

Summary: Design of a Wheelchair-Mounted Kibble Dispenser for Low-Dexterity Users and Their Service Dogs

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Low-dexterity users often have trouble rewarding service dogs with a single piece of kibble. In response to this challenge, a junior-level design course at Penn State tasked our team with designing a purely mechanical dispenser that could attach to a wheelchair. As stated in the project requirements [3], the dispenser must release only one kibble at a time, operate without electronics, and prevent the kibble from touching the ground. This project summary presents the design of a wheelchair-mounted kibble dispenser that satisfies these requirements through a user-friendly pull-slide mechanism and a compact, modular design suitable for a variety of wheelchairs.

To guide the development of this design, our team identified three primary customer needs: ease of use, consistent output, and ease of transport. From these needs, we assigned measurable specifications, including a target setup time of less than two minutes and a total device weight under five pounds. Using a functional decomposition chart, we divided the system into four key subfunctions: store kibble, dispense kibble, catch kibble, and attach to wheelchair. We then generated concepts for each subfunction and evaluated five dispensing mechanisms using a screening matrix. Based on a weighted selection matrix, our team selected a pull-slide design. As shown in Figure 1, this mechanism consists of a sliding platform with a single opening that aligns momentarily to dispense one kibble before returning to its closed position.

Over the course of the semester, our team built and tested three prototypes: Alpha 1, Alpha 2, and Beta. Each prototype iteration addressed key issues related to reliability, manufacturability, and usability. In the final beta design, we incorporated flexible backpack-style straps for wheelchair mounting, a weather-resistant lid for kibble storage, and two dispensing ports operated by sliding the pull mechanism in opposite directions. As shown in Figure 2, the beta prototype reflects improvements in component fit, sealing, and accessibility. The dispenser met all performance metrics during testing and demonstrated consistent single-kibble output without jamming or spilling. To conclude the project, our team documented the design process in a short film [4].

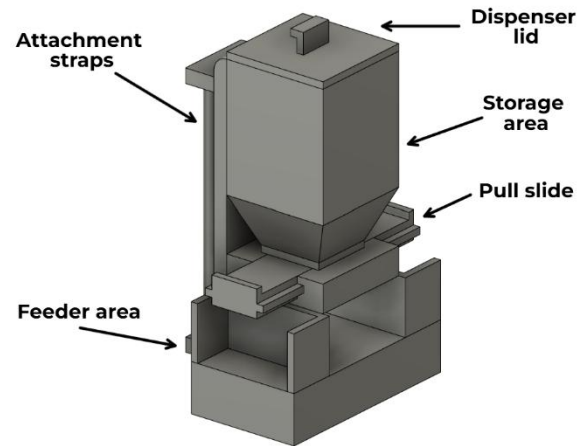


Figure 1. CAD model of our team’s wheelchair-mounted kibble dispenser. The design includes a pull-slide mechanism with dual feeder ports, a weather-sealed storage container, and flexible mounting straps compatible with standard wheelchair frames.



(a)



(b)



(c)

Figure 2. Prototyping sequence of our kibble dispenser: (a) Alpha 1 prototype, (b) Alpha 2 prototype, and (c) Beta prototype. Improvements focused on sliding precision, durability, and attachment stability across all three iterations.

References

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2. Canine Companions. (n.d.). *Who We Are*. Retrieved from <https://canine.org/about/who-we-are/>.
3. Katie Fitzsimmons, *ME 340: Mechanical Engineering Design Methodology* (University Park, PA: Department of Mechanical Engineering, Penn State, 2025).
4. Sikora, J., Gent, J., Bertsch, S., & Joshi, A. (2025). *Initial Research for the Design of a Kibble Dispenser for Low Dexterity Users and Their Service Dogs*.