Parkinson's Kitchen Redesign Final Proposal

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Communications in the Engineering Professions - CMN 432 - 06

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December 5, 2023

I. COMPANY OVERVIEW AND EXECUTIVE SUMMARY

A. Company Overview

Adaptive Design Solutions (ADS) is a pioneering interior design firm committed to revolutionizing living spaces for individuals facing mobility challenges and disabilities. Specializing in creating environments that seamlessly blend functionality and aesthetics, ADS is dedicated to enhancing accessibility and inclusivity, particularly for seniors and individuals diagnosed with Parkinson's disease. With a team of seasoned professionals, ADS has established itself as a leader in crafting innovative solutions that prioritize the well-being and independence of its clients.

Our firm takes pride in a proven track record of designing spaces that not only meet physical needs but also contribute to an improved quality of life. Focusing on affordability and personalized alterations to accommodate unique requirements, ADS stands at the forefront of creating environments that empower individuals to live with dignity and self-sufficiency in their homes.

B. Executive Summary

Adaptive Design Solutions (ADS) presents a comprehensive proposal for specialized interior design solutions, with a primary focus on creating accessible kitchens for individuals aged 65 and above diagnosed with Parkinson's disease. Our mission is to develop functional and adaptive kitchen environments that promote independence, safety, and an enhanced quality of life for individuals facing mobility challenges.

The proposed design by ADS addresses the distinctive challenges posed by Parkinson's disease, encompassing accessibility and safety considerations, thoughtful appliance and furniture selection and development, innovative storage solutions, and implementation of available new technologies. Key features include accessible design elements, non-slip flooring, strategically placed grab bars, appropriate lighting, user-friendly appliances with prominent controls and newly developed technologies, adaptive tools and utensils, easily accessible storage solutions, and a layout designed to facilitate safe and comfortable meal preparation and cooking.

The accompanying report provides a detailed breakdown of costs, a timeline for implementation, and technical drawings showcasing customized appliances and utilities. These adaptations include a stable cutting board, motion-sensor drawers, an avant-garde blender, a magnetic induction stove, and a pitcher rotary holder. The proposal is backed by robust evidence, incorporating data, technical drawings, sketches, and insights from peer-reviewed literature, ensuring that each design iteration is meticulously crafted to address the unique needs of Parkinson's disease patients.

In summary, ADS aims to redefine living spaces by creating adaptive kitchen designs that prioritize safety, accessibility, and comfort for individuals with Parkinson's disease, promoting a sense of independence and improved quality of life.

II. INTRODUCTION AND PROJECT APPROACH

A. Introduction

Creating a kitchen that accommodates individuals with Parkinson's disease involves incorporating ergonomic elements to support limited mobility and ensure safety. Achieving this objective can be realized through the development of user-friendly appliances, the application of universal design principles, and optimizing the kitchen layout for patients. The symptoms of Parkinson's disease often result in a significant loss of abilities, making certain tasks challenging or impossible. Integrating such features into the kitchen facilitates easier navigation and use of appliances for users. When designing and constructing these products, the primary focus lies on affordability, time efficiency in the kitchen, independence, and environmental impact. It is crucial to keep the cost of the product comparable to common alternatives to avoid discouraging Parkinson's patients from adopting these designs. Additionally, selecting materials that are environmentally safe is vital. Prioritizing both individual safety and time-saving features in the kitchen is essential for maintaining the independence of individuals with Parkinson's disease.

Firstly, the fridge is a common household appliance that is used repetitively throughout the day. However, simple tasks such as opening the freezer door become complicated with the disease. Therefore, we redesigned the fridge to be more assistive to someone with Parkinson’s with features such as having a built-in touchscreen tablet and voice-activated doors. Redesigning such a commonly used appliance is essential to having a Parkinson-friendly kitchen.

We ensured that we looked into every aspect of the kitchen, and commonly overlooked components are countertops and surfaces in the kitchen. We designed a countertop with innovative features such as plate/cup indents and a drainage system in case of accidental spillage, which can be common in a kitchen that someone with Parkinson’s uses. These features will help with the day-to-day frustrations that someone with the disease will have.

Next, we redesigned utensils such as the spoon to be better to use for patients. The improved design includes deeper bowls, larger handles and adjustable weights to help with tremors. This will allow those with severe mobility issues associated with Parkinson’s to be able to regain their independence and the ability to feed themselves.

In addition, we redesigned the hood fan/ range hood. We completely redesigned the hood fan, as regular range hoods can be high up and hard to reach. Furthermore, we added a simple-to-integrate control console that can be installed on any existing hood fans to simplify the implementation of our design and reduce costs.

Furthermore, we designed a Parkinson-safe oven with features such as button-controlled garage doors and a touchscreen with haptic feedback. We also added other safety features, such as an emergency shut-off, to further enhance the safety of our kitchen with each appliance.

Finally, cleaning dishes can become a gruelling task as it involves precise movements and force to scrub dishes in awkward positions. Or if you have a standard dishwasher, there is a lot of bending required, which poses a major hurdle to patients with Parkinson’s. We custom design the dishwasher to be the appropriate height for the customer.

The inherent variability in the effectiveness of drug therapies for Parkinson's disease, combined with the rising global expenses of medications, underscores the urgent requirement for pragmatic and economical interventions. Guided by the principles of affordability, efficiency, independence, and environmental impact, our suggested kitchen design aims to create a significant positive impact on the lives of individuals facing the challenges of this condition.

B. Project Approach

In this complete kitchen redesign, the focus was on optimizing functionality and accessibility while maintaining affordability and safety. The space is defined by open areas and a traditional layout, enhanced by a unique drainage system around the perimeter along with high-grip flooring. To cater to diverse needs, we made several adjustments to make the kitchen more adaptive to customers with Parkinson's. We have introduced voice automation for a variety of common household appliances. The colour palette and textures prioritize light shades for a bright and visually clear environment, which has been proven to aid people with Parkinson's. More specifically, customized redesigns effortlessly blend into this versatile space, enabling individualized modifications. This includes the fridge, kitchen counters and flooring, utensils, range hood, stove, and dishwasher. Specific designs in our collection provide a control module, eliminating the necessity to replace your appliances. Instead, you can simply add a control module to manage your devices, keeping overall expenses low. These kitchen integrations aim to make these adjustments affordable and realistic for Parkinson's patients, promoting inclusivity and reintroducing independence to their lives. This report will go over the technical aspects of creating the kitchen, current social perspectives and potential user experience, and finally, conclusions and recommended options for further analysis.

III. TECHNICAL ASPECTS

A. Technical Development and Implementation

The objective of this project was to create a user-friendly kitchen for people with Parkinson's by modifying appliances. The fridge was equipped with a Bluetooth-enabled touchscreen tablet and voice control for easy management. Bright lighting and customizable storage improved visibility and organization. The oven featured an intuitive touch screen and a sliding door for accessibility. Utensils were made versatile, with larger handles and deepened bowls. The range hood had an easily accessible control console, voice activation, and customizable settings. The dishwasher included touch controls, voice commands, and adjustable features for easier dish handling.

With implementation and deployment, prototyping and rigorous testing are critical in ensuring the functionality of the appliance is aligned with users' needs. Collaborating with manufacturers such as Google and SOFIHUB will lead to a scale-up in production while maintaining quality, as well as revolutionary developments such as integrating SOFIHUB's fall detection, GPS tracking, and connectivity to alert caregivers or family members in case of emergencies [1]. Installation integrated the appliances seamlessly into existing setups. User training familiarised individuals with the operation, and ongoing support addressed issues. Feedback and evaluation loops facilitate continuous improvement, ensuring an optimized, user-centric kitchen environment for those with Parkinson's.

B. Project Proposal Timeline

- **Research and Proposal Development (1-2 months):**
  Research beta appliances and gather information for the proposal.
  Develop a comprehensive proposal outlining the project scope, objectives, timeline, and budget.
  Key Milestone: Proposal Completion

- **Proposal Review and Approval (2-4 weeks):**
  Present the proposal to stakeholders or decision-makers.
  Allow time for review, potential revisions, and final approval.
  Key Milestone: Proposal Approval

- **Preparation Phase (1-2 weeks):**
  Finalize design plans and appliance selections based on approved proposals.
  Obtain necessary permits and approvals for the project to commence.

- **Demolition and Infrastructure Setup (1-2 weeks):**
  Clear out existing structures and prepare the space for the new appliances.
  Begin any necessary foundational work such as electrical, plumbing, and structural modifications.
  Key Milestone: Demolition Completion and Infrastructure Setup

- **Installation of Beta Appliances (1-2 weeks):**
  Install and test the new beta appliances as per the proposal's specifications.
  Key Milestone: Installation of Beta Appliances

- **Cabinetry and Countertops Installation (2-3 weeks):**
  Install new cabinets, countertops, backsplash, and fixtures according to the proposal.

- **Final Touches and Clean-Up (1-2 weeks):**
  Complete final painting, electrical, plumbing, and any additional adjustments.
  Key Milestone: Finalisation of Remodelling

- **Feedback and Evaluation Period (2 months):**
  Initiate the feedback sessions and testing phase outlined in the proposal.
  Gather feedback, assess appliance performance, and document user experiences.
  Key Milestone: Feedback and Evaluation Reports

Fig. 1. Render of the kitchen orientation

C. The Project Scope

All of the appliances are showcased in Figure 1 in their respective orientations. The design of the fridge prioritizes accessibility and safety by featuring user-friendly large handles and a touchscreen tablet with Bluetooth and voice activation. This setup minimizes the need for precise movements, making it easier to open and control the fridge. Inside, the bright LED lighting, adjustable shelves, and colour-coded storage bins enhance visibility and accessibility, which is particularly helpful for individuals facing motor challenges or visual impairments.

When it comes to the oven and stove, the modifications aim to address accessibility concerns. They include side-hinged doors, larger knobs with better grips, voice-activated controls, and touchscreen interfaces. These adjustments are geared to reduce the need for reaching, bending, or applying excessive pressure, improving safety and ease of use. Added safety measures like automatic shut-off when not in use further enhance the appliances' user-friendliness.

For utensils, there's a specialized weighted spoon designed to assist with motor control and stability challenges. It features variable weights and an easy-to-grip handle, allowing for customization based on individual needs, ultimately promoting independent eating experiences.

In terms of the range hood, this design offers a choice between textured tactile buttons and an OLED touchscreen, along with voice activation. This versatile approach empowers users to control the hood fan according to their preferences, contributing to a more user-friendly kitchen environment.

In the case of the dishwasher, the modifications prioritize intuitive controls with large, readable buttons, touch screen interfaces with haptic sensors, and voice-activated commands. These adaptations cater to individuals dealing with tremors or fine motor control difficulties. Safety features such as anti-slip surfaces, gradual unloading assistance, and customizable interior layouts aim to prevent accidents and accommodate diverse needs without requiring excessive physical effort.

Each appliance's specific modifications align with the project's focus on accessibility, safety, ease of use, and customization. These adaptations aim to create a kitchen environment that caters to the unique challenges faced by individuals living with Parkinson's disease.

D. Cost Estimate

For the cost of each appliance: the fridge ranged from $3000-$4000, the flooring and custom countertop ranged from $500-600, the countertop ranged from $50-$100 per square ft, and a drain installed into the countertop ranged from $500-$800. The other appliances, such as weighted utensils, are priced at $20. The Range hood ranges from $250 to $7800. The oven ranges from $2000-$2400, and the dishwasher ranges from $1200-$1800. These prices were determined by analyzing the material and manufacturing costs of today's manufacturers and how they would benefit someone with Parkinson's.

1) Materials and Manufacturing Costs: Appliances utilizing stainless steel components or touchscreens, such as fridges, ovens, range hoods, dishwashers, and utensils, incur varying costs based on material choices and manufacturing methods. High-quality plastics for utensils, priced at 0.99 cents/kg for moulding or $9.10/kg for silicone, offer affordability and usability. For manufacturing by stamping, the cost is $139.00 per mould for components [2]. Ducting materials for range hoods vary from copper ($4.7/kg), PVC ($50 for a 20in * 10ft pipe), aluminum ($1.92/kg), and stainless steel ($2.9-$4.2/kg) [3], [4]. Touchscreen appliances might use Google's Nest Hub Max as a comparison, priced at $299 for similar functionalities [5]. In terms of flooring, high-grip flooring such as textured vinyl or linoleum are priced at $2-$5 per square foot [6]. Specialized countertops range from $39 to $200 per square foot and utilize durable materials like quartz or solid surfaces [7].

2) Benefit for Parkinson's and Material Selection: Stainless steel surfaces in appliances ensure durability, easy cleaning, and corrosion resistance, beneficial for hygiene and safety in kitchens for individuals with Parkinson's. Touchscreen controls and wireless features aid those with limited dexterity. The choice of ducting materials, like stainless steel, known for corrosion resistance, aluminum for lightness, or plastics like PVC for lightweight applications, depends on environmental needs and cost-effectiveness. Utensils, moulded from high-quality plastics or silicone, provide enhanced grip and usability for Parkinson's patients, with 3D printed plastics costing $20-$50/kg for manufacturing [8]. Integrating Parkinson-friendly elements like high-grip flooring and specialized countertops impacts material choices and expenses, while the countertops feature a grate system to prevent spills and simplify cleaning. Reducing countertop materials minimizes cleaning efforts, benefitting those with limited dexterity.

3) Manufacturing Methods and References: Manufacturing methods, such as stamping for components and various ducting materials, contribute to the overall cost. Stamping costs $139.00 per mould for appliances like utensils, ovens, range hoods, dishwashers, and fridges. Materials like stainless steel, aluminum, copper, and PVC serve specific purposes in ducting systems, chosen based on environmental factors, cost, and durability. Online

marketplaces, material suppliers, and industry reports offer information for cost estimates and reference points in the appliance manufacturing industry.

IV. CURRENT SOCIAL PERSPECTIVES AND POTENTIAL USER EXPERIENCE

When considering redesigning a kitchen for Parkinson's patients, it's essential to focus on creating a space that addresses these individuals' unique challenges. Parkinson's disease often results in motor symptoms such as postural instability, freezing of gait, and dyskinesia, which can pose significant challenges in daily life and increase the risk of falling [9]. Therefore, the design should aim to mitigate these risks and enhance the user's independence and confidence. For instance, maximizing the width at thresholds and passages can help minimize freezing of gait, which tends to occur at these 'bottleneck' locations [9].

A. Comparison with Other Pilot Projects and Products

There are several existing projects that aim to enhance home accessibility for individuals with disabilities. The Universal Design Living Laboratory (UDLL) and Accessible Home Design are two notable initiatives that have made strides in enhancing home accessibility. However, they have certain limitations when it comes to addressing the specific needs of individuals with Parkinson's disease. The UDLL aims to create a comfortable living environment that enhances the quality of life for the widest possible range of people [10]. It follows the seven principles of universal design, which include equitable use, flexibility in use, and simple and intuitive use [11]. However, while the UDLL's principles are commendable, they are not specifically tailored to the unique challenges faced by individuals with Parkinson's disease. For instance, the UDLL does not specifically address issues such as tremors, freezing of gait, and postural instability, which are common in Parkinson's patients. Accessible Home Design, as discussed in the Harvard University study, focuses on creating accessible housing designs [12]. However, it faces criticism for its continuous revisions of accessible design regulations, which can be confusing and frustrating for architects and builders [12]. Moreover, it has been noted that many developers and builders believe that accessible design is less desirable to renters and buyers, fearing that remodelling for accessibility will diminish property value [12]. This perspective could potentially limit the implementation of such designs. Similar to the UDLL, Accessible Home Design also lacks a specific focus on the needs of Parkinson's patients.

In the context of kitchen redesign for Parkinson's patients, there are several products that have been developed with similar goals. For instance, Emily Andrews' Parkinson's Optimised Cutting Board and the Handsteady Cup are two products that aim to assist individuals with Parkinson's in the kitchen [13], [14]. Emily Andrews' cutting board design restricts the movement of the knife blade, which can be beneficial for individuals with tremors. However, it does not account for the diminished grip strength often experienced by those with Parkinson's disease, and the knife blade's direction remains susceptible to unintentional movements [15]. The Handsteady Cup features a handle with a seamless 360-degree rotation capability, which contributes to the cup's self-levelling and self-stabilizing attributes. This can facilitate comfortable and stable holding positions, particularly in situations where tremors are a concern. However, the challenge of pouring liquid into the cup persists, a challenge that the proposed design for the rotary pitcher holder effectively addresses [16].

While these pilot projects and products have made significant strides in enhancing home accessibility and assisting individuals with disabilities, they lack a specific focus on the unique challenges faced by individuals with Parkinson's disease. The proposed kitchen redesign project aims to fill this gap by tailoring the design to the specific needs of Parkinson's patients.

B. Stakeholders

The stakeholders involved in Parkinson's disease care and accessible design projects are diverse, spanning from the individuals directly affected by the disease to the broader societal entities that influence and are influenced by these initiatives. The primary stakeholders are individuals diagnosed with Parkinson's disease. They are the direct beneficiaries of these projects, experiencing improvements in safety, independence, and overall well-being as a result of the proposed designs. Caregivers and family members, who traditionally shoulder significant caregiving responsibilities, are also key stakeholders. The proposed designs can alleviate the intensity of assistance required, fostering a more balanced caregiving dynamic. Healthcare professionals, including Parkinson's disease specialists and nurse care managers, are crucial stakeholders. They are involved in the care management of Parkinson's patients and can observe potential enhancements in the daily lives of their patients due to these projects [17]. Companies specializing in assistive technology and engineering firms are potential partners in these projects. They can integrate innovative solutions into kitchen designs to cater to the specific needs of Parkinson's patients. Hospitals and healthcare providers can collaborate to offer kitchen design solutions as part of comprehensive patient care, especially for those undergoing rehabilitation. They can also conduct workshops and training sessions for healthcare professionals to raise awareness about the benefits of adapted kitchen designs. Public health organizations can partner with these projects to promote the positive impact of accessible kitchen designs on the overall well-being of individuals with Parkinson's. They can conduct awareness campaigns on the importance of kitchen safety and adapted designs in preventing accidents, contributing to public health initiatives.

C. Impacts of Proposed Technical Changes

The proposed technical changes in the design of kitchens for individuals with Parkinson's disease can have significant impacts on various aspects, including health, user experience, economics, and engineering. The primary health impact of these changes is the potential to improve the safety and well-being of individuals with Parkinson's disease. By designing kitchens that cater to their specific needs, the risk of kitchen-related injuries can be significantly reduced. For instance, the integration of assistive technologies can help mitigate the effects of tremors and other motor control issues that these individuals often experience [18], [19]. This can lead to a safer environment, reducing the risk of falls and other accidents [20], [21]. The user experience can be greatly enhanced by involving Parkinson's patients in the design process. This approach ensures that the designs are tailored to their daily challenges and preferences, thereby improving their ability to perform tasks independently and comfortably [18]. For example, the use of smart utensils can make cooking and eating easier for individuals with Parkinson's disease [22], [19]. The economic benefits of investing in Parkinson-friendly kitchen designs are twofold. Firstly, they can reduce healthcare costs associated with kitchen-related injuries. Secondly, these designs can open up a new market for specialized products, offering economic opportunities for

companies specializing in assistive technology and kitchen appliance manufacturers [23]. From an engineering perspective, these changes challenge traditional kitchen design norms and push for innovation. They highlight the need for a user-centred design approach that takes into account the specific needs of individuals with Parkinson's disease [18]. This can lead to the development of new standards for accessibility in kitchen appliances and designs, promoting the adoption of inclusive technologies [23]. The proposed technical changes can have far-reaching impacts, not only improving the lives of individuals with Parkinson's disease but also influencing public health, user experience, economics, and engineering practices.

D. Consideration of Current Building Standards

The current building standards can significantly impact the implementation of proposed technical changes in the design of kitchens for individuals with Parkinson's disease. Many developers, including for-profit residential builders, believe that accessible design is less desirable to renters and buyers, and remodelling for accessibility may diminish property value [12]. This perception can pose a challenge to the implementation of Parkinson's-friendly kitchen designs. However, it's important to note that accessible design is not just about catering to a small, specialized segment of the population; it's about creating environments that are usable by more people, regardless of age, height, or physical limitation [24], [12].

Despite the potential benefits, the implementation of these changes can be affected by current building standards. Standard architecture may not be optimized for the elderly or those with conditions like Parkinson's disease. Therefore, these changes may necessitate a review and potential modification of existing building standards to accommodate the specific needs of these individuals. On the other hand, these changes present an opportunity to challenge traditional norms and push for innovation in the building industry. They highlight the need for a user-centred design approach that takes into account the specific needs of individuals with Parkinson's disease. This can lead to the development of new standards for accessibility in kitchen appliances and designs, promoting the adoption of inclusive technologies.

In conclusion, the proposed kitchen redesign for Parkinson's patients aims to address these individuals' unique challenges, improve their quality of life, and contribute to public health initiatives. It seeks to fill a gap in existing projects by focusing specifically on the needs of Parkinson's patients, and it involves various stakeholders in the process.

V. CONCLUSIONS AND RECOMMENDED OPTIONS FOR FURTHER ANALYSIS

A. Redesign Main Points

The major redesigns include a fridge, countertops, kitchen island, utensils, hood fan, oven, and dishwasher. The fridge includes many smart features, such as a touchscreen tablet on the door and voice recognition. The interior of the fridge includes bright LED lights and adjustable and colour-coded trays. The redesigned countertops feature high-grip flooring and have features to secure loose objects. The redesigned kitchen island features a new drainage system that makes cleaning any sort of liquid spills a relatively easy task. The redesigned utensils feature ergonomic, grippy, weighted tools that are adjustable to the user’s needs. The designed hood fan can be both ducted and ductless, depending on the user’s needs. It features a control console and voice recognition. The redesigned oven has haptic buttons instead of knobs to help

Parkinson’s patients set the controls with ease. The main feature of the oven is the garage door mechanism. The oven door opens like a garage door with a button click. This saves space in the kitchen, as the door does not take up extra space. The racks in the oven are adjustable as well. The redesigned dishwasher is adjustable to the user’s preference and features a mechanism where the dishes from the back are pushed up if the dishes at the front are taken. The dishwasher is also built with an audio sensor and a touchscreen interface.

B. Next Steps

The next steps regarding the proposed solutions for Parkinson's patients should be emphasizing the significance and importance of a collective line of action between Parkinson's patients, doctors, healthcare professionals, and caregivers. A schedule or routine check should be implemented to address the needs of the patients. Collecting feedback and responses for the new modified technology is important to advance the technology further and the help given to Parkinson's patients. More testing and examinations are needed to improve the products for Parkinson's patients to increase safety, user-friendly environment, and reliability. In order to achieve this, more surveys and tests should be proposed to collect more data to better account for the different situations and accessibilities. This will allow for maximum performance and efficiency in improving a patient's life.

In conclusion, the kitchen design proposed in this report focuses on accessibility, affordability, customizability, and practicality. By keeping these aspects in mind, a kitchen that is accessible and affordable has been designed. From the garage door oven mechanism to the touch screen features of every design, it enhances an efficient and friendly kitchen setting.

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