

Fruit Flies in Biomedical Research

Drosophila, commonly known as fruit flies, are utilized in biomedical research to model and develop solutions for neurodegenerative human diseases. Flies contain low genetic redundancy, allowing for a granular understanding of human brain activity as it relates to diseases like Parkinson's, Alzheimer's, etc.

At biomedical laboratories, including Bhandawat Laboratory at Drexel University, flies are placed in mechanical chambers where their neural activity can be manipulated using a variety of light-based stimuli.

However, researchers are limited by existing hardware and software constraints, which have resulted in inconsistent monitoring, prolonged setup times, and manual adjustments that impact data reliability. Bhandawat Lab aims to address current grievances via a new and improved fly testing chamber.

Linear Actuator Requirements

- Speed must be at least 5 cm/s
- Accuracy/Positioning repeatability should be at most $\pm 0.05\text{mm}$

Requirement	Weight	Linear Motor	Belt Driven	Ball Screw
Accuracy	5	5	1	4
Speed	2	5	4	2
Cost	4	1	5	4
Reliability	4	4	2	4
Noise	3	3	2	3
Total	=	64	47	65

Methods

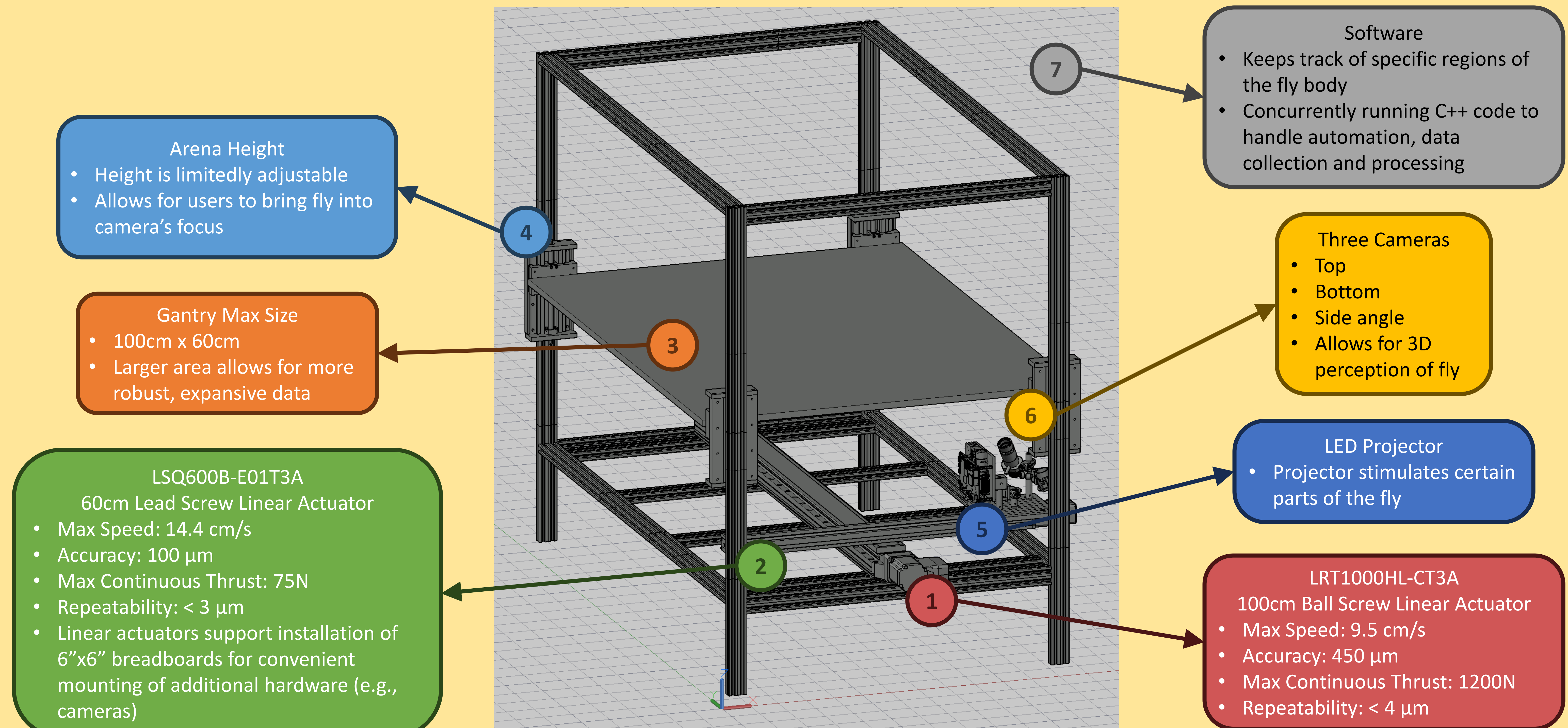
Manual Tests:

- Trial and error testing of newly mounted components (projector + 2-camera system) to account for size and angle measurement
- 3D Environment Camera Calibration using updated C++ codebase based off pre-existing Calibration with improvements, and adjustments

AutoCAD:

- To account for spacing and physical scaling concerns with the additional of a DLP Light Crafter, CAD models were developed to confirm whether gantry components would fit appropriately without impacting performance

Gantry Redesign



Conclusion

Hardware:

- Completed the design and structural scaling objectives of this project by modeling a new chamber to support 100cm x 60cm XY linear actuators
- Testing the new camera/projector mounting system on the current gantry rig resulted in a successful first pass

Software:

- Completed an in-depth analysis of the existing software to update existing code for upgraded motors and newly added projector
- Testing and creating libraries for the cameras and projector for future, open-source, automation implementation

The upgraded model of the two-camera and projector system allows for compact placement on the breadboard of the Y-axis linear actuator, ensuring minimal distance between the camera and projector and removing the need for manual calibration of the mounted components.

Mount Development

