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Fuzzy logic and RULA method for assessing the risk of working

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Abstract

Productivity is today one of the most important aspects of a business, the productivity concept not only implies higher profits, but use their resources efficiently, based on the purpose or goal of the organization. One of the most important resources is the human resource, which is why when talking about productivity, it is vital to consider the environment or workspace in which the operators perform. Ergonomics talk is talk of a tool for increasing productivity, as this, to bring the physical conditions of the work area, allows workers feel more comfortable and the risk is diminished by poor posture, resulting an increase in production since the worker gets healthier and safer working conditions. In the northern state of Veracruz, Mexico, is located a company Ironmonger industry and construction, which has about 376 people. It has been found that operators do not have the area right job, so a study was done through the RULA (Rapid Upper Limb Assessment) method for the assessment of risk by maintaining inadequate by the poor design of workspace views. The Rula method provides a useful tool for evaluating working postures that may create a risk tool, however when you have a large number of workers, this process becomes tedious. Fuzzy Logic is an extension of traditional logic, but uses similar concepts belonging to the human way of thinking, the concept of fuzzy logic was introduced by LA Zadeh in 1965, who described that Fuzzy logic does not use exact values as 1 or 0 but if you use values between 0 and 1 (inclusive) that may indicate intermediate values. The use of fuzzy logic in this case study aims to minimize the valuation work for every operator with Rula method, indicating, through fuzzy sets, the levels of risk that may arise in representative areas of the Hardware Store in where work is carried out with similar positions, regardless of the area from which it comes. Allowing this, assign values to assess accurately if no or a risk index.

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1. Introduction

The design and maintenance of a suitable work environment is one of the objectives of Ergonomics and real demand from companies all want their workplaces are promoters of productivity and quality; for this, it needs a correct relationship between environmental factors (lighting, noise, temperature), developed effort, postures, repetitiveness and tools [1].

Currently, human resources and the cost of labor have greater impact on organizations, so it is important to facilitate work and make workers more productive.

To increase productivity companies must adapt ergonomic practices considering the anthropometric measurements of each worker, particularly in regard to workstations, the choice of equipment and working methods, forward or decrease the monotonous routine activities, optimization of space and preserving the health of workers and reduce injuries for work in inadequate conditions or maintaining poor posture.

In Mexico, the worker, according to the stipulations of the Federal Labor Law (LFT) must labor a daily 8-hour day; ie one third of the day was spent on labor force takes place, it affects their quality of life, which according to the World Health Organization (WHO) is defined as the perception of the individual's life situation, within the cultural context and values on which lives in relation to their goals, expectations and interests.

In Mexico only three out of 10 companies have ideal working conditions, poor environmental conditions harm 60% return on an employee, according to the IMThe Rula method was developed by McAtamney and Corlett doctors at the University of Nottingham in 1993 (Institute for Occupational Ergonomics) to evaluate worker exposure to risk factors that can cause disorders in the upper limbs of the body, postures, repeatability movements, applied forces, static activity of the musculoskeletal system [2].

2. Background

Within organization dynamics, the decision-making process often relies on experts to make a complex decision or solve a problem, thus, their knowledge and experience is used. It can be identified three computer-based systems suited for problem solving analysis [3]: Expert Systems, Decision Support Systems, and Integrated Systems.

Musculoskeletal disorders are among the most important problems of occupational health and absenteeism in the United States and Latin American countries; generate significant economic consequences to workers, business, health institutions and gross domestic product. The musculoskeletal disorders are derived from muscle overload in the work place by postures, repetitive movements with strength and intensity, frequency and duration; it is relevant to identify them to generate actions to prevent the consequences mentioned [4].

Regarding ergonomic modeling, translating linguistic descriptions resulting from human observers to mathematical assumptions can be done through fuzzy modeling [5].

Taking into account ergonomic evaluation, the advantages of the fuzzy evaluation mechanism are [7]:

- The mechanism is appropriate for use in case of mixture of quantitate and qualitative criteria;
- It does not required statistical sample. The evaluation of only one variant is permitted too;
- All the measurements values of some single criteria can be missing;
- The mechanism does not require independence between ergonomic criteria;
- It uses the natural hierarchy of the ergonomic evaluation criteria.

Fuzzy logic has also applied to layout planning and ergonomic design. A fuzzy simulation-fuzzy analytic hierarchy process-fuzzy data envelopment analysis algorithm is proposed by [8] to solve a particular case of facility layout design in connection with safety and ergonomics indicators such as flexibility, safety, ergonomics, maintenance and accessibility in order to performance of a manufacturing system.

A fuzzy multi-attribute axiomatic design approaches for selection of the most ergonomic electronic consumer product is introduced by [9] and the implementation process is represented by mobile phone selection as a real world example. Furthermore, the proposed methodology is based on fuzzy multi attribute decision making and fuzzy axiomatic design realized in three steps; determination of ergonomic attributes for electronic consumer products,

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