Workplace Improvement through Ergonomics Using DHM: A Case Study

Manjunatha. N[1], Dr. M. Mohan Ram[2]
[1, 2] Department of Industrial & Production Engineering
[1, 2] NIE, Mysuru

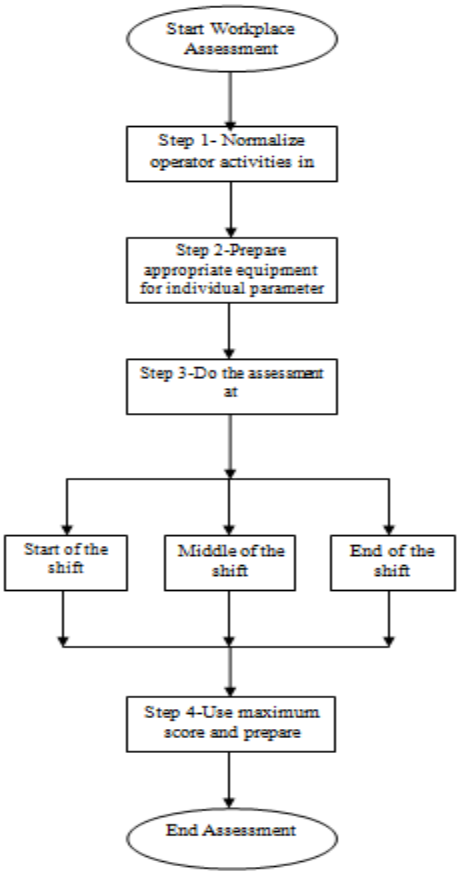
Abstract- *State –of –the-art the industrial success greatly depends on the Quality, delivery and uptime. In order to achieve this industry should implement new techniques which will increase the quality, productivity and decrease worker fatigue. One such technique is ergonomics. Ergonomics an important concept to transform the workplace into better place to work. It mainly depends on the actions how work is performed and what sort of work is performed. It tells us where to target and take action according to it. It has a lot of advantages mainly it increases person's morale to work and it also increases productivity indirectly .The existing workstation design was studied and suggestion was given to improve the method for productivity by reducing shoulder and wrist injury and fatigue.*

Keywords- Ergonomic workplace Evaluation, Musculoskeletal Disorders, DHM, RULA, MMTD socket cell.

I. INTRODUCTION

Ergonomics is the science of "designing the job to fit the worker, not forcing the worker to fit the job." Ergonomics covers all aspects of a job, from the physical stresses it places on joints, muscles, nerves, tendons, bones and the like, to environmental factors which can affect hearing, vision, and general comfort and health, when there is a mismatch between the physical requirements of the job and the physical capacity of the worker, work-related musculoskeletal disorders (WMSDs) can result. This work presents a system that permits a real-time ergonomic assessment of manual tasks in an Industrial environment. First, a biomechanical model of the upper body has been developed by using inertial sensors placed at different locations on the upper body. Based on this model, a computerized RULA ergonomic assessment was implemented to permit a global risk assessment of musculoskeletal disorders in real-time. Furthermore, local scores were calculated per segment, e.g. the neck region, and gave information on the local risks for musculoskeletal disorders. Visual information was fed back to the user by using a see-through head mounted display.

1.1 Ergonomic Workplace Evaluation:-Poor working postures, repetitive tasks and heavy workloads an lead to increased risk of workplace injuries. An Ergonomic assessment can identify these risk factors by using a variety of data capture and risk assessment tools. by performing an Ergonomic assessment, your business can benefit from:



- Prevent costly litigation
- Comply with health and Safety citations
- Decrease injury risk, error rates and lost working days.

Increase efficiency and productivityA Workplace Assessment can help determine what is working effectively in an organization and what is not and assists all levels of employees to become aware of issues; to accept these issues are creating problems, and to take action to resolve them. The main objective of a Workplace Assessment initiative is to allow an organization to take action to address issues perceived to be a source of high conflict or creating a high level of dissatisfaction within the work environment. A Workplace Assessment also identifies what is working well within an organization. This allows an organization to fully leverage these strengths and further provides a means of promoting the continued use of these desired behaviors and practices among its workforce.

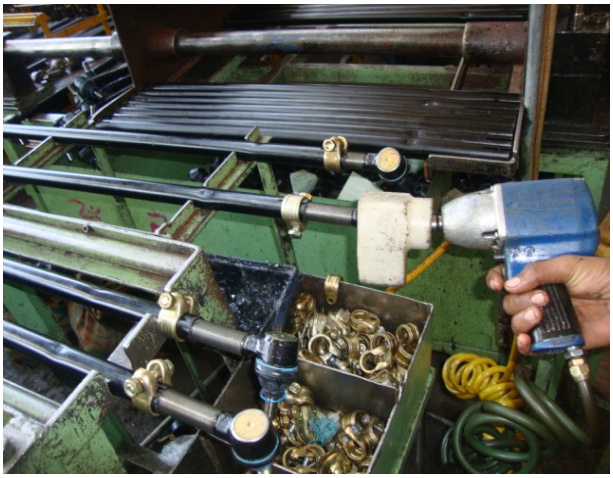
II. STANDARD OPERATING PROCEDURE (SOP) FOR WORKPLACE AUDIT

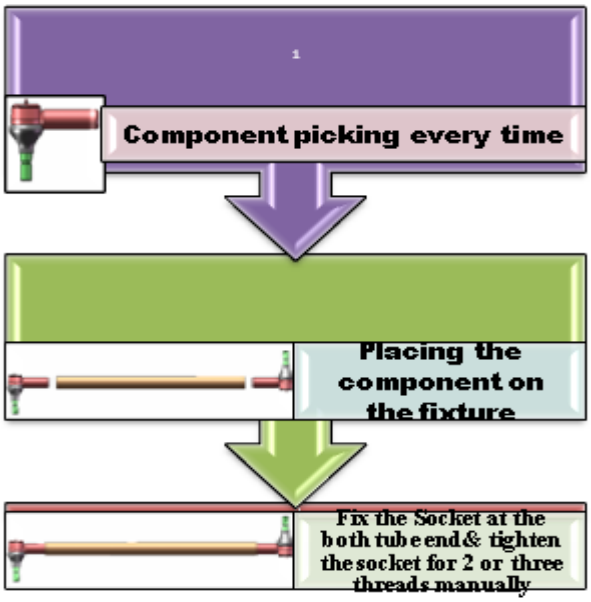
Poor working postures, repetitive tasks and heavy workloads can lead to increased risk of workplace injuries. An Ergonomic assessment can identify these risk factors by using a variety of data capture and risk assessment tools. By performing an Ergonomic assessment, business can benefit from: Prevent costly litigation, comply with health and safety citations, decrease injury risk, error rates and lost working days, increase efficiency and productivity It covers the major areas like Controls and displays, lightings, material Handling, surrounding Environment..

III. CASE STUDY

Ergonomics workplace improvement using Ergonomics –During the initially conduction of the study of ergonomics at the Industry, the critical areas having the maximum critical ergonomic areas which means having a unfavorable working postures which leads to human fatigue which needs immediate attention, are suggested them to reduce the human fatigueless and improve productivity.

MMTD Assembly Cell: In RML (Rane madras Ltd) Plant mysuru, the MMTD (Mahindra & Mahindra tractor division) Assembly work-station, assemble of sockets to the tube at both ends carried out using manually, It is fully manual operation and has to produce 450 nos. per shift, this project important to reduce Operator Fatigue and improve productivity at present who's working facing high Musculoskeletal Disorders.





RANE (Madras) Ltd Manufactures and assembles the MMTD (Mahindra and Mahindra tractor division) drag link end assembly. It is fully manual operation and has to produce 450 nos. per shift, this project important to reduce Operator Fatigue and High Ergonomic Score of 7 & it is in Alert zone as per RULA assessment and using DHM (Digital Human Model) to represent the amount fatigue faced by operator while assembly.

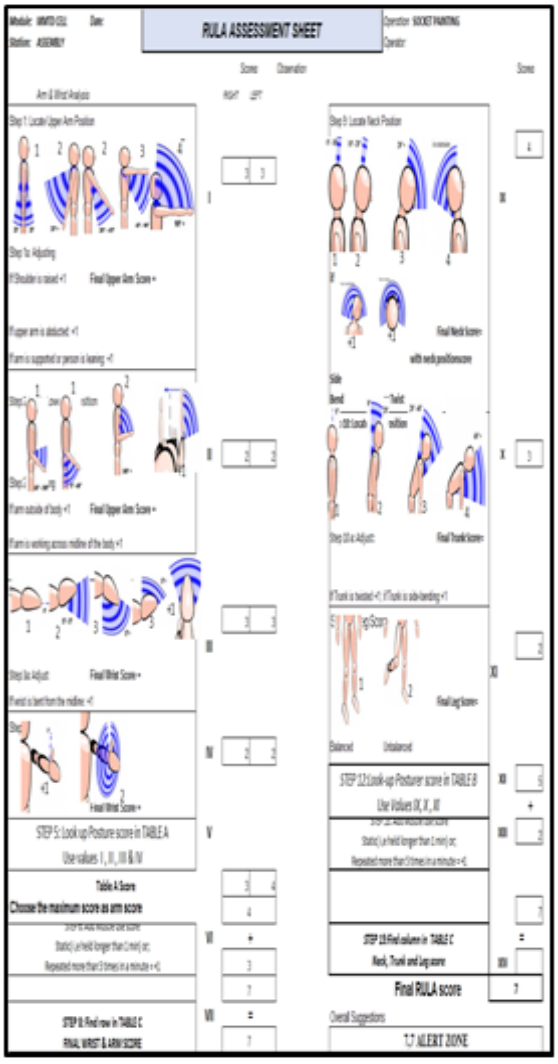
3.1 Rapid Upper Limb Assessment (RULA) Rapid Upper Limb Assessment (RULA) RULA was developed to evaluate the exposure of individual workers to ergonomic risk factors associated with upper extremity MSD. The RULA ergonomic assessment tool considers biomechanical and postural load requirements of job tasks demands on the neck, trunk and upper extremities. A single page worksheet is used to evaluate required body posture, force, and repetition. Based on the evaluations, scores are entered for each body region in section A for the arm and wrist, and section B for the neck and trunk.

Procedure

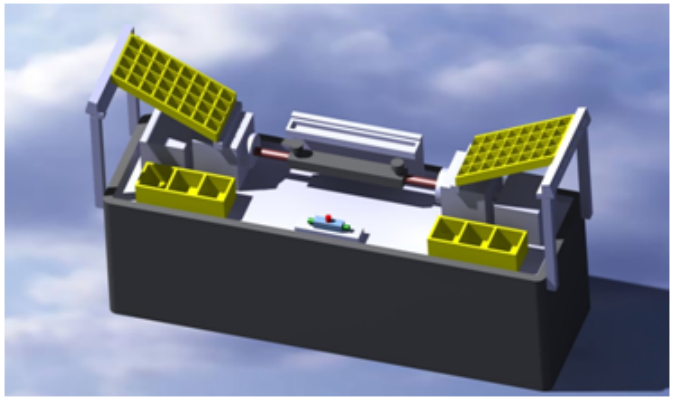
The procedure for using RULA is explained in three steps:

1. The posture or postures for assessment are selected.
2. The postures are scored using the scoring sheet, body-part diagrams, and tables.
3. These scores are converted to one of the four action leve

RULA SHEET FOR MANUAL MMTD END ASSEMBLY (BEFORE)



IV. PROPOSED NEW SEMI AUTOMATIC MACHINE FOR END ASSEMBLY

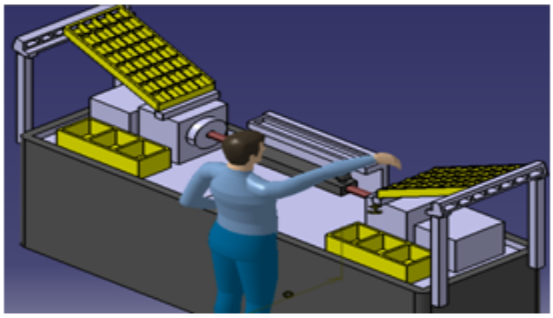


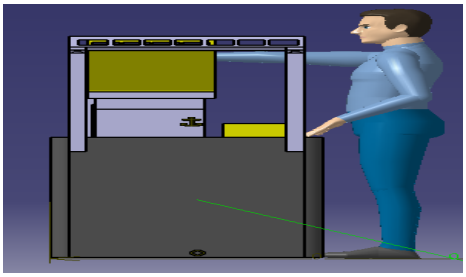
Above figure shows the operator working at good posture in semi automatic machine.

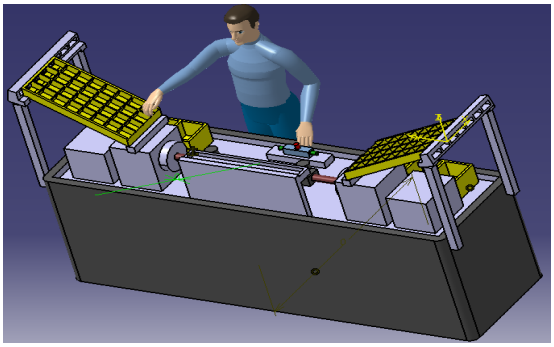
The ergonomic applied research platform provided by CATIA DELMIA V6 can build 3D models for human body and gymnastic device through the establishment of virtual human body model and the specific applied research in gymnastic device design field of body posture simulation, which improves the efficiency and structural performance of gymnastic device design, and makes a scientific and accurate evaluation on its safety and comfort, thus providing designers with a most efficient and effective way to design humane gymnastic devices.

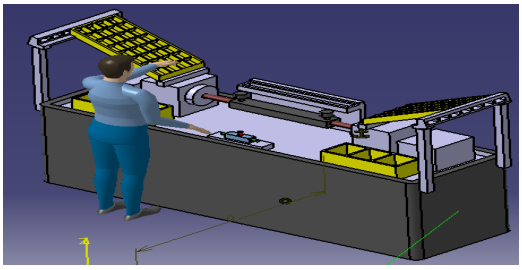
4.1 Establishment of human body model:

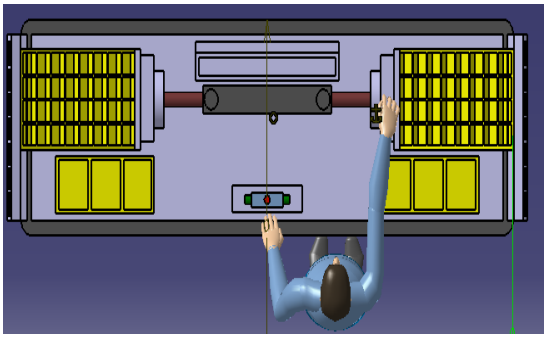
First of all, the creation of human body model requires the percentile of human size based on the actual application subjects of products. The data of human measurement often takes percentile PK as a position indicator or critical value. A percentile divides all measured values of group or samples into two parts: the measured value with K% is less than or equal to it; while that with (100-K) % is greater than it.

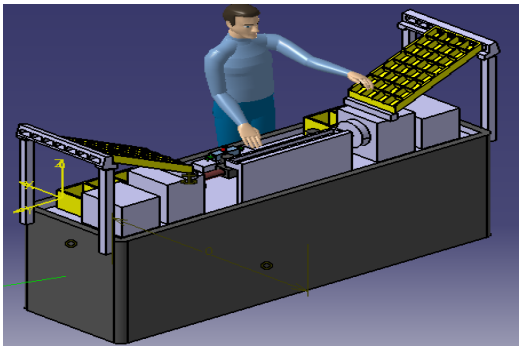






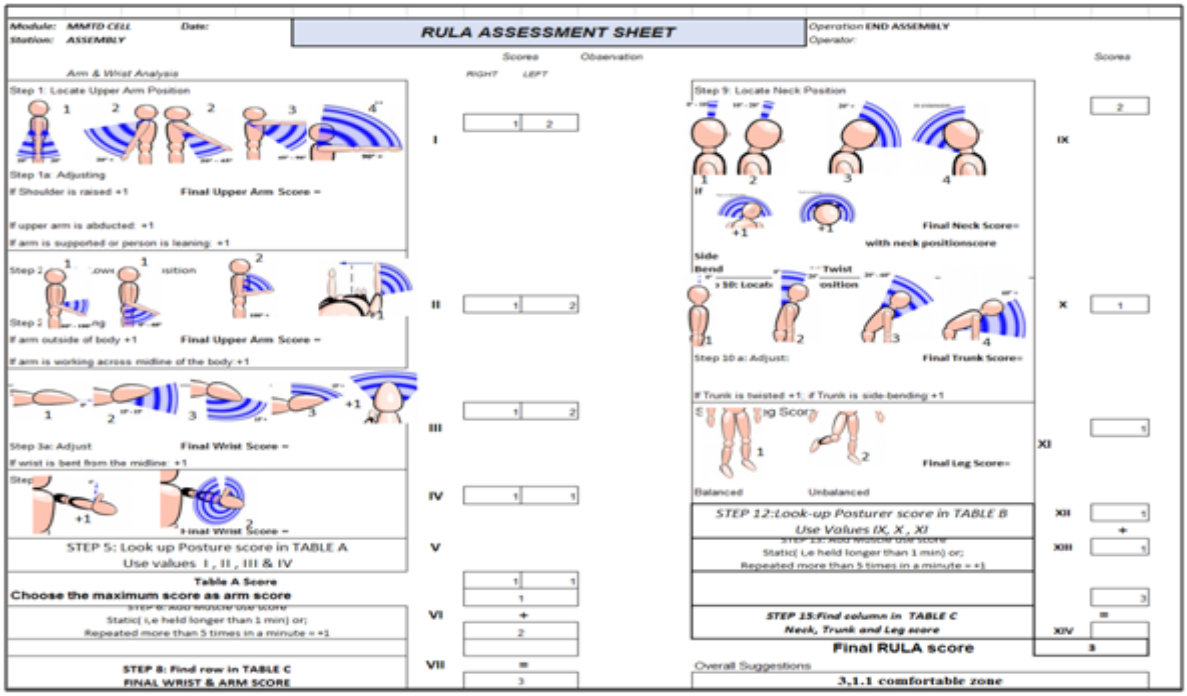






DHM to indicate Human fatigueless end assembly operation

RULA SHEET FOR MANUAL MMTD END ASSEMBLY (AFTER)



V. CONCLUSION

The project work pertains to the application of Ergonomics to improve the productivity of MMTD End assembly cell. The Ergonomics approach aims at enhancing productivity, quality, cost, delivery, safety, morale and effective safe environment (PQCDSME) of the process. It also aims at reducing operator fatigue using DHM.

REFERENCES

[1] Baba Md Deros, Nor Kamaliana Khamis, Ahmad Rasdan Ismail, Haris Jamaluddin, Azmi Mat Adam, Sarudin Rosli, "An ergonomics study on assembly line workstation design" American Journal of Applied Sciences 8 (11): ISSN 1546-9239, 1195-1201, 2011.

[2] Ravikumar Kamble, Vinayak Kulkarni, "Productivity improvement at assembly station using work study techniques" IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163, pISSN: 2321-7308, Vol. 03, Issue 09, Sep-2014.

[3] Sandip B.Wanave, Manish K.Bhadke, "An ergonomic evaluation & assessment of the workstation to improve the productivity for an enterprise" IJERA: International Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 03, Issue 06, Nov-Dec-2013.

[4] Mr. Gurunath V Shinde , Prof.V.S.Jadhav, "Ergonomic analysis of an assembly workstation to identify time consuming and fatigue causing factors using application of motion study" IJET: International Journal of Engineering and Technology ISSN : 0975-4024 Vol. 04, No 4 Aug-Sep-2012.

[5] Ibrahim H. Garbie "An Experimental Study On Assembly Workstation Considering Ergonomically Issues" Proceedings of the 41st International Conference on Computers & Industrial Engineering.

[6] Andrea Lešková "Designing Of Manual Workstation Structure With Emphasis On Ergonomic" ISSN-2067-3809

[7] Dr. Tauseef Aized "Materials handling in flexible manufacturing systems"ascicule 4 [October – December] ISSN: 2067 – 3809 ISSN:: 2067 – 3809 I ISSN: 2067 – 3809 SSN: 2067 – 3809

[8] F. Caputo, G. Di Gironimo, A. Marzano "Ergonomic Optimization of a Manufacturing System Work Cell in a Virtual Environment" Acta Polytechnica Vol. 46 No. 5/2006

[9] A. Cimino, F. Longo*, G. Mirabelli "A multimeasure-based methodology for the ergonomic effective design of manufacturing system workstations" International Journal of Industrial Ergonomics 39 (2009) 447–455

[10] Štefan VÁCLAV, Katarína SENDERSKÁ, Albert MAREŠ "Design Of Manual Assembly Worstations In Catia.

[11] S. Thorley* and N.D.L. Burger "Applied ergonomics for operator compartment design in an EJC 88 XLP loader"