All papers submitted for publishing to the **RECENT®** journal are subjected to the scientific review procedure.

The objective of scientific review is to ensure that all papers accepted for publishing meet the requirement of an adequate scientific level and provide original and significant contributions to the respective field.

The scientific review procedures practiced by the **RECENT®** journal are *"Expert Peer-Review"* (scientific review by experts, including the members of the Scientific Board of the journal) and *"Editorial Board Peer-Review"* (review, scientific included, by the members of the Editorial Board). All members of the Scientific Board and of the Technical Board of the journal are holders of PhD degrees, are members of the scientific community and experts in their respective fields of activity.

The complete scientific review procedure of submitted papers practiced by the **RECENT®** journal is available at http://www.recentonline.ro/PeerRew.htm.

RECENT®

REzultatele CErcetărilor Noastre Tehnice

Industrial Engineering Journal

Transilvania University of Brasov, Romania

Vol. 14 (2013), No. 4(40) **ISSN 1582 - 0246**

ICEEMS 2013
7th International Conference on Economic Engineering and Manufacturing Systems

- selected papers -

iceems

40

November 2013

CONTENTS

Vol. 14, no. 4(40), November, 2013

Authors Presentation 207

Sorin Adrian BARABAŞ, Adriana FOTA
Experimental Determination of the Hardness Curves in Deep Carburizing Heat Treatment 212

Adina BĂNCILĂ, Constantin BUZATU
Design of an Innovative Kitchen System for People with Physical Disabilities 216

Laura BOGDAN, Monika MOGA
The Role of Infrastructure in Economic Development 220

Constantin BUZATU, Iulian Alexandru ORZAN
Contributions at the Modeling Dimensions of the Gauges by the Wear of this and by the Number of Verified Pieces 226

Catrina CHIVU
Computer Aided Selection of Material Handling Equipment 231

Cătălin-Iulian CHIVU
Virtual Grade-Sheet Based on Electronic Signature 235

Tudor DEACONESCU, Andrea DEACONESCU
Medical Recovery System of the Upper Limb Muscles 242

Grigory DEYNICHENKO, Oleg TERESHKIN, Dmitry GORELKOV, Dmitry DMITREVSKY
Stabilization of Quality Cleaning Onion Innovative Way 246

Grigory DEYNYCHENKO, Inna ZOLOTUKHINA, Kateryna SEFIKHANOVA, Inna BELYAEVA
Resource-Saving Technology of Raw Milk Recycling 251

Elena EFTIMIE
Energy Simulation of a Solar Thermal System for Domestic Hot Water and Space Heating 255

Ovidiu FILIP, Tudor DEACONESCU
Pneumatically-Actuated Device for Wrist Rehabilitation 263

Adriana FOTA, Sorin Adrian BARABAŞ
Stochastic Modeling Applied for Inventory Optimization in Advanced Production Systems 267

Cătălin GHEORGHE, Flavius Aurelian SÂRBU
Art–Market for Cultural Products Having Investment Potential 271

Mihai IONESCU
Sequence Logic Modules 278

Dmitry KRAMARENKO, Irina GALIAPA, Grigory DEYNICHENKO
Effect of the Influence of Hydrolyzate of Molluscs on the Oxidation of Vegetable Oil 283

Dmitry KRAMARENKO, Elena KIREEVA, Grigoriy DEYNICHENKO
Investigation of the Influence of Mollusc Hydrolyzate on the Elastic Properties of Wheat and Rye Dough 288

Radu Mihai MAZILU
Fittings and Pipelines MAG Tandem Welding 292

Vladimir MĂRĂSCU KLEIN
Resource Planning in the Development of Maintenance Strategies 296

Doina NEGREA (ȚÂRLIMAN), Tudor DEACONESCU, Andrea DEACONESCU
Principles and Stages of New Gripper Systems Development 301

Gennady POSTNOV, Grigory DEYNICHENKO, Mykola CHEKANOV, Vitaly CHERVONIY, Oleg YAKOVLIEV
Physicochemical Basis for Intensification of the Process of Salting Fish 307

Notes 311

All papers submitted for publication to the **RECENT®** journal undergo a peer-review procedure.

The objective of peer review is to verify and endorse that all papers accepted for publication are of adequate scientific level and include original and significant contributions in their respective field.

The **RECENT®** journal provides *Expert Peer-Review*, including by members of the Scientific Panel as well as *Editorial Board Peer-Review* by the members of the Editorial Board. All members of the Scientific Panel and of the Technical Panel have PhDs, are members of the academic community and experts in their respective fields of activity.

The received papers undergo initial *Editorial Board Peer-Review* by the members of the Technical Panel of the **RECENT®** journal, conducted mainly by the scientific secretaries. Evaluation concerns with priority whether the paper matches the fields covered by the journal and meets its standards.

Complete scientific evaluation procedure is available at http://www.recentonline.ro/PeerRew.htm

Electronic version of **RECENT®** journal, ISSN 2065-4529, is available at www.recentonline.ro

DESIGN OF AN INNOVATIVE KITCHEN SYSTEM FOR PEOPLE WITH PHYSICAL DISABILITIES

Adina BĂNCILĂ, Constantin BUZATU
Transilvania University of Brasov, Romania

Abstract. Taking into consideration the special needs of people with physical disabilities, this paper presents an innovative design of an adaptive kitchen system. The components of this system are described and an experimental case is considered in order to compare this innovative system with the classical kitchen model.

Keywords: adaptive, design, physically disabled people

1. Introduction

The understanding of the complex process of disablement has been gradually but significantly transformed, ever since the middle of the last century, from an individual medical problem to a major socio/political issue with implications for society as a whole. Led by disabled activists in the 1960s [1] this transformation has resulted in a general recognition that people with impairments whether physical, sensory or cognitive and labeled "disabled" experience a range of environmental and social barriers that inhibit their active participation in the economic, political and cultural development of their communities. It is also widely acknowledged that this exclusion is manifest in the design and construction of physical and cultural infrastructures [2].

Taking into consideration that people differ in size, age, and ability the design should adapt to these differences and the resulted products should accommodate a wide range of physical abilities and impairments. Thus, in order to determine a good relation between the demands and the performances of the products or of the living space the user's needs should be first considered. A logical approach to workspace design that meets the needs of everyone is what the designers known as "universal design" and it calls for the products adapting to people and the other way around.

By studying the characteristics of individuals, it can be determined the interaction between users, products and functional systems.

Considering all the above, this paper proposes a kitchen system that would help users with physical disabilities – users in wheelchairs especially – carry on their daily activities facing less constraints. To be able to make their own meal, or only to help around, would bring the users self-respect and confidence in themselves [3].

A well arrangement of the kitchen consists first of all in achieving an economy of movements, so as user can be able to reach most of the needed objects only by the move of his arm (the objects are thus placed in the action radius of the arm). The ideal dimensioning of the room is the one that allows the placement of furniture and appliances so they can be used in best conditions avoiding unnecessary movements [4].

2. Designing for people with special needs

The modern direction regarding the design for physically disabled try to eliminate the limitations as much as possible. The objective is a better life for people with special needs, a better working environment for those who help them, and a better, longer term solution for managements that invest in the facilities.

The fulfillment of requirements is ensured by cross-disciplinary collaboration. It involves users, occupational therapists, physiotherapists, doctors, architects, engineers and public authorities in the entire process – from development until the products are in use. The result takes into consideration such diverse issues as respect for the individual, the opportunity for rehabilitation, regulations on working environment, precepts of hygiene, environmentally friendly production and environmentally safe disposal of used products.

The phrase "universal design" refers to the design of products and environments that are usable by all people, to the greatest extent possible, without the need for adaptation. Advocates of universal design acknowledge that poorly designed products and environments are discriminatory and

disable large sections of the population at various stages in the life course. People with impairments and older people are particularly disadvantaged.[2].

Nowadays, new and revised built environment instruments are developed that include more focus on specific disability populations, incorporation of all "universal design" principles, as well as attention to psychometric quality and measurement specificity [5].

Developing a well functional room system for people with low mobility possibilities is, of course, a complex task. The solutions should take into consideration three clearly defined and important elements. The products must cover the needs of users as well as the needs of the persons caring them. Also, the solution should adapt to people and not the other way around.

3. Redesigning kitchen space for people with low mobility

Regarding the user, meaning the person with physical disabilities, the design should take care of a few features:

– Independence: the system should enable the user to maximize his or her abilities and perhaps to require less personal assistance.
– Flexibility: the system should be adjusted and positioned for the individual user walking or sitting.
– Safety: the strength and durability of the system should create a safer environment.
– Comfort: contact surfaces should be soft and warm and combined with the correct positioning should provide the highest level of comfort.

The usual kitchen furniture does not match the needs of a physically impaired person. That is not just because the dimensions of the furniture pieces (i.e. heights of the worktops) do not suit the user, but also because the floor cabinets make the access to worktops harder for a user in wheelchair. The top cabinets are too high on the wall for a comfortable reach from the seating position. Thus, there are needed some modifications from the pieces of furniture used in usual kitchen models.

At first, it should be provided leg room under the worktop, for better working conditions for a seated person. Also is better to position the worktops at 700 mm above the floor level rather than the usual 800 ÷ 900 mm. But taking into consideration that usually a physically disabled person is assisted by a career, the worktop should provide adjustability to a height suitable for a standing person. So a height adjustable worktop is best in a kitchen system for impaired persons.

The top cabinets are mounted to high on the wall so they have to be placed at a lower position and also they should allow height adjustment to the countertop surface.

All the objects on the kitchen should be positioned within comfortable reach for a seated person, so as unnecessary movements are avoided. It should be developed a kitchen system that moves around the user that adapts to the user's needs.

4. Innovative kitchen system design

An innovative kitchen model was proposed in order to provide good adjustability of the elements, to ensure passage and turning space for the user and easy access to workstations.

The general dimensions of the whole kitchen system were selected so it would fit most kitchens. The presented model has 2500 mm length, 2000 mm width, and 1750 mm height (Figure 1). The pieces come separately, though, so they can be positioned according to the needs of each users or each room.

Also, it is recommended that the pieces formed an L shape, in order to ensure continuity to the counter top and easy access to workstations.

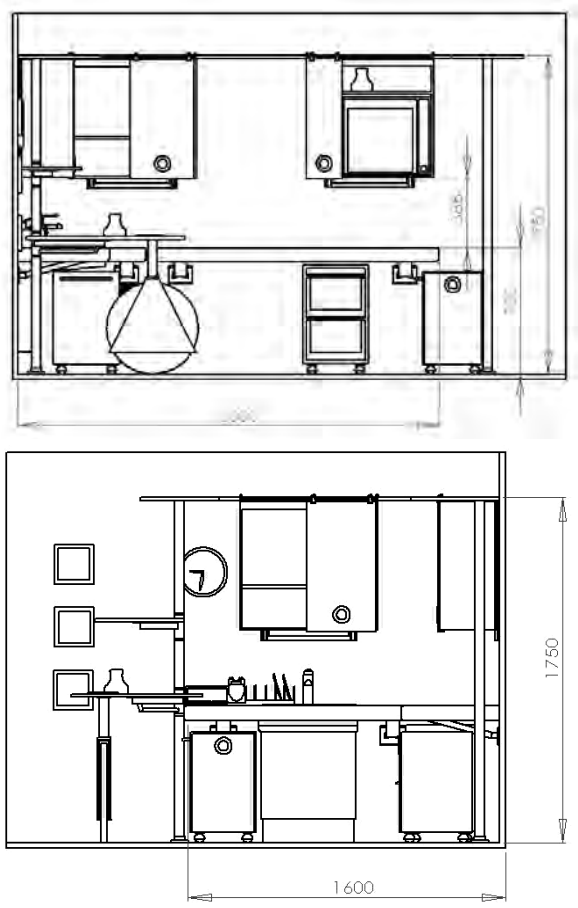

Figure 1. Kitchen system general dimensions

4.1. The counter top

The counter top comes in two different pieces: one assigned to the cleaning area and one for the cooking area. Thus, the users have the possibility of adjusting their high separately. The height adjustment is realized due to a manual screw-nut mechanism, (Figure 2), which allows the counter top to be raised from the height of 700 mm fixed for a seated user to a height of 850 mm suitable for a standing person.

In order to enable the height adjustment in the washing-unit zone a flexible feed/waste system is necessary.

The counter is designed without cupboard under it, thus allowing leg room under and providing a better working position for the seated user, but also used as supplementary turning space.

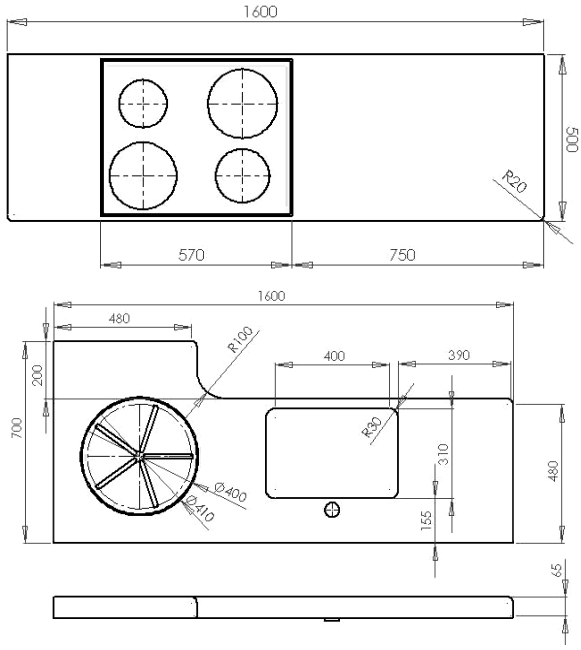

Figure 2. Counter tops dimensions

4.2. Wall cabinets

Freeing the space under the counter top, the storage place is unfortunately small. So, the storage facilities are limited to the wall cabinets and floor mobile storage units.

The wall cabinets provide storage place for dishes and kitchen utensils, but also for food that does not need necessary refrigeration.

Considering the fact that the kitchen system designed refers to people with disabilities, especially to people using wheelchair, the wall cabinets are mounted at a lower height than the usual one. Thus, they positioned at 300 mm above he counter top level, lower than the usual 500 mm height.

But because for a user in a wheel chair or with low mobility to slide the door from one side to the other would be easily than opening it, for the doors opening was chosen a sliding system.

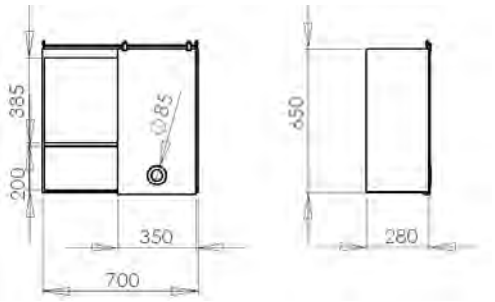

Figure 3. Wall cabinet dimensions

Also, the cabinets have a pulling down system (Figure 3) which allows them to be lowered to the counter top high and broth to front. This is possible due to a pneumatic system mounted to the back of the cabinets (Figure 4).

The counter top is designed without cupboards under it, so the oven was also mounted in an adjustable wall cabinet (Figure 5).

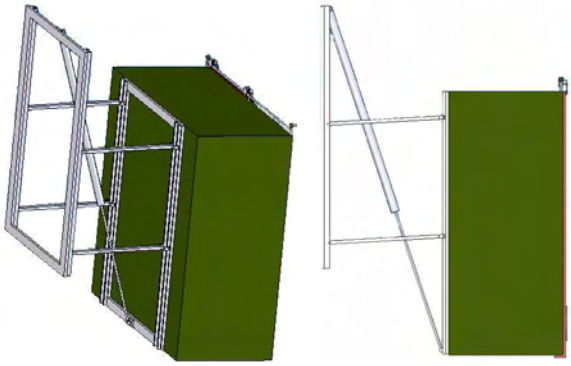

Figure 4. Wall cabinet pulling down system

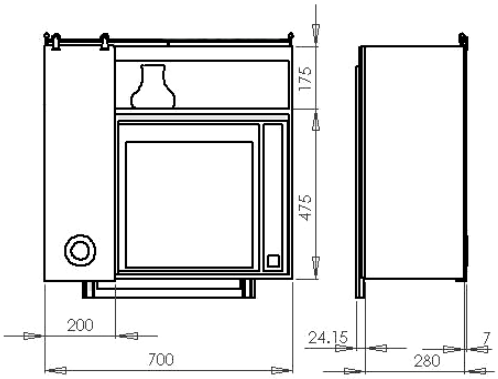

Figure 5. Oven cabinet dimensions

4.3. The table

The table is pivoting, (Figure 6), allowing a 180° turn, and it provides either a supplementary working space or a place to serve meals.

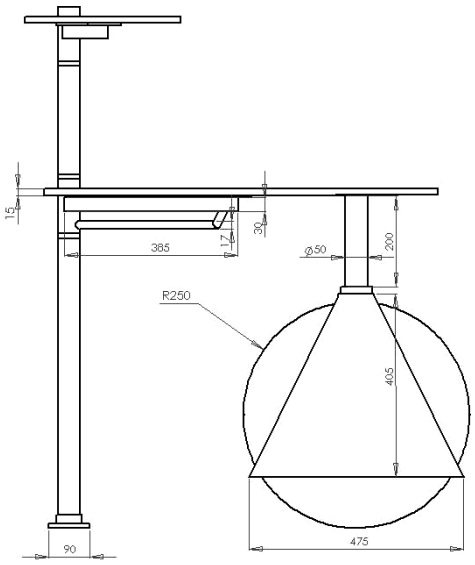

Figure 6. The table dimensions

5. Experimental work

In order to determine the efficiency of the innovative kitchen design, a group of ten persons with different physical disabilities was asked to compare it with a classical kitchen model. Each person gave a note between 1 and 10 to every component part of the innovative design considering its adaptability to his or hers disability and its ease of use. The results of the experiment are shown in Figures 7 and 8.

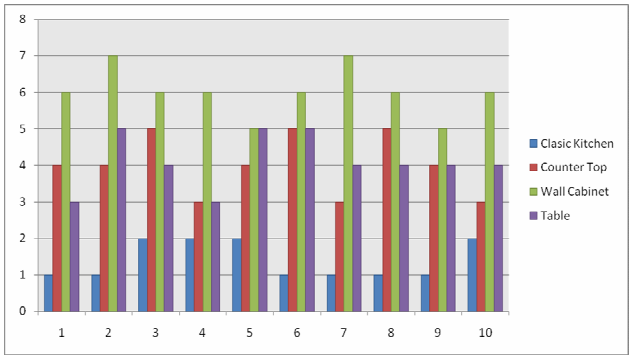

Figure 7. Adaptability of the system

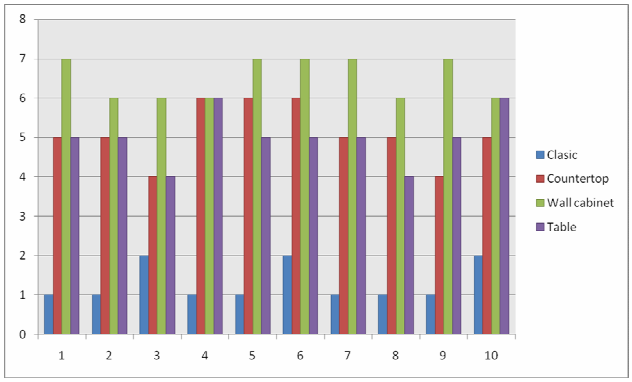

Figure 8. Ease of use of the system

6. Conclusions

In this paper an innovative kitchen design for people with physical disabilities was presented. The description of the innovative model was presented along with its main components.

Compared to the classical kitchen model, this innovative design brings, due to its adaptive particularities, major improvements in terms of independence, flexibility, safety and comfort of the disabled person.

An experimental case was considered in order to determine the efficiency of the system regarding its adaptability and ease of use.

References

1. Nichols, P.J.R., Morgan, R.W., Goble, R.E.A. (1966) *Wheelchair Users – A Study in Variation of Disability*. Ergonomics Magazine, ISSN 0014-0139, vol. 9, issue 2, p. 131-139
2. Barnes, C. (2011) *Understanding disability and the importance of design for all*. Journal of Accessibility and Design for All, ISSN 2013-7087, vol. 1, issue 1, p. 55-80
3. Jarosz, E. (1996) *Determination of the workspace of wheelchair users.* International Journal of Industrial Ergonomics, ISSN 0169-8141, vol. 17, issue 2, p. 123-133
4. Karp, G. (2009) *Life on Wheels: the A to Z Guide to Living Fully with Mobility Issues*. 2nd ed., Demos Medical Publishing, ISBN 978-1-932603-33-0, New York, USA
5. Gray, J. A., Zimmerman, J. L., Rimmer, J. H. (2012) *Built environment instruments for walkability, bikeability, and recreation: Disability and universal design relevant?* Disability and Health Journal, ISSN 1936-6574, vol. 5, issue 2, p. 87-101