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Posture Data Processing Software using RULA Method

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Abstract

The RULA method is used to analyze risks due to work. Using the Employee Analysis Worksheet Rula requires a long analysis time if changes in posture occur in the work process, especially dynamic work. Research using Kinnect was carried out to capture posture, but for the need for improvement of the workstation, it is better if a simulation of the human object and environment model is made. Tecnomatix Jack as digital human modelling can simulate work processes and get posture results as a function of time. The software is made using the PHP programming language in this research, processing posture data from Tecnomatix Jack according to the Rula method. Score Action Level in the graph as a function of time. The validity of the software is tested on the job with a computer by comparing the two conditions. The results obtained are in accordance with the Rula method. This software can perform workstation repairs quickly. The analysis results can be compared with videos of the current work process. The software can analyze static and dynamic work.

Keywords: DHM, Posture, RULA, Work analysis software

1. Introduction

The World Health Organization (WHO) and the International Labor Organization (ILO) have developed estimates of the burden of occupational diseases and injuries (Hulshof et al., 2021). Diseases due to incorrect work posture include MSD (Sekkay et al., 2021). Analysis methods related to occupational risks include NIOSH, RULA, OWAS, REBA (Lynn & Corlett, 1993). The Rula method is widely used because it does not require additional tools in its implementation (Joshi & Deshpande, 2021). Rula is an abbreviation of Rapid Upper Limb Assessment which is a work risk analysis method that can be carried out quickly (Hanafi, 2021). The Rula method go through 3 phases: the development of a method for recording posture, the development of a scoring system and an action level scale (Lynn & Corlett, 1993). The Rula method uses the upper arm, forearm, wrist posture to get table A and the neck, trunk, and leg postures to get table B. The results of table A and table B are respectively added with external force and muscle strength to produce table C which is an interpretation of the results of the analysis related to the action to be taken (Nigel Corlett, 2005). Calculation results using the RULA method represent a worker's posture (Lueder, 1996). In dynamic work, there will be a change in posture during the work process. It takes software that can calculate and analyze every work process in progress so that it is easy to compare a number of changes in body posture that occur. If it is done manually, it requires a lot of calculations so it is very risky for errors to occur. The first phase process, namely recording posture, can now be done by Digital Human Modeling (DHM)(Alipour et al., 2021). Digital Human Modeling is a technology of how to simulate a virtual human ("Handb. Digit. Hum. Model.," 2016). Currently, DHM is able to simulate work processes such as features in the Tecnomatix Jack software on the task simulation builder (TSB) menu (PLM, 2017). TSB is able to make work process simulations and the results of TSB analysis can produce limb postures during the work process. The data is stored in the Static Strength Prediction file or ssp.csv. This file has not been processed by DHM so that it provides an opportunity to create software that processes the data into tools that can provide an interpretation of the results of the risks caused by the work process. From this problem, software is

made that can provide calculations for every change in posture during the work process. With this software, it will be easier to interpret the results of the risks caused by the work. To get a risk analysis due to work that is carried out dynamically, it is expected that the results can be displayed in a graph so as to speed up knowing when the highest risk occurs.

1.1 Objectives

The objective of this study is to get an action level score on the Rula method quickly and easily recalculated, especially on jobs with changing postures during the work process

2. Literature Review

The first Rula method was published by Corlet and Lynn in 1993(Lynn & Corlett, 1993), This method was developed for the work risk analysis of the upper posture. Use the RULA Employee Assessment Worksheet to get an action level score from the current work posture (Hedge, 1993). The worksheet is only to get the action level from one posture only like on paper Work Posture Analysis of Welding Workers Using the RULA Method. How to get an action level score if the work is done with changing posture positions? In the Usability study of integrated RULA-kinectTM system for work posture assessment successfully integrated with KinectTM but for the purpose of repairing work stations or posture it cannot be implemented(Halim et al., 2018) and Combining ergonomic risk assessment (Rula) with inertial motion capture technology in dentistry—using the benefits from two worlds(Maurer-Grubinger et al., 2021). A way is needed in the form of a work simulation that can be analyzed and improve the work station if needed.

3. Methods

In this study, anthropometric data were obtained from https://antropometriindonesia.org using the average data for males aged 16 to 47 years. To capture the work process using Handycam and Camera. Making models of humans, objects and the environment using tecnomatix jack version 9 and posture analysis according to the Rula method using software made using the PHP programming language.

4. Data Collection

In this study, anthropometric data were obtained from https://antropometriindonesia.org (Indonesia, n.d.) using the average data for males aged 16 to 47 years. Anthropometry on tecnomatix Jack requires data on ancle height and interpupil distance which are not found in Indonesian anthropometry. These data are not needed for analysis in this study, but to complement the anthropometric data, efforts are made to measure these two factors in a local sample.

5. Results and Discussion

The software display is shown in Figure 1 which can be accessed at https://kerjadinamis.web.id. To be able to use this software, the user must register first. When logged in, the user can create a ticket which the admin will receive later. Tickets are used to make an appointment to come to the location of the work that will be analysed. The ticket creation is shown in Figure 2. The data that must be input when making a ticket is the type of work to be carried out, the name of the applicant, the applicant's phone and address. Address determination is also provided using a google map. Each ticket represents one task the admin will perform. If you want to add another analysis, the user must add a ticket that will be done by the admin.

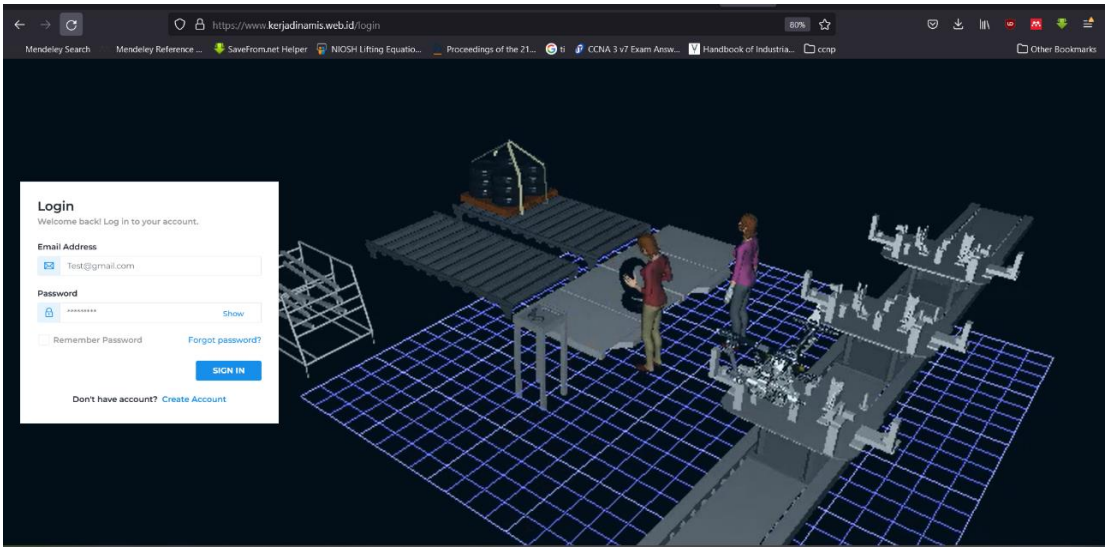


Figure 1. https://kerjadinamis.web.id

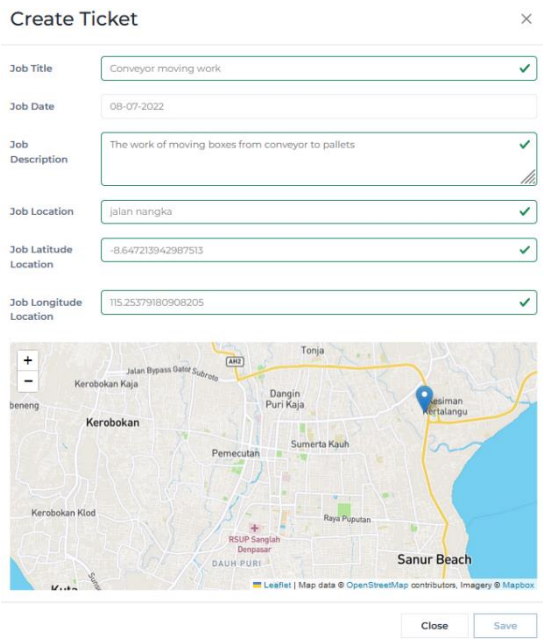


Figure 2. Ticket from User

The process is continued with the capture of the work process carried out in the workplace. The capture results will be made models of humans, objects and their environment using DHM Tecnomatix Jack. Anthropometric data is obtained from direct measurements using an anthropometer, using secondary data such as those on https://antropometriindonesia.org (Indonesia, n.d.), or using anthropometric data that has been provided on tecnomatix Jack (Dvouletá & Káňová, 2014). The making of a human model on the tecnomatix jack is shown in Figure 3. Figure 4 shows the modeling of humans, objects and their environment in tecnomatix Jack version 9. And Figure 5 shows a simulation on the TSB for people with bend conditions working in a sitting position in front of the computer for 10 seconds.

The result of the TSB that will be processed by software is the ssp.csv file. To compare with the results of the analysis, video files are also uploaded. Both files will be uploaded by admin via

login admin@kerjadinamis.web.id. The results obtained on the software made at the top show the data related to the job being analyzed as shown in Figure 6.

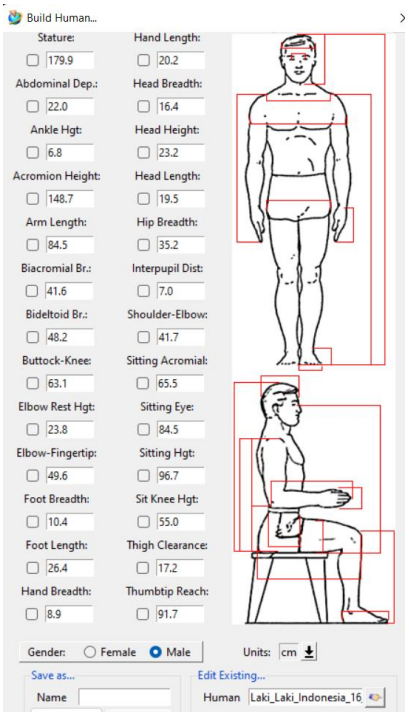


Figure 3. User Anthropometry

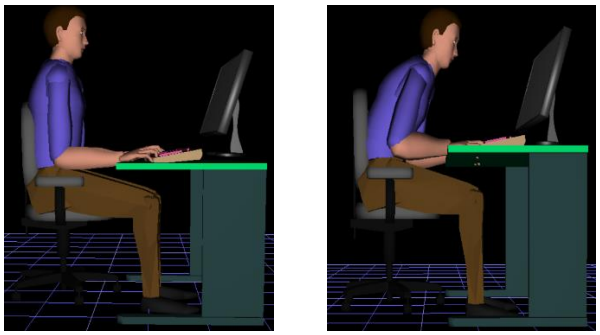


Figure 4. Normal Position and Bend Position When Working with Computers on Dhm Tecnomatix Jack

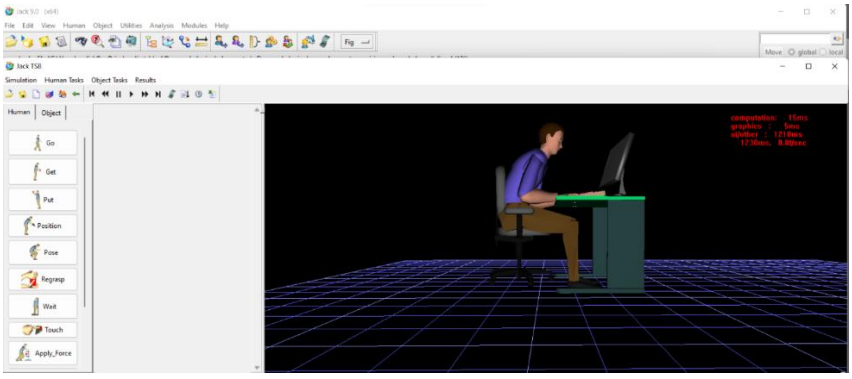


Figure 5. Simulation of Working with Computers on TSB Menu

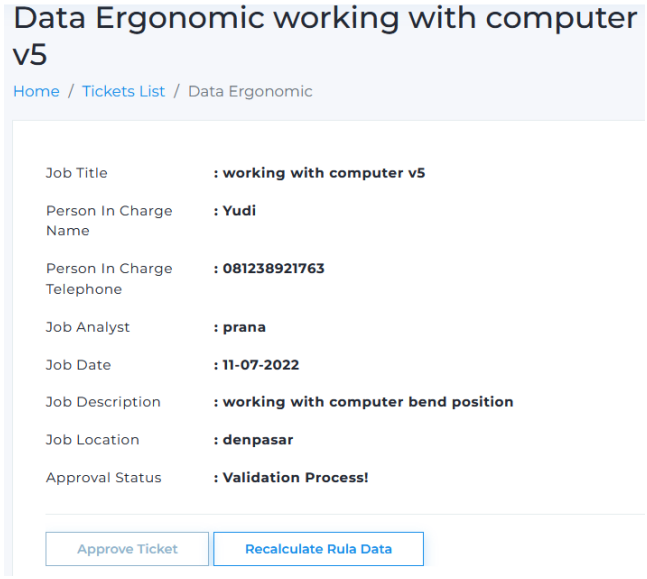


Figure 6. Employee Data

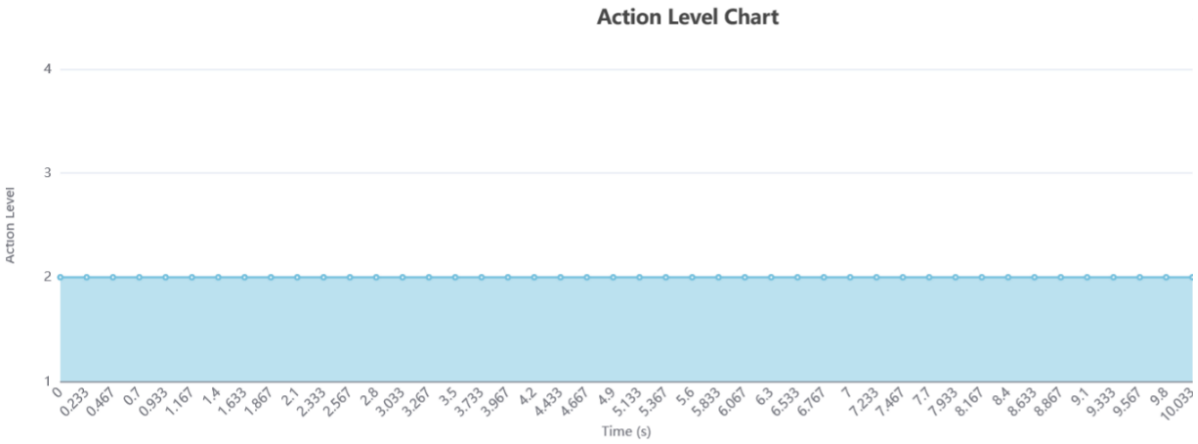
Table 1. Calculation Using Employee Assessment Worksheet Rula

No	Score	Table A								Table C					
		Upper arm		Lower arms		Wrist		Wrist twist		Neck		Trunk		Legs	
		N	B	N	B	N	B	N	B	N	B	N	B	N	B
1	Posture	1	2	2	2	2	2	1	1	3	3	3	4	1	1
		N (normal)				B (Bend)				N (Normal)				B (Bend)	
2	Table A	3				4				5				6	
3	Muscle	0				0				0				0	
4	Load	0				0				0				0	
5	Table C Action	4 (normal)								6 (bend)					
6	Level	2 (normal)								3 (bend)					

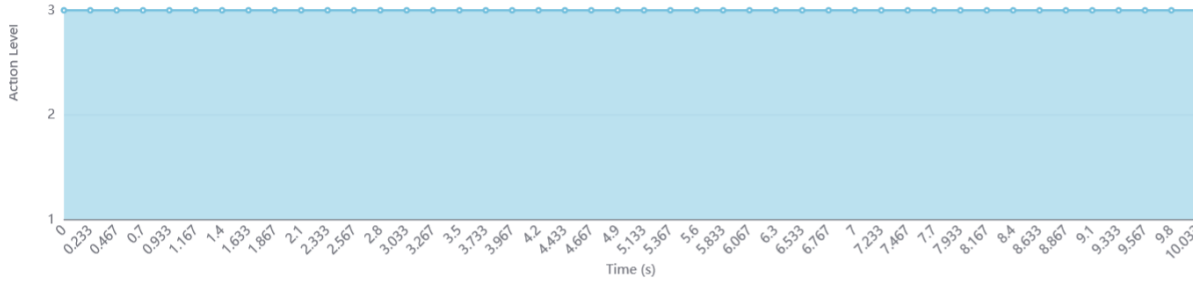
Table 1 shows the results of calculating the action level using the Employee Assessment Worksheet from RULA. The results obtained are Action Level 2 for normal conditions and Level 3 for bending conditions. Meanwhile, from the software calculation, the action level value is shown in Figure 7. The graph in Figure 7a is for computer workers in a normal sitting position and 7b for a bend position. The action level obtained is the same as that in Table 1.

The software also displays a simulated work process in the form of a video on the reporting page to users. This is intended to make it easier to see the posture when it has extreme values. Equipped with a video, it is easier to change body posture to get a lower RULA action level. The video display image is shown in Figure 7. From the action level, the number of each level is also sorted and the posture can be matched according to the existing level.

Software for analyzing work risks by utilizing body posture obtained from DHM Tecnomatix Jack on the TSB menu using the RULA method can be used to get a risk analysis quickly. If you want a change in posture, this software through the TSB menu can simulate these conditions and can process it again to get a risk analysis. With this concept, the analysis process can be carried out preventively using a simulator, so that the risk factor will be reduced because it can be done before the work station is made. In addition, the software can analyze the risk due to work for static work and dynamic work. This can be done because the simulation of dynamic work processes can be done by TSB.



(a) normal position



(b) bend position

Figure 7. Action Level Chart

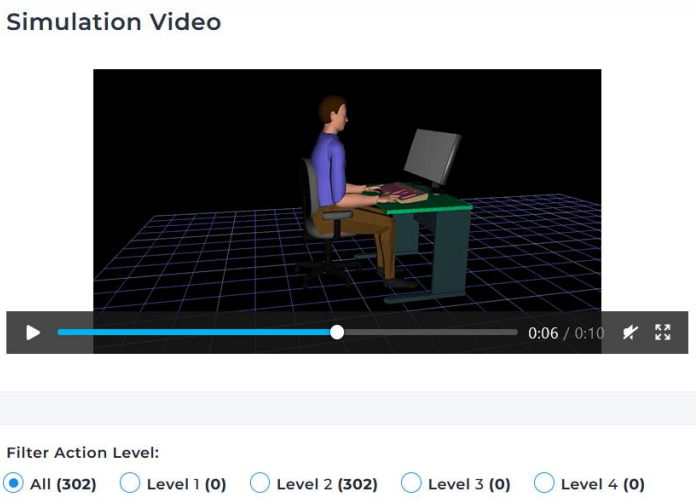


Figure 8. Video Shows The Working Process

To facilitate changes to the work posture, it can be done by viewing the posture on the video and matching the time and the value of the risks that arise. Repeated analysis can be done quickly by changing the simulation posture and using reanalysis software.

The software created helps the process of rapid analysis of the Rula method, especially if the work you want to analyze is in a certain time range and there is a change in the posture of workers.

The weakness of the software made is that it is not suitable for dynamic work with changing loads. For such a case, it is necessary to divide the simulation based on the load carried by the workers.

The software created is also only able to analyze one person at a certain time. Software development is necessary if there is more than one person working together on different postures.

6. Conclusion

- Calculation of risk due to work using the RULA method can be carried out quickly by utilizing posture data from DHM and making data processing software
- The use of software allows changes in posture and recalculation and is carried out in a preventive manner.
- Software can be used for static work or dynamic work.

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Biography

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