Assisting Gastrostomy Tube Feedings

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THE FOUNDRY

Problem Statement

Many patients with amyotrophic lateral sclerosis (ALS) have upper extremity weakness and need a device in the home that can raise and lower a 1L bag filled with nutritional formula in order to help feed themselves autonomously.

Significance

5,000 people are diagnosed with ALS yearly and some require feeding tubes surgically inserted into their stomachs. Patients rely on gravity-dripping liquid formula into the tube; however, some are unable to raise them to those heights and rely on caretakers and not all individuals with ALS have caretakers. This design allows for a feeding regimen independent of caretakers.

Figure 1: *Gastrostomy Tube User*

Design Criteria

Criteria	Target Value
Ease of Use	Easy to Use value of 4 ≥ on User Defined Scale (UDS)
Easy Maintenance	Easy to Maintain value 3.5 ≥ on UDS
Life Span	Product lifetime > 5 years
Portability	Weight < 12 kg

Design Blocks

Base:
- Wheels
- Frame
- Motor Attachment to Frame
- Intravenous Bag (IV) Hook

User Interface (buttons and lights):
- Arduino Code
- PCB
- Gearbox motor
- Power Source

The device raises and lowers a 1L bag. This is done through a rotating winch mechanism at the very top, with a bag attached to a hook (Figure 1) being raised and lowered by a motor (Figure 5). The user interacts through three buttons to raise, lower, and stop the bag. An LED lights up to signal the raising and lowering actions (Figure 3).

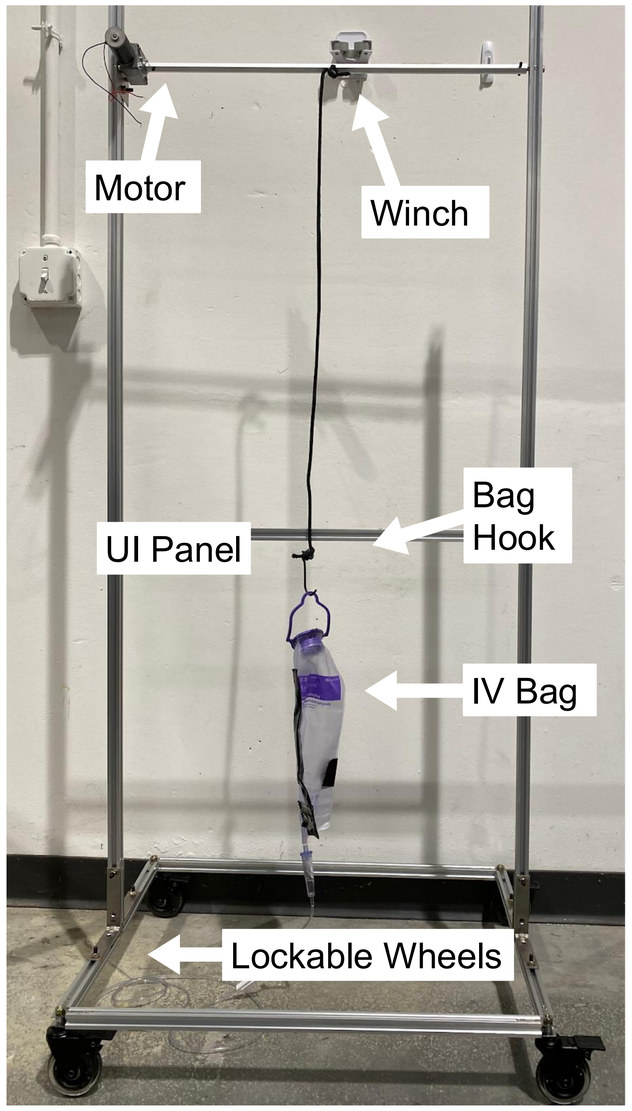

Figure 2: Entire solution with frame, UI panel, and winch mechanism

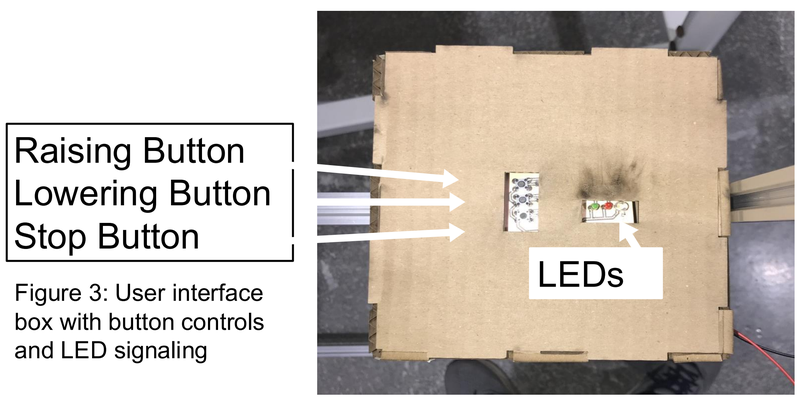

Figure 3: User interface box with button controls and LED signaling

Figure 4: Prototype iterations. Final winch mechanism pictured above

Testing

Ease of Use	15 users lift and lower filled bag with device	TBA
Easy Maintenance	15 users perform a cleaning cycle (lifting & lowering bag, flushing w/ 250 ml)	TBA
Life Span	Lower and raise the bag without failure for 300 times	TBA
Portability	15 users move the device 10 yards. Weight <11 kg	TBA PASSED: weight test

Each test was conducted twice and ranked on a user defined scale (UDS) unless stated otherwise.

Future Plans

- High-fidelity attachment mount for button user-interface (UI) to frame of device
- Aesthetic rope attachment method
- Adjustable height controls
- One button-control UI and automatic stopping
- Waterproof cover for the motor

Conclusion

We constructed a device lowers and raises a 1L bag of liquid feeding formula for patients with ALS. The bag travels from sitting height to above the head to allow for a gravity drip of the feeding bag to occur.
Testing still needs to occur, however, this proof of concept is promising and fulfills the needed mechanisms described in the problem statement.

References

Sue Steves, Registered Dietician
Kevin Caves, Ph.D.
Roarke Horstmeyer, Ph.D.
Cameron Kim, Ph.D., Technical Mentor
Jackie Herzberg. Teaching Assistant