



# Modular Filler / Extractor

Festo - University of Colorado at Boulder - Design Center Colorado

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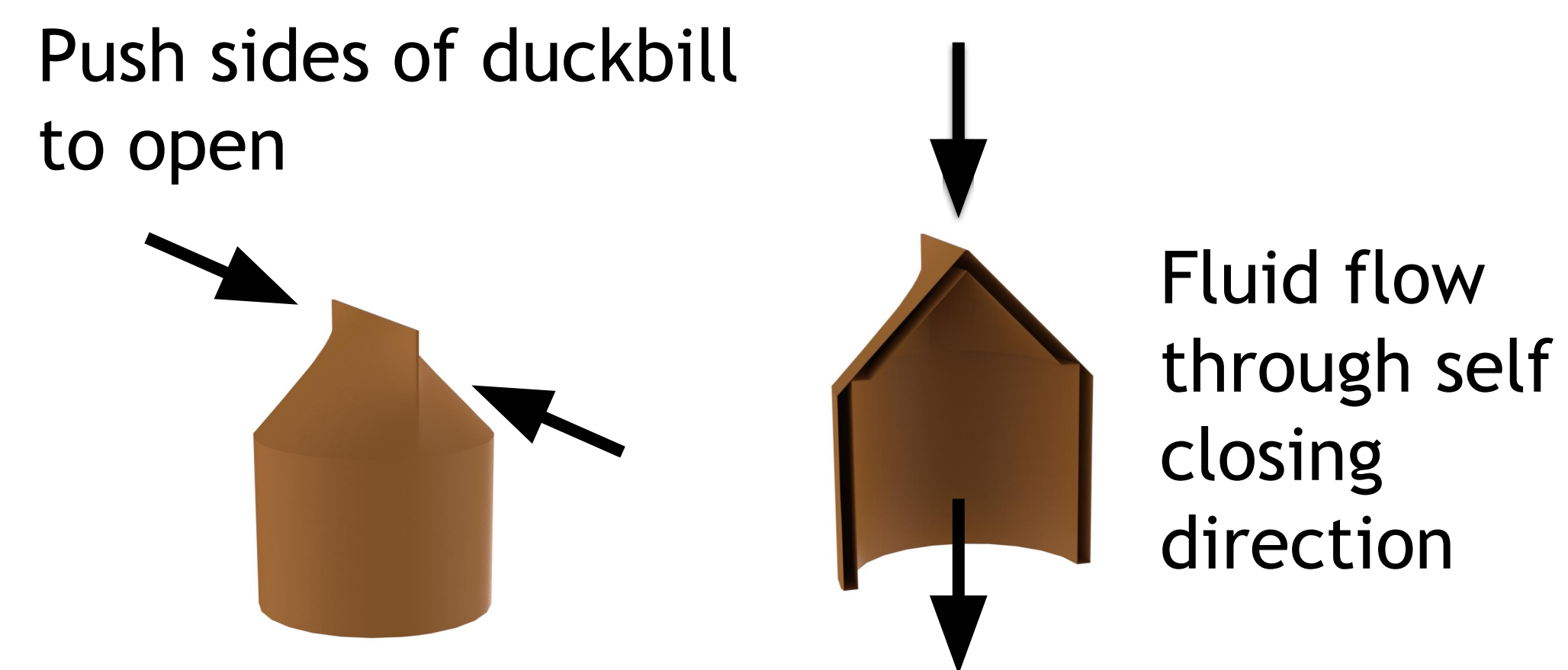


## Objective

Test the feasibility and efficiency of duckbill valves in an automated liquid actuation system

## Background

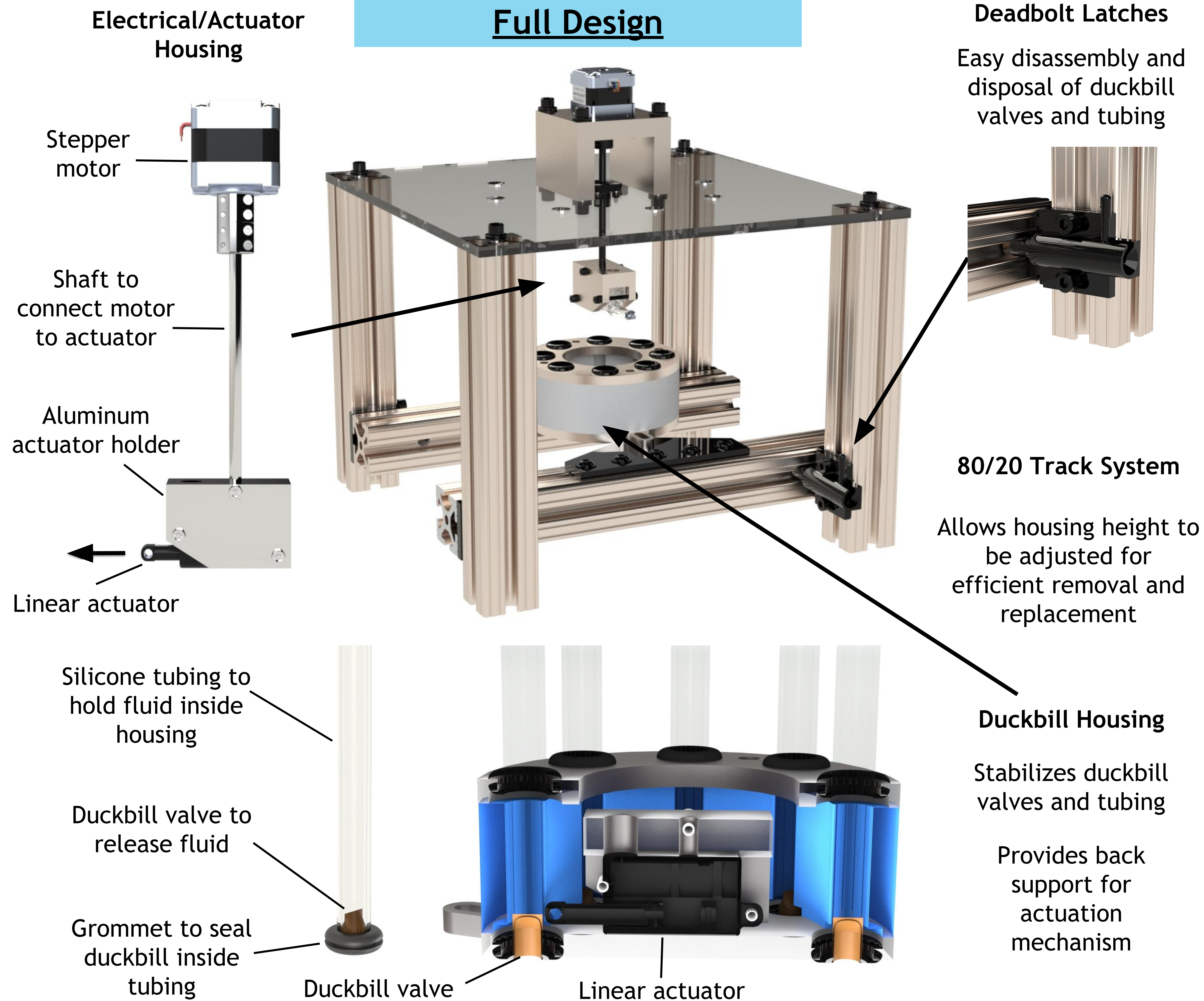
- Duckbills are a type of check valve
  - Open by applying force to each side
  - Allows for fluid flow in one direction
- Duckbills prevent contamination in medical devices and drainage systems



## Specifications

- Minimum 8 duckbill valves
- Overall housing diameter < 10 cm
- Autonomous fluid dispensing
- No leakage
- 2 bar duckbill burst pressure
- Reusable actuating system
- Disposable device housing

## Full Design



## Preliminary Testing

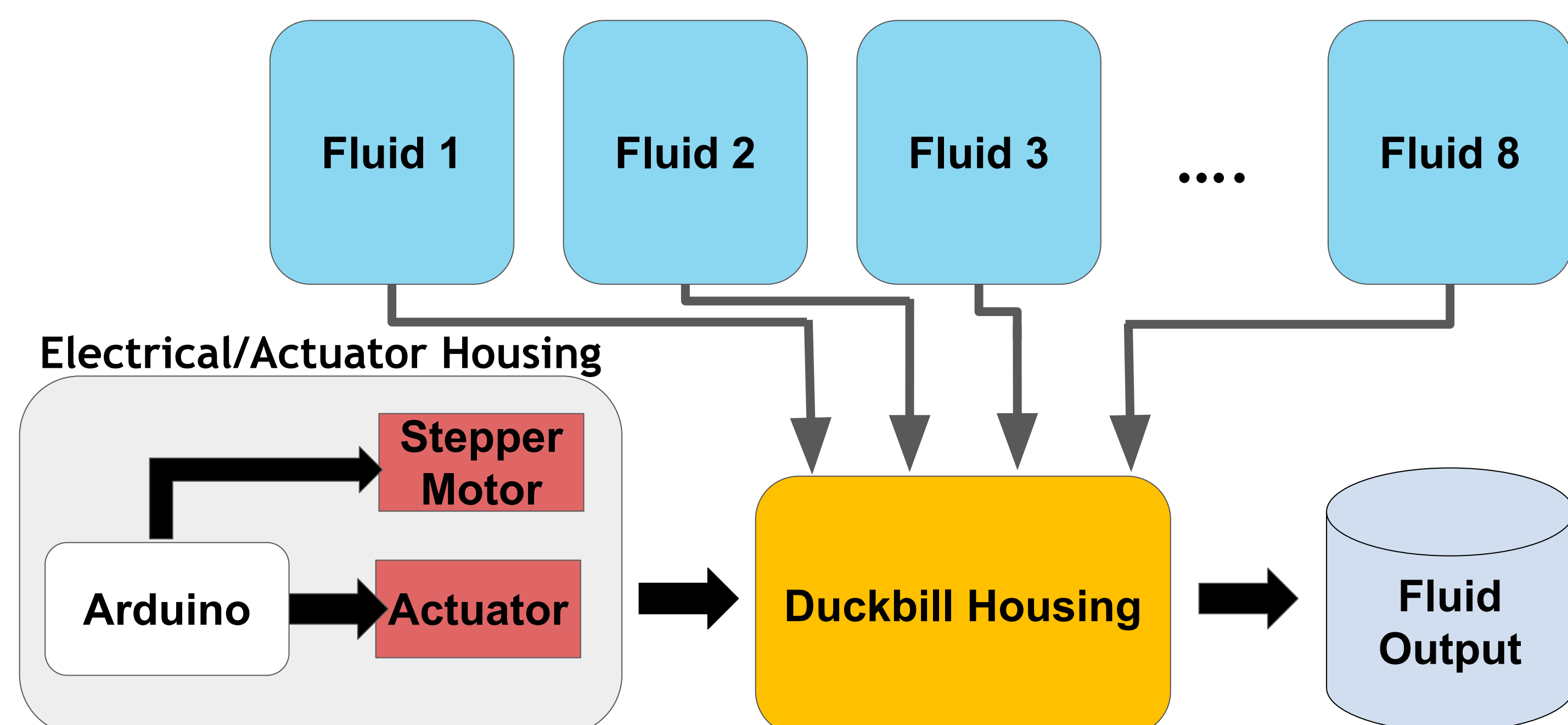
- Duckbill Valve Burst Pressure Test:**
- Burst Pressure: 0.5 Bar
- Duckbill Compression Test:**
- 7 Newtons
- Duckbill Leakage Test:**
- Eliminated fluid leakage with the addition of a rubber grommet

## Final Testing

- Actuator Alignment Test:**
- Aligned actuator with each valve
- Duckbill Valve Burst Pressure Test:**
- Burst Pressure: 0.5 Bar
- Zero Positioning Test:**
- Implemented switch to locate zero position

## Results

- Actuation:**
- Had enough force to open duckbill but was not as precise as needed
- Electrical:**
- Full rotation code and actuation process was successful
- Full Integration:**
- Integrated system with 8 IV bags



## Electrical System

- Shaft spins until switch activated in motor mount setting origin
- Arduino receives position from laptop user input (position 1-8)
- Stepper motor rotates to desired position
- Linear actuator extends to compress duckbill and dispense liquid

## Improvements

- Different housing materials for ease of manufacturing, recycling, and lower cost (injection molding)
- Tighter tolerances; metric manufacturing
- Liquid rack designs
- Design and manufacture duckbills specific to our uses

## Conclusion

- Would not recommend using duckbill valves for small scale, high precision work, specifically in life science industries
- Duckbill valves are viable for this application on larger scale because less precision is needed and more cost effective

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