Rising Toilet Seat

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Introduction
Many elderly and persons with disabilities struggle to get on and off the toilet by themselves. Passive devices such as toilet seat boosters and handrails are often inadequate. Several active lifting devices are available, but these devices have several downfalls:
• Requires large batteries and power cords
• Too wide to fit in most residential bathrooms
• Expensive
An affordable and safe toilet lift is needed that doesn’t require power cords or renovation!

Design

Testing & Results
• 1st Phase: A Matlab analytical model was created to predict the device lifting performance. The model was used to design the device lifting geometry and hydraulic cylinder specifications.
• 2nd Phase: A physical stand-alone prototype was constructed to test the critical lifting time and weight capacity.
• 3rd Phase: User testing was conducted with senior residents at Legacy Village Apartment Complex. The user’s weights ranged from 100-280 lbs and ages from 62-97 years old. User feedback was vital for determining the 3-way valve placement as well as validating ergonomics and lifting performance of the device.

Conclusions
• Created a successful lift device powered by the toilet supply line
• Met all specifications except device lifting time was faster than specs from competitive benchmarking. However, user testing showed faster lifting times were comfortable.
• Users felt safe using the device
• A more ergonomic seat lifting motion would be beneficial

Advantages to Rising Toilet Seat
No batteries – the device is always ready to use
Compact – fits most residential bathrooms without renovation
Eco-friendly – uses less than 2 liters of water per cycle and the water is drained into the tank for flushing
Easy installation – the device mounts in place of the toilet seat and uses the water line that supplies the toilet
Cost – much cheaper than other solutions

Challenges
Problem: Need to power the device without batteries or power cords
Solution: Use existing water supply line as power source to operate device

Problem: Hydraulic cylinders vibrate when operated with water (instead of oil) at low pressure
Solution: Designed and built custom low pressure cylinders

Problem: Initial design was too wide to fit in residential bathrooms
Solution: Redesigned the lift mechanism to allow the hydraulic cylinders to be positioned closer together

Analytical Model - Lift Time vs. Weight

Metric | Physical Performance | Target Specs
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User Weight Capacity [lbs] | 280+ | 300
Install Time [hr] | <1 | <2
Overall Width [in] | 23.25 | <25
Lifting Time [s] | 10-15 | 14<s<23
Water Usage [L] | 1.9 | <3
Cost [$$] | $275 | <$1,000

Acknowledgements
• Selective Innovative Technology and Engineering (SITE): Senior Design Projects Grant funded by NSF under Grant 1159885
• Legacy Village Apartments
• BT Steelfab