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POSTURAL ANALYSIS OF A WORKSTATION IN ELECTRONICS INDUSTRY

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Abstract

The human element is the most crucial part in any organization. The productivity of the workstation depends on the human performance, comfort and safety. Ergonomic evaluation helps to provide better and safer working condition to the operators. Ergonomic evaluation can be done using various analyses such RULA, REBA, questionnaires, interviews etc. The aim of this study was to perform postural analysis of a workstation of an electronics industry using RULA. The evaluation has been using the computer software DELMIA.

Keywords: *Ergonomics, Safety, Electronic Industry, RULA, DELMIA*

I. INTRODUCTION

Ergonomics refers to the analysis of work that may lead to a risk of musculoskeletal disorders (MSDs) and the development of practices to eliminate or at least reduce their severity. MSDs refer to the injuries or diseases that involve muscles, ligaments, tendons etc. The basic principle of ergonomics is to fit the job to the worker rather than fitting the worker to do a job. When the workers are fatigued there is a direct influence on the productivity, quality and cost to the company. Deficient industrial ergonomics is a major reason for sick leave and work injuries in manufacturing industry. A company has to spend large amount of money for rehabilitation and replacement of staff that are absent because of health issues. In this study we used RULA analysis to find out the body postures that were at risk of MSDs.

1.1 RULA (Rapid Upper Limb Assessment)

RULA is a survey method that was proposed by Lynn McAanncy and E. Nigel Corlett in 1993. RULA is a screening tool that assesses postural and biomechanical loading on the whole body with particular attention to the trunk, upper limbs and neck [1]. RULA is used where work related injuries are reported. RULA is used without the need for any equipment and, after training in its use, has proved a reliable tool for use by those whose job it is to undertake workplace assessments. It is an easy and quick tool to evaluate postures. It provides scores from 1 to 7 as shown in table 1.1.

RULA Score	Colour	Remark
1 and 2	Green	Negligible risk, no action required
3 and 4	Yellow	Low risk, change may be needed
5 and 6	Orange	Medium risk, further investigation, change soon
7	Red	Very high risk, implement change now

Table 1.1 RULA Scores and corresponding colors
(Source: www.ergo-plus.com)

DELMIA has been used in this study to perform RULA analysis on the postures that have been selected after simulation in DELMIA itself. Various other analyses such as push pull analysis, lower-lift analysis, and biomechanics single action analysis can be performed in DELMIA.

II. LITERATURE SURVEY

Lynn McAanncy and E. Nigel Corlett (1993) proposed a method called RULA [1]. RULA is designed to assess operators who may be exposed to risk of musculoskeletal disease. Kee D. and Karwowski W. (2007) made a comparison of three observational techniques for assessing postural loads in industry [2]. For this study OWAS, RULA and REBA are taken as observational techniques. Tarwinder Singh et al. (2014) studied the impact of bad body postures on MSDs in electronics industries using RULA [3]. N. A. Ansari et al (2014) evaluated working postures in small scale industries using RULA concluded that there is a moderate to high risk of MSD occurrence [4]. Himanshu Chaudhary et al. (2013) reported that the exposure of worker in cardboard industries to MSD is high by using RULA [5]. Yeow and Sen (2003) aimed at reducing the occupational health and safety problems faced by the manual component insertion operators .Subjective, objective assessments and direct observations were made in the printed circuit

assembly factory [6]. Yeow and Sen (2004) studied an ergonomics improvement that was conducted on the visual inspection process of a printed circuit assembly (PCA) factory [7]. Three problems identified were operator's eye problems, insufficient time for inspection and ineffective visual inspection. Ergonomics interventions were made to rectify the problems. A visual inspection sequence was introduced to rectify it. A.R. Anita et al. (2014) carried out analysis of awkward posture among assembly line workers using the Rapid Upper Limb Assessment (RULA) technique [8]. Abdullah et al. (2009) studied to identify and quantify ergonomics working postures that contributed to the serious development of musculoskeletal injuries and thus investigated possible contributory their related causes [9]. Vignais N et al. (2013) studied a system that permits a real-time ergonomic assessment of manual tasks in an industrial environment [10]. Chang et al. (2007) proposed a method of conducting work place valuations in the digital environment for the prevention of work-related musculoskeletal disorders and apply a digital human modeling system to the workplace virtual dynamic simulation [11]. Asim Zaheer et al. (2012) Claims that the application of ergonomic principles would help to increase machine performance and productivity, but mostly help human operator to be comfortable and secure[12].

III. METHODOLOGY

To find out the causes of MSDs among workers in an electronic industry, postural analysis was performed. Firstly a workstation from the PCB assembly line was selected. The selected workstation was studied thoroughly and several videos were made so as to generate postures in the software on which the analysis had to be performed. The data was collected from the company to design a virtual environment for the simulation of tasks that were being performed on the selected workstation. After the creation of virtual environment, digital human modeling was used to create an operator that was positioned in the virtual environment using DELMIA software. The tasks were assigned to the operator and virtual simulation was performed so as to generate postures on which the analysis had to be performed and after the postures were selected RULA analysis was performed on the selected postures using DELMIA software to find out the RULA scores.

IV. RESULTS AND DISCUSSIONS

A PCB assembly workstation from an electronics industry was selected. The task of the operator was to pick the discrete components from the bin and place them on the PCB. After the simulation in DELMIA, four postures were selected for posture analysis. The four selected postures were (i) Initial idle sitting i.e. when the operator was sitting and was not working, (ii) Picking component i.e. when the operator was picking discrete component from the bin, (iii) Checking component i.e. the operator investigates the component for any visual defect and orients it to be properly placed in the PCB, and (iv) Placing Component i.e. when the operator was placing the picked discrete component into the PCB. The RULA score was find out on the selected postures by using DELMIA software. This software consists of human manikins which can be changed as per the anthropometric dimensions of workers. Using direct kinematic techniques, angle of each body joint was changed according to the particular posture of the worker.

The results for the RULA analysis were saved and have been categorized according to the postures. The results have discussed as follows.

Posture-1: In figure 4.1 the operator sitting idle and its RULA scores have been shown.

Figure 4.1 RULA scores and manikin (Posture 1)

Figure 4.1 shows the operator sitting idle. The final RULA score was found out be 3 that mean that the operator was at low risk of injury and change might be required.

Posture-2: In figure 4.2 the operator picking the component from the bin and RULA scores have been shown.

Figure 4.2 RULA scores and manikin (Posture-2)

From figure 4.2 it was observed that final RULA score for posture-2 was very high i.e. 6. It indicated that the changes were required soon and the operator was at medium risk.

Posture-3: In figure 4.3 the operator checking the component and RULA scores have been shown.

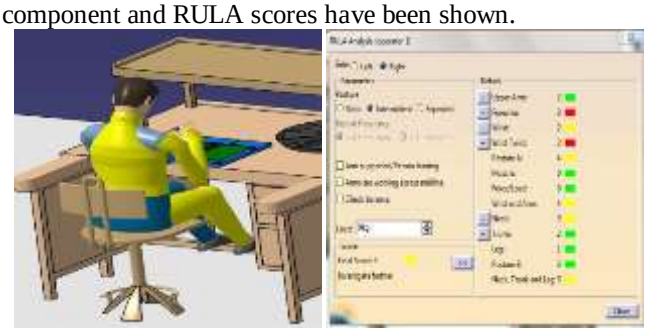

Figure 4.3 RULA scores and manikin (Posture-3)

The final RULA score for this posture was found to be 3 as shown in figure 4.3. It indicates that there was low risk and the change might be required after further investigation.

Posture-4: In figure 4.4 the operator placing the component in the PCB and RULA scores have been shown.

Figure 4.4 RULA scores and manikin (Posture-4)

It was observed for posture-4 that final RULA score was 4. The operator was at low risk and further changes might be done after investigation.

To summarize it was found that the posture-2 in which the operator was picking the component from the bin to be placed on the PCB needs further investigation as the operator was at medium risk of injury and change was required soon. Rests of the postures were found to be of low risk and changes might be required after further investigation.

V. CONCLUSION

In this study the workstation of electronics industry was ergonomically evaluated. RULA analysis was performed and the results were calculated. There was risk of operators facing MSDs as the RULA score was high for one of the postures. Health issues can include back pain, shoulder pain due to bending, twisting of the body. On the basis of results it can be concluded that there is need of ergonomic planning in the industry and workers should be made aware of the possible hazards of poor ergonomic conditions.

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