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Review Paper

Ergonomic Study of VDT Workstation for Physically Disabled Persons

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Abstract

This study focuses on the various parameters for designing a VDT workstations for a physically handicapped person generally operating on the wheel chair with specific anthropometric measurements to visualize and evaluate human-machine interaction with the help of AutoCAD software. This paper tries to solve the problem of in reachability of various peripherals to the wheelchair users. This program operates on a personal computer instead of main-frame based similar systems. The working of wheelchair users are analysed by the test ring. The introduction of VDT in the offices has now limited the number of permitted postural to the employees. Work posture of VDT operators are checked in assessed with the centre of gravity in four stages of ring test than an appropriate model is prepared with the help of AutoCAD for physically disabled persons. The aim of the workstation design was to obtain maximum postural/visual efficiency, bearing in mind environmental, manufacturing and marketing constraints.

Keywords: Wheelchairs, AutoCAD, Ergonomics, Zero Gravity.

Introduction

Now a day's even physically challenged people are doing performing their day to day tasks by themselves. The people sitting on the wheelchairs are not only doing daily jobs but also lot of official activities. Wheelchair users generally have to perform daily and professional activities exclusively in their wheelchairs[1].

Therefore, wheelchair users should be considered as integral with their chairs. The design of workstation involved locating the all components within the reach dimension of the person with in workstation space and by maintaining all technical constraints of the job and considering the inter-relationship between the man and machine along with some other factors such as production cost and reliability[2]. Generally, VDT are designed by bring up many furniture having no proper relationship with the operator and the task. Therefore, a well-integrated furniture system is needed for the proper functioning of the VDT design for the physically disabled persons.

VDT workstations have been extensively studied recently, with most studies focusing occupational hazards such as perceived fatigue, visual discomfort and musculoskeletal stresses for normal VDT operators Ergonomics issues for the physically challenged individuals, e.g., wheelchair users, have also been studied, as have anthropometric measurements for wheelchair users.

Constraints of Workstation Design- the ability of the employee to perform its job efficiently depends on the workplace equipment, constraints and its job contents.

Physiological Evaluation: These factors were designed by making a small test for VDT users which includes following steps: i. The monitor was placed on the table around the height of 50-70cms above the ground on the table along with the mouse and CPU on the same table[3]. ii. The position of CPU was adjusted according to the anthropometric details of the person. It is placed right side for right handed and left side for left handed person. iii. The monitor screen is so adjusted upwards facing the eye of the operator. iv. Now a video recording of all users working on it has been done as to analyse the problem faced by the wheel chair users[4].

Centre of Gravity: This factor is completely responsible for the balancing of the human body and taken as an important constraints while designing on the AutoCAD. It is measured by the help of segmental method with the reference of X-Y axis.

Environmental Factors: The important parameters to be considered are illumination level, glare, luminance and sound level along with the thermal and other environmental conditions.

Design of Wheel Chairs[5]

Depending on the video recording done by the ring test or by the help of AutoCAD 3D model visualization the wheel chairs are designed according to the work layout and the task[6]. The desktop PC instead of mainframe computers are selected for the design purpose in order to minimise the cost. The information about the existing computer peripherals is collected and the anthropometric details of users is taken. The use of AutoCAD

serves the two purposes first they provide an easy understanding logical interface between the system and the user. The input of anthropometric details is provided and the macro commands from the AutoCAD database are executed[7]. The table is designed in such a way that a wide spacing between the two legs to accommodate the wheel chair is given. As per observation from the video recording the straight monitors is used in comparison to the tilted one. A computer screen with slight elevation gives the best result. All the peripherals are placed on the same table opposite to the computer screen. Instead of flat or the round tables the appropriate two arm table is designed within the reach dimension of the user. The maximum and minimum distance given to the distance depended on the anthropometric data collected previously. The reach dimensions of table and its arm should be designed according to the average person as to accommodate the both tallest and shortest person.

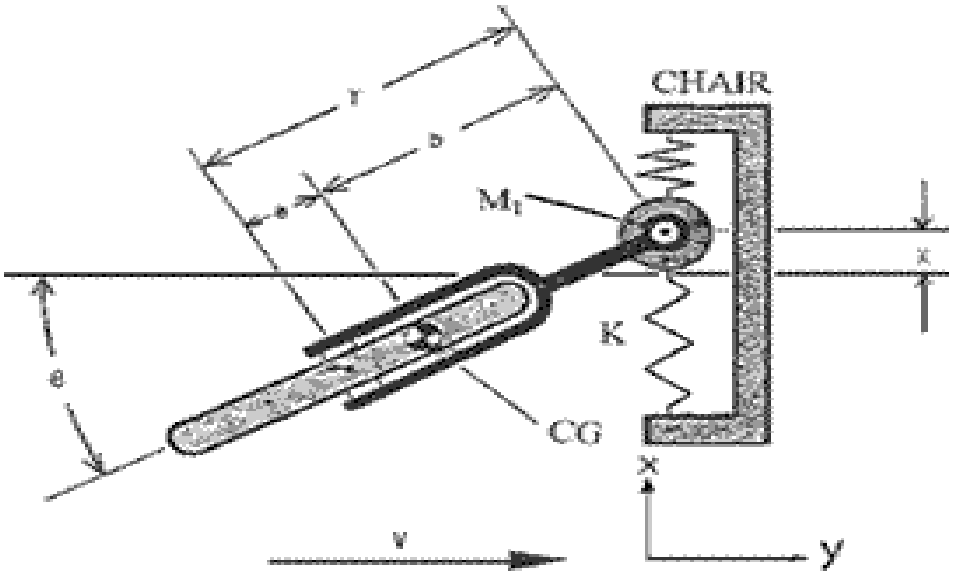

Figure-1
C.G. of Wheel Chair[5]

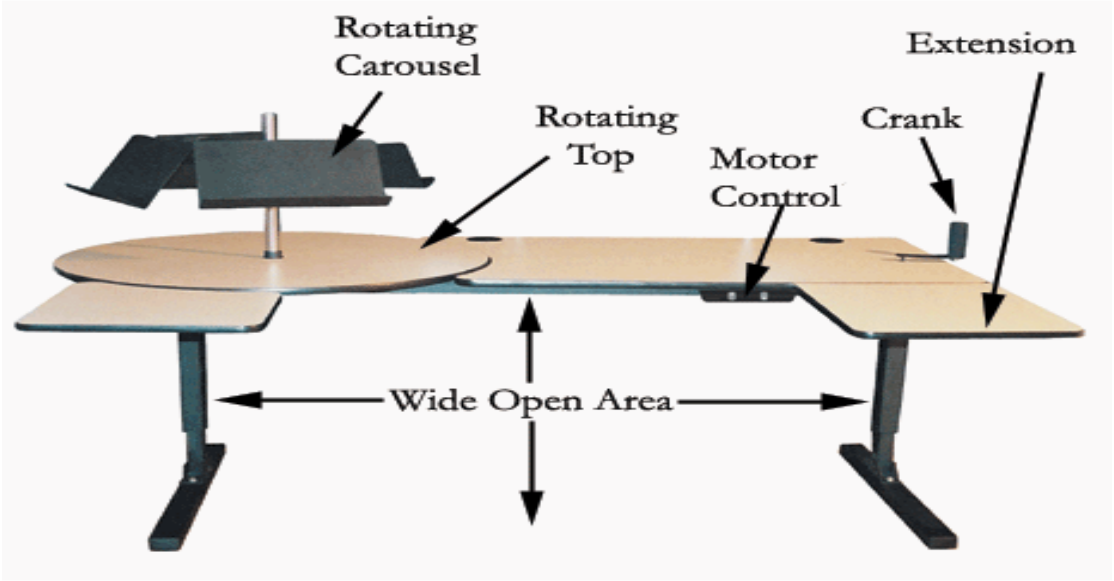

Figure-2
Design of computer workstation table[8]

Design of Zero Gravity Chairs

Ergonomically the zero gravity chairs are more efficient and environmentally friendly for the wheel chair users. They consists of lifting system operating electrically so as to adjust the work surface height. By maintaining proper height for the wheel chair users depending on the anthropometric data collected. A program was stored in the storage device and attached to the wheel chair along with the four programmable buttons provided on the dashboard operated with the help of fingers. This type of table can be used by the multiple operators. This zero gravity table can be available in various shape, sizes and with different working features in the market. Ergonomics are all about the way the body naturally works, and the adjustable desks for wheelchair users from Zero Gravity Tables are specially designed to help prevent stress injuries, and to allow wheel chair users to perform routine tasks safely, efficiently, and comfortably. With precision height adjustment to within millimetres, the work surface of our wheelchair computer tables can be set to the exact height desired, preventing those with limited mobility from having to stretch, slouch or contort uncomfortably while working[9,10].

The analysis based on the survey basis which was carried out at different workstations shows that less area is required for designing the workplace for physically disabled persons than for able bodied persons.

Keyboard Height and the Viewing Angle: The effect of keyboard height and viewing angle has also been analysed by the video recording test. The persons on wheel chairs are made to sit in the different viewing angles and it was concluded from the study that the height of each monitor with the eye level is the best suited with a slightly bent keyboard and this reduces the effect of musculoskeletal disorder considerably. It is suggested that the optimum keyboard height is 5cm below the elbow[11]. The reason for this posture is to maintain the upright posture of the wheel chair users in order to avoid the problem of cervical and thoracic spine erector activity.

Figure-3
Zero Gravity Wheelchair[10]

The range of screen height for the wheel chair users is between eye level and 5 cm below it[12].

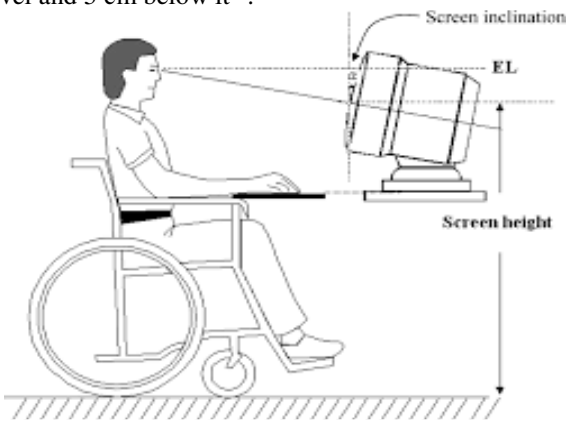

Figure-4
Screen viewing angle[13]

Environmental Factors

The other common factors that are considered are light glare etc. The ordinary light may glare on the screen so our equipment should be arranged in such a way that no direct light from the sun should access the screen and also the direct sharp bright light is also avoided.

Conclusion

In modern technological life most of work has been shifted to the computer desk therefore in order to cope up with the present scenario the redesign of existing computer workstation is necessary even with the consideration of physically handicapped persons so to obtain best output in the industrial field. The following points have been concluded from the above study: i. Zero gravity chairs along with proper programming of adjustment are more prominent to use as compared to the normal ergonomic chair. ii. A 3D design analysis of the whole work station along with the manpower on AutoCAD is better than the questionnaires asked or analysis based simply on viewing. The drawing on the AutoCAD provide us clearer picture of the workstation along with the postural movements also. iii. The new workstation design not only reduces the risk of the postural discomfort but it also lowers the tendency of musculoskeletal disorder in the employees. The better position and viewing angle provides comfort for the eyes and prevent many eye diseases. The tables with the adjustable heights can be get used by the multiple users.

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