International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 13 Issue 12 ǁ December 2025 ǁ PP. 184-187

Design Specifications for Elderly-Friendly Assistive Dining Table

Chuanye QI, Chengshuo LIU, Sijiang SUN,Shuang HU,Jiatao HUANG
School of Mechanical and Automotive Engineering, Shanghai University of Engineering Science, China

Abstract
The paper design an elderly-friendly assistive dining table, comprising a dining tray. The dining tray is arranged on a tabletop panel via a rotary moving mechanism. One end of the bottom surface of the tabletop panel is connected to a mobile cart via a lifting mechanism. The lifting mechanism adopts a nested structure for driving the tabletop panel together with the dining tray to move up and down. The rotary moving mechanism is used for driving the dining tray to perform rotational movement and to move linearly along the tabletop panel. The mobile cart is used for driving the elderly-friendly assistive dining table to move autonomously. With the assistance of the mobile cart, it can autonomously move to a target location as needed, facilitating meal delivery. With the assistance of the lifting mechanism, the height of the tabletop panel is automatically adjusted to accommodate different posture requirements of the elderly during meals. Utilizing the rotary moving mechanism, not only can the dining tray be moved to different positions on the tabletop panel, but also the food at different positions on the dining tray can be rotated to the front of the elderly at the current location, thereby improving dining convenience.

Keywords: *Rotary moving mechanism; Lifting mechanism; Autonomous movement; Height adjustment*

Date of Submission: 07-12-2025 Date of acceptance: 19-12-2025

I. INTRODUCTION

By 2023, the number of elderly people in China is approaching 300 million, with the number of solitary elderly exceeding 130 million, and this figure is growing at an unprecedented rate.

In the daily lives of the elderly population, mealtime often presents numerous inconveniences: hand tremors causing difficulty picking up food, joint degeneration making it hard to adapt to fixed-height tables, declining physical function leading to difficulty standing to reach dishes, and solitary elderly facing safety risks when carrying hot soup and meals alone. Research shows that 72% of elderly people experience a 30% or more increase in mealtime duration due to unsuitable table design, while frequent spills increase cleaning burden and psychological stress.

The Elderly-Friendly Assistive Dining Table is centered on the core logic of "convenient dining, caring for the elderly," transforming rigid needs into a natural life ritual. The electrically adjustable table legs eliminate the need for bending, controlled via tabletop buttons and an APP; the rotating lazy Susan uses mechanical buttons with light-touch interaction for easy dish selection by the elderly; ergonomically designed arm supports on both sides of the table provide gentle support, avoiding psychological rejection while maintaining dining autonomy. The remote-controlled mobility function breaks the physical barrier between the kitchen and dining room, allowing solitary elderly to dine conveniently anytime, anywhere. The table features a single offset leg support, enabling the table to be remotely driven to the bedside for in-bed dining without the user needing to get up.

II. MECHANICAL DESIGN

2.1 Lead Screw Telescoping Mechanism

The table leg telescoping mechanism is as follows。The telescoping mechanism (Figure 1) uses a 42 stepper motor at the base, connected via a coupling to the lead screw. The lead screw is fixed to two platforms. Two sets of pulleys and sliders between the upper and lower columns ensure linear extension/retraction of the legs, preventing lateral sway.

When height adjustment is needed, the user controls the motor shaft rotation via the APP. The lead screw converts the motor's rotary motion into linear up/down movement of the nut, achieving height adjustment. This accommodates elderly individuals of different statures in various dining settings.

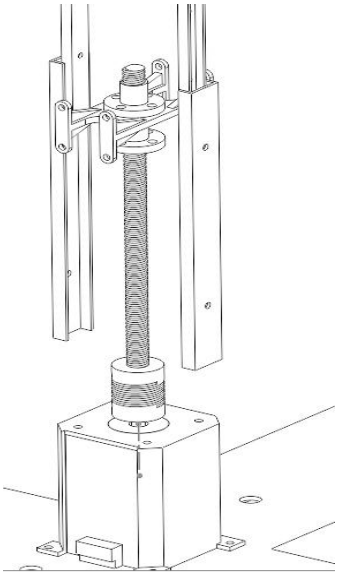

Figure 1: Table Leg Telescoping Mechanism

2.2 Table Mobility Device

The table base uses a T-shaped structure (Figure 2). A DC geared motor paired with a drive wheel is located at each end of the horizontal bar, providing locomotion. A caster wheel is at the end of the vertical bar for directional control.

This function benefits mobility-impaired or semi-paralyzed elderly, reducing their burden of movement during meals, allowing them to use the table anywhere.

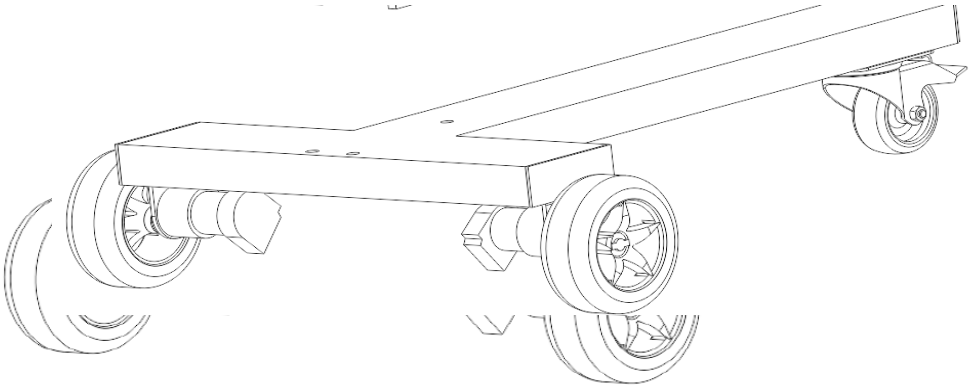

Figure 2: Table Mobility Device

2.3 Assistive Arm Support Device

The assistive arm supports are located on both sides of the tabletop, one pair per side, for users on either side of the bed. The base is a small metal plate. A neodymium magnet is attached above it, followed by a metal platform . A bolt connects to a disc damper (Figure 3) above, providing damping for users with hand tremors, reducing the risk of dropping food and increasing stability. Above the damper is the support plate . The support plate and the armrest are connected via hook-and-loop fasteners (Velcro). When the user is on the opposite side of the table, the armrest can be detached and attached to the support plate on their side (Figure 3).

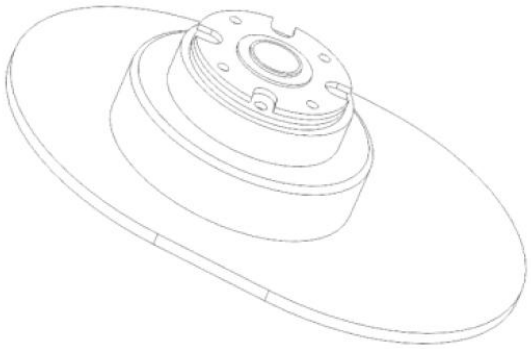

Figure 3: Disc Damper

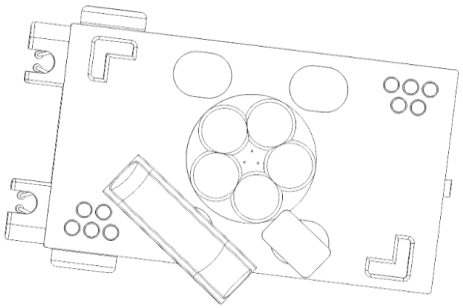

Figure 4: Table Top View

2.4 Rotating Lazy Susan Device

The rotating lazy Susan is driven by a servo motor rotating a worm gear. The worm gear engages and rotates a worm wheel, which drives an active pulley. This, in turn, drives an intermittent mechanism (Geneva drive) connected to the lazy Susan, achieving motorized rotation.

Users control the servo's rotation angle via buttons near the armrests to select desired dishes, making the dining process more convenient.

The cane holder bracket is installed near the table leg (see Figure 5), making it more convenient and safer for cane users.

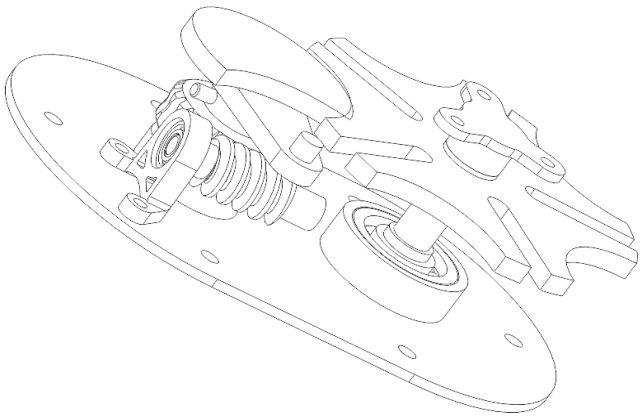

Figure 5: Cane Holder Bracket

III. ELECTRONIC CONTROL

3.1 Table Mobility

The mobility system achieves high-precision movement through the coordinated architecture of dual CHR-GM37-520 DC optical encoder geared motors + L298 driver module + APP control interface.

Due to the T-shaped base, straight-line travel is impossible with the caster wheel leading. The solution is to initially have the drive wheels lead, then rotate 180° upon reaching the destination.

3.2 Table Leg Height Adjustment

The electric height adjustment function is achieved via a 42 stepper motor (17HS6001S) + TB6600 stepper motor driver + lead screw transmission mechanism for precise height control, deeply integrated with the APP.

3.3 Lazy Susan Rotation

The rotating lazy Susan function is achieved via a servo motor + worm gear reducer + intermittent positioning mechanism for precise sectional rotation, combined with physical button interaction and logical control.

IV. CONCLUSION

This paper breaks through the limitations of traditional static and single-function dining tables, constructing a full-scenario elderly-friendly dining solution through mechatronic design. Addressing issues like utensil slippage due to hand tremors, difficulty standing after prolonged sitting, and height mismatch with wheelchairs, the table employs an electric height-adjustment framework: the main structure incorporates electric actuators for height adjustment, adapting to diverse scenarios like wheelchairs and beds. A rotating lazy Susan is embedded in the tabletop, using a Geneva mechanism to select corresponding dishes. L-shaped recessed handles on the edges provide support when users push themselves up, reducing joint pressure. Magnetically attached damped arm supports on both sides of the lazy Susan stabilize users' hand strength, making it harder to drop food while picking it up.

REFERENCES

[1]. Chen, L., Wang, Y., & Zhang, H. (2022). Design and evaluation of an intelligent assistive dining table for elderly with motor impairments. Journal of Rehabilitation and Assistive Technologies Engineering, 9(1), 45–58.

[2]. Kim, S., Park, J., & Lee, M. (2021). A study on the development of a height-adjustable and movable dining table for bedridden elderly. Gerotechnology, 20(3), 112–125.

[3]. Wang, Q., Liu, F., & Zhou, T. (2020). Ergonomic design of assistive dining devices for elderly with hand tremors: A case study of damping-based arm support systems. International Journal of Industrial Ergonomics, 78, 102–115.