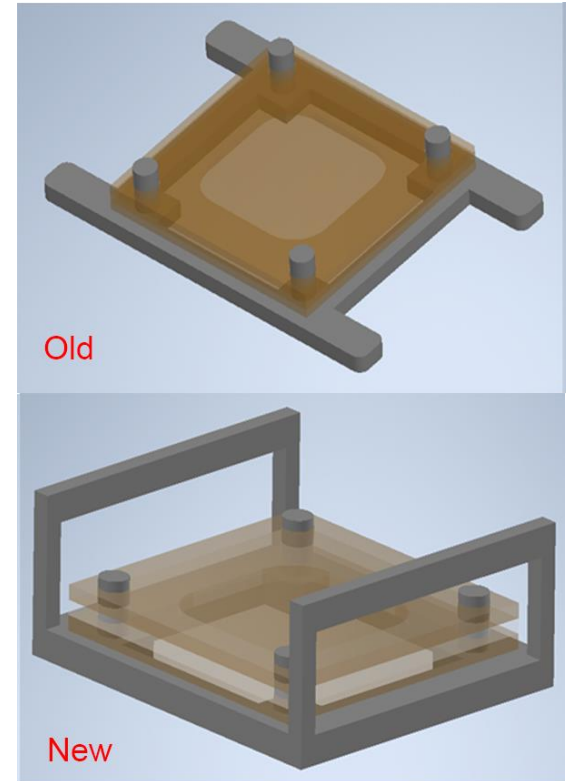


Figure 9 Old and new arena design



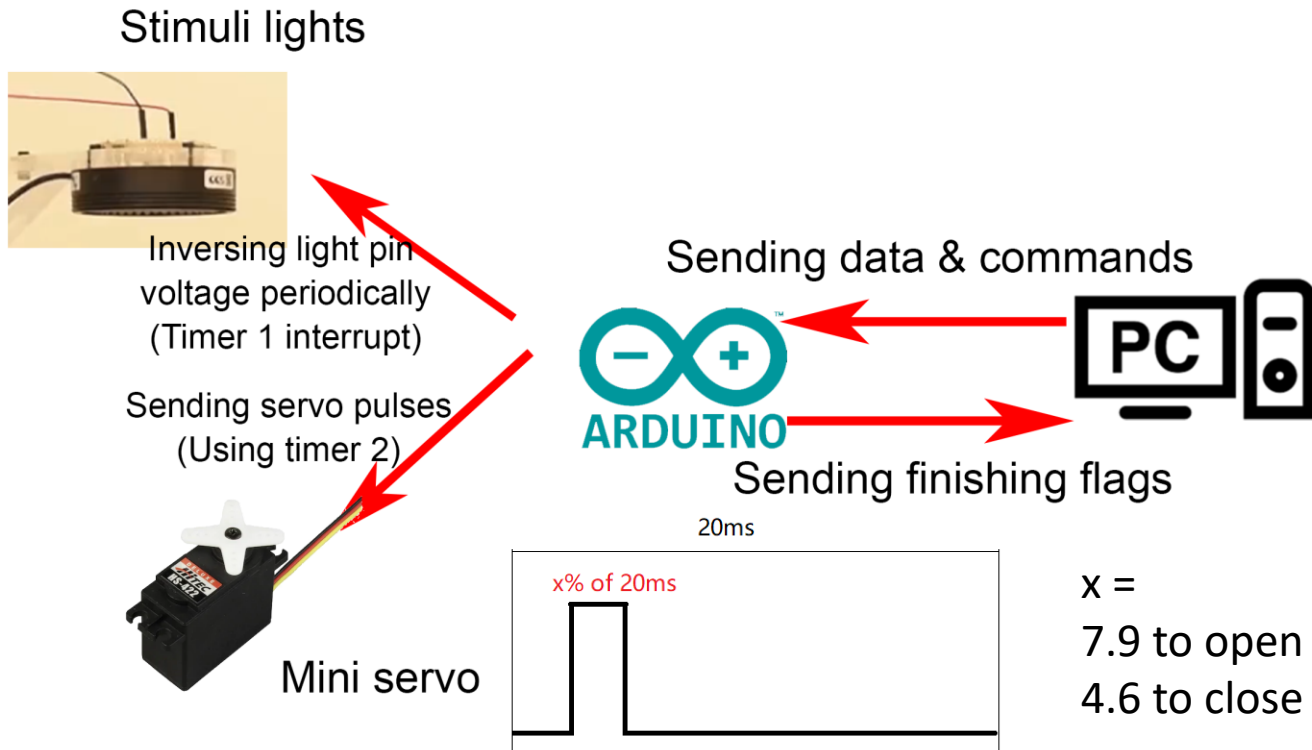


Figure 10 Controlling logic of gripper finger and stimuli lights



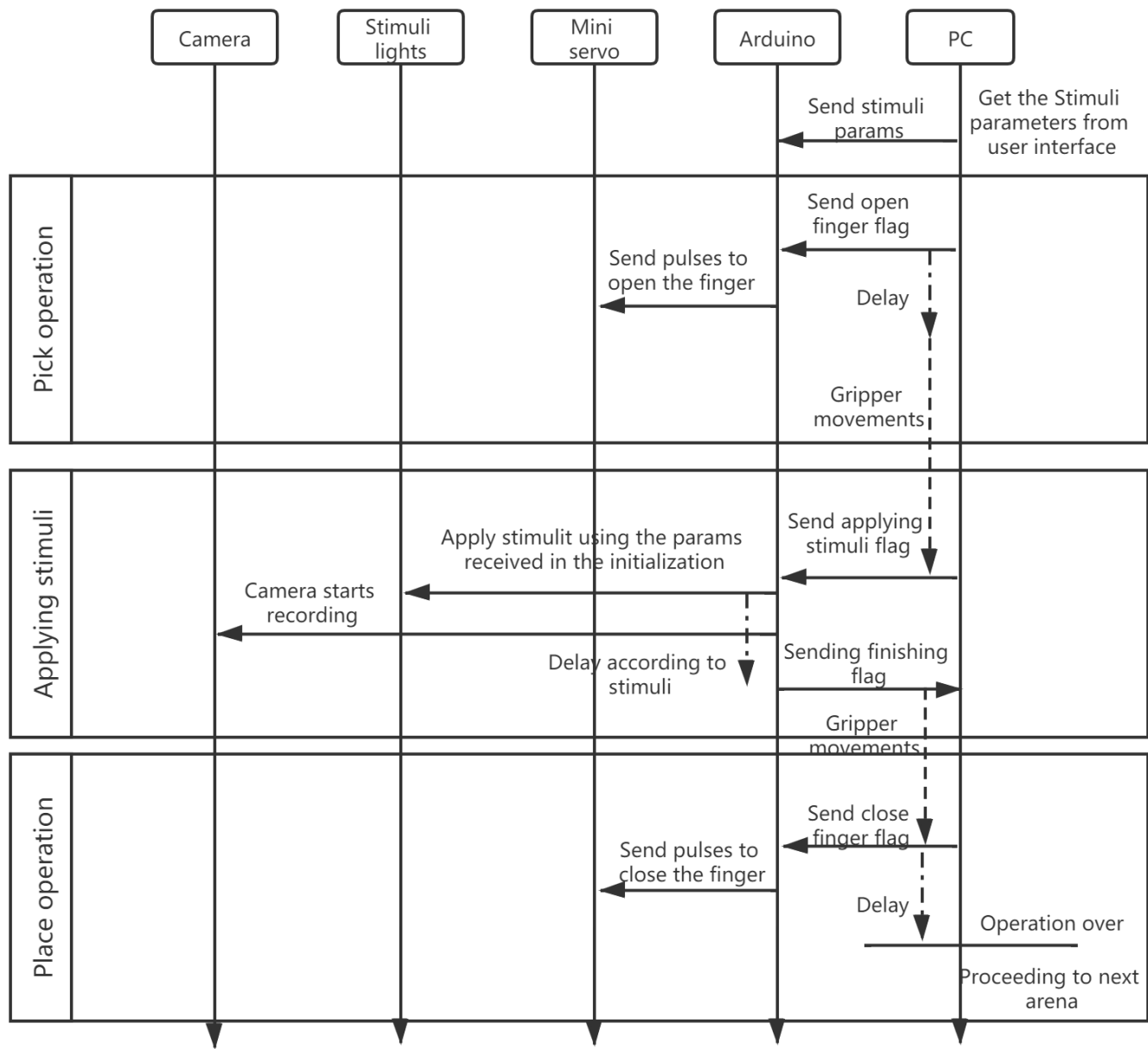
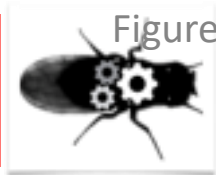
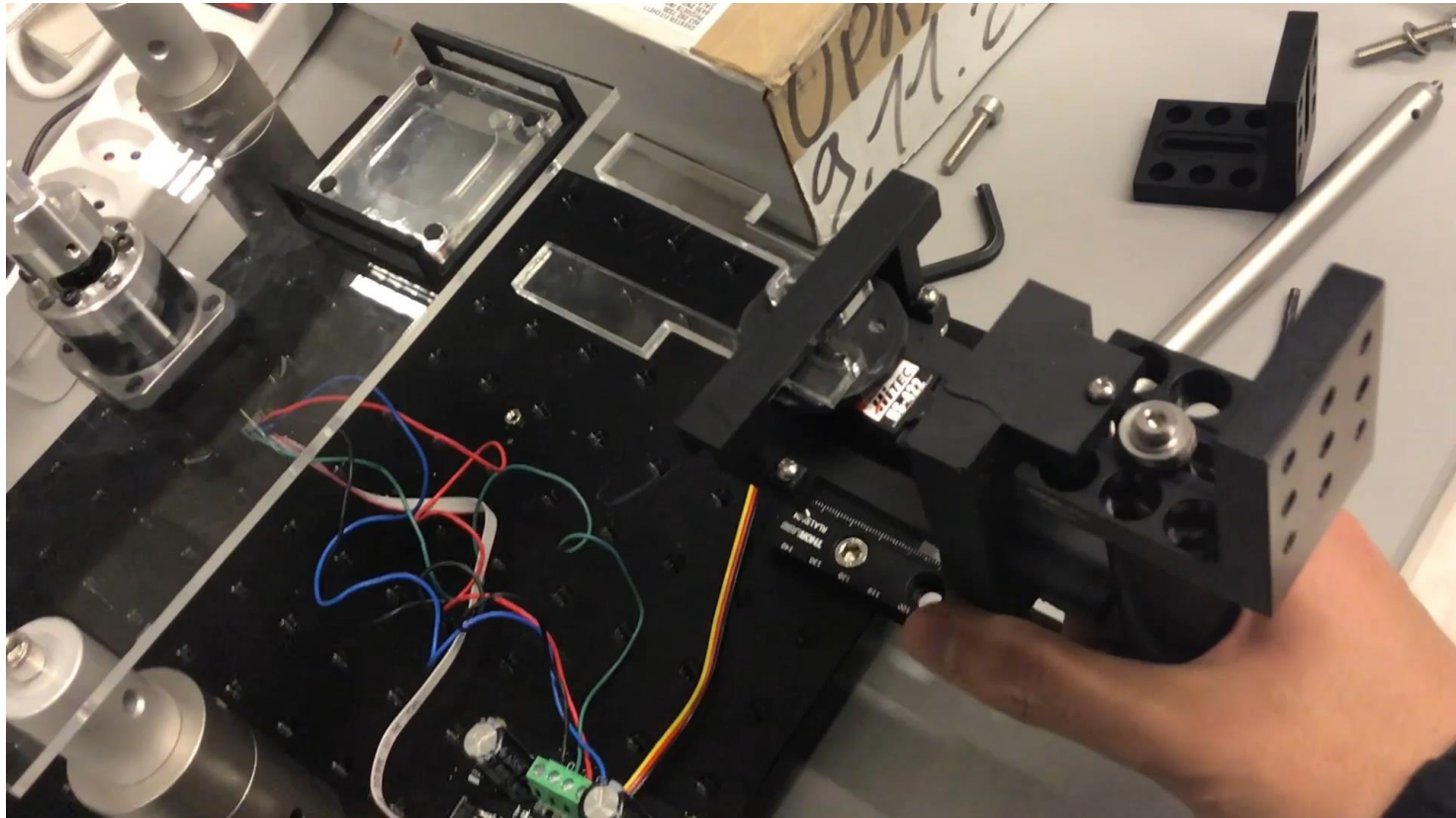


Figure 11 Communication graph in gripper control



# Gripper & arena module test



# Rack module



Figure 12 Capacity expansion

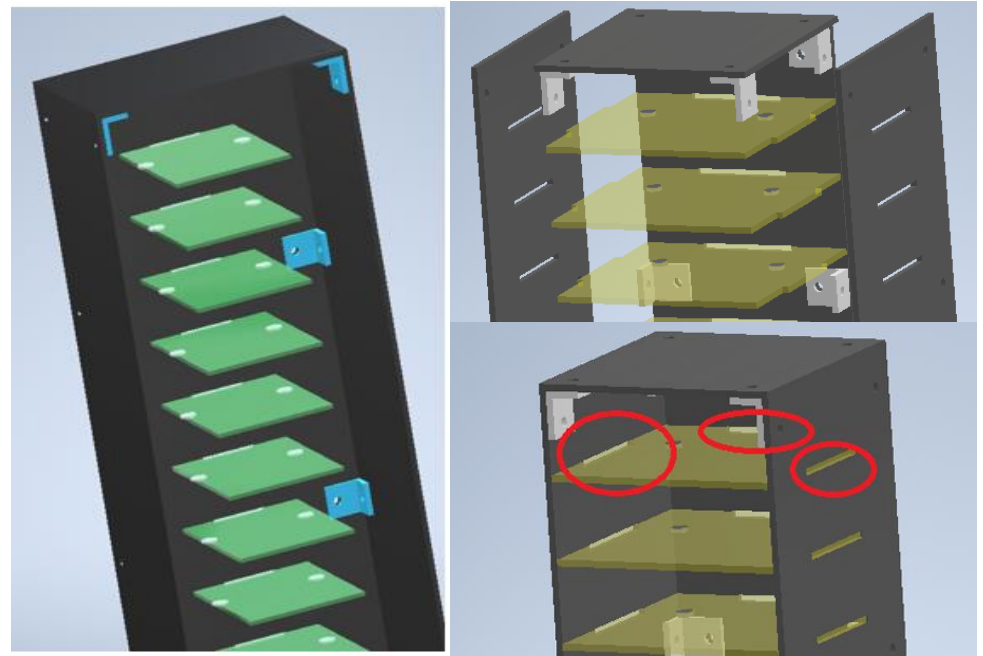
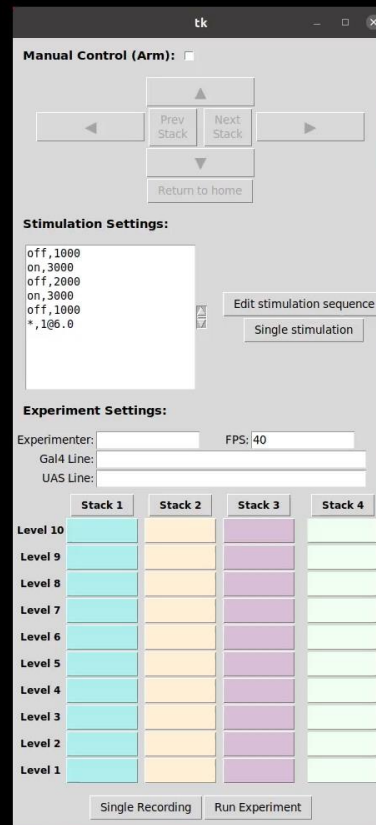


Figure 13 Structure improvement



# Overall tests





# Conclusion

- Module tests showing the robustness and functionality.
- Overall test showing the whole working process of the system and coordination between each modules.
- Rack and arena modules do not have many interactions with other modules. But they need to be manufactured and mounted on the carousel so that the movement of gripper can be adjusted.



# Evolution of product

