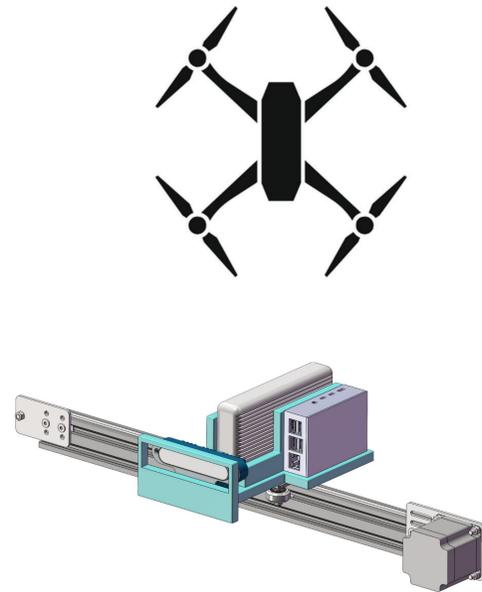


Dodge The Wrench

Project

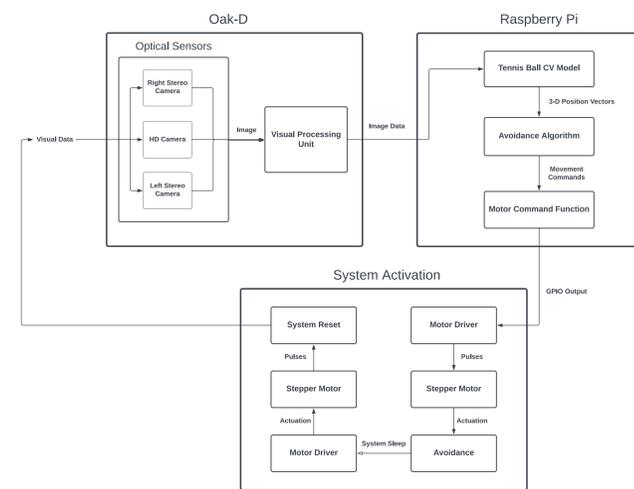
The Dodge The Wrench (DTW) project focused on developing a compact method for object detection and avoidance. The primary goal was the improvement of unmanned drone flights for Space Dynamics Laboratory (SDL). Currently, these unmanned flights require extensive planning and are contingent upon uncertain factors and conditions.

SDL desired the development of an embedded system which could reduce the risk of projectile collisions with the drone. DTW aimed to provide a simple prototype that SDL may utilize for the development of a sophisticated avoidance system.

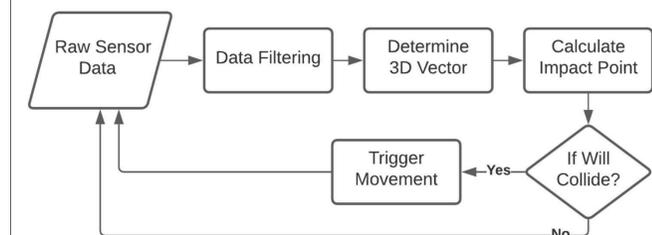


System

System Diagram



Software Diagram



Methods

Sensing and Object Tracking

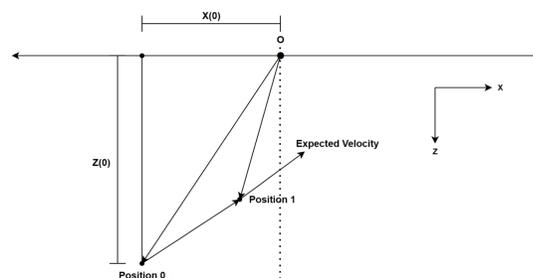
- Multi-camera optical sensor (Oak-D)
- Real-time visual processing (Oak-D)
- Computer Vision model (Tennis Ball)
- Linux-based computer (Raspberry Pi)

System Housing

- Necessary component mounts
- Custom fit slot for Oak-D sensor
- Shielding for sensor

Avoidance Determination and System Motion

- Determines if impact will occur
- Outputs movement commands
- Feeds pulses to motor for movement



Conclusion

The avoidance algorithm produced desirable results for a single degree of freedom. The primary benefit of the avoidance algorithm was the consistent behavior. Future work for this project will include developing the algorithm for viability in drone applications.

The computer vision model for detecting projectiles proved successful. Further research will assess the feasibility of expanding the range of detectable objects with this method. The Oak-D was able to provide near real-time object detection and tracking. Future work will involve reducing response times of the system.

The OpenBuilds linear actuator performed well for the benchtop prototype by providing necessary speed and consistency. The motor control algorithm further improved the system's motion. Lastly, the acceleration and deceleration programs within the motor control algorithm dampened the jerk experienced by the system and motor.