E-AIRS : INTERACTIVE ERGONOMIC MONITORING SYSTEM FOR WORK POSTURE

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Abstract. Work posture and/or position of work is a crucial problem in work system. Unnatural posture will lead to discomfort when doing the task such as pain at part of body such that it will cause accident in the end. This accident will affect level of work performance of the worker so as the work productivity fails achieve a target determined. The failure mode, of course, results in a big loss for a company. This state should be avoided by use of the natural posture by worker in completing a job. However, many workers do not still understand what kind of a natural and unnatural work posture directly. So, this condition has high risk for being occurred the discomfort. Thus, it is important to develop a tool for helping them to identify a certain posture of work. Objective of this study is to design a monitoring system devices to capture and to determine an natural posture of the worker based on ergonomic principles. Rapid Upper Limb Assessment method is applied to determine a risk of work posture. Machine Learning concept is implemented to support in designing a system by also applying python programming language. Result of this study shows that monitoring system devices developed is usable in informing an unnatural posture of worker in completing a job. Thus, this result will beneficial for worker to improve work posture to be natural position so as discomfort can be prevented.

Keywords: ergonomics, physical work posture, monitoring system, machine learning.

1 Introduction

Work posture is a position of body part of the worker when interact to a workplace in completing a task which is formed by an angle between two body segments. This posture indicate the level of comfort at musculoskeletal system in which this condition will affect the work performance of the worker [1]. Use of a good posture may support to achieve a high productivity. It because of a worker can be able to do the task effectively. Otherwise, productivity will decrease if unnatural posture employed causes a disorder on that system such as pain on back, neck, upper and lower extremities. This disorder is called the musculoskeletal disorder that is a stress condition at soft tissues, muscles, ligaments, joints, tendons and nervous system that is also caused by repetitive work motion [2]. Similar study at the Faculty of Public Health on educational staff has been also done stated that worker who has the improper body posture when operating computers in a long time can suffer musculoskeletal disorder (MSD) in the neck [3].

In several cases like in the office and/or in the manufacturing activity, many workers

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experience stress at part of the body that inflicting loss of concentration in doing a job [4]. This occurrence is frequently affected by use of ineffective movement and also poor work posture when completing a task . In addition to, the understanding about kinds of work posture by the worker is still low so as they can not be able to classify and identify whether it is poor or good posture. The worker focuses only how to do the job faster without think comfort of work. Such condition will danger their safety and health for getting accident if this matter occurred continuously. Increasing knowledge and skill for workers through training or education is not enough to avoid the stress on body. It because of weakness of human for neglecting a criteria of a good posture. This fact encourage this study should be done with developing a device for remembering the worker related to an unnatural/poor posture. By implementing this device developed, it is expected the worker will be able to know earlier unnatural posture that is their used such that they are avoided from the discomfort.

Numerous of research has been conducted related to the effectiveness of the reminder device of worker's unnatural posture. Gopinath and Kiruba have developed a flex sensor for detecting workers' posture by attaching it on the mid thoracic and lumbar region [5]. Unfortunately, this device is not applicable in real activity because it should be attached sensors on the body part that disturbing the work activity. While, a study done by Manghisi about a design of a device (Ergosentinel) by using motion and depth sensors is to track joints motion and workposture as well as informing a degree of angle between two body segments [6]. But, this device can not be able to communicate the results to workers directly because no reminder system. Thus, objective of this study is to develop a monitoring device to detect an unnatural posture directly without attaching sensors on body part and it may be able to remind a worker about such posture.

2 Methods

2.1 RULA

Rapid Upper Limb Assessment (RULA) is a method to assess working posture at upper body of the worker when doing the task. This method provides an information about the musculoskeletal risk level of posture used by worker [7],[8]. It is presented by RULA's score. This score is classified into 1-2 (acceptable), 3-4 (need further investigation, changed may be required), 5-6 (need further investigation, change soon), and 7 (investigation and change immediately) [9]. Figure 1 explain a guideline of RULA.

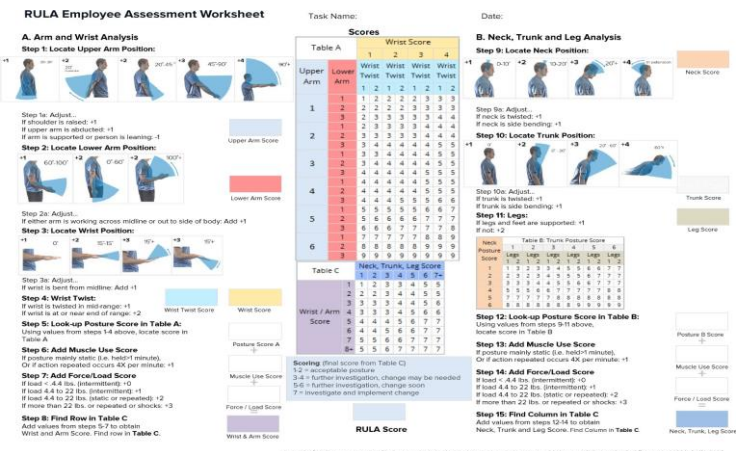


Fig. 1. RULA Guidelines.

2.2 Python Programming

Python is a programming language for multiple applications such as data science, software development, web development, and machine learning [10]. This language is easy to generate and arrange the programming code such that it is faster to develop an application software. The python will also be applied to make a reminder system for sending a notification alert. Thus, it is properly to develop the monitoring device [11].

2.3 Machine Learning

Machine learning is a branch of Artificial Intelligence which give an ability for machine to learn a thing automatically without being controlled by operator through computer. It is made by developing an advanced algorithms and statistical approach to analyze and classify the patterns of data [12]. This technology is able to collect, learn, and analyze data on the variety of task, like postural data or RULA score [13].

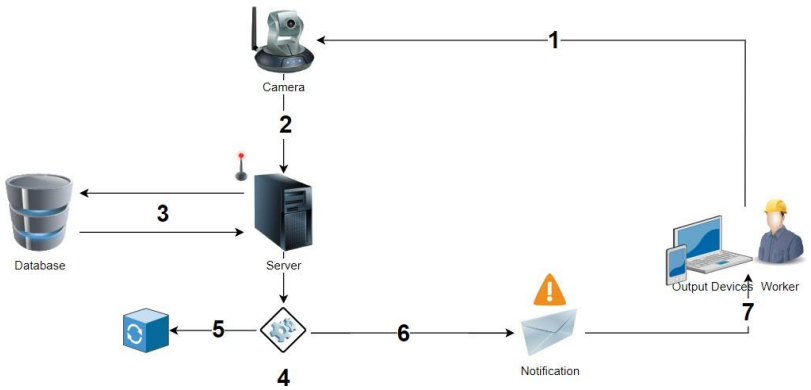
2.4 Computer Vision

Computer vision defines an ability of computer to acquire the visual data from image or video through implementation of artificial intelligent and camera so as the computer can be able to recognize a certain object or motion [14]. This technology has been implemented in many instances such as face detector apps, goods sortation and photo scanner [15]. This facility in computer is utilized to scan and detect a detail picture or motion with programming algorithm.

3 Result and Discussion

Figure 2 present a new design of the interactive monitoring system (E-AIRS) for identifying unnatural work posture. It consist of Camera, Server, Database, Output devices that are connected through wireless system. Camera works to capture the visual motion and posture of a worker. It becauses this dynamic picture will be identified or classified by machine learning into unnatural posture on basis RULA guidelines. And server functionates to run the machine learning algorithm which it is developed by applying python code. While, database save RULA data models as the basis of posture analysis, and the output devices are as the notification receiver to display the alert for worker through mobile phone or laptop or other devices so as the worker can understand that unnatural posture used is poor. The following figure explains the workflows of ergonomic monitoring system.

Fig. 2. New Design of Interactive Monitoring System (E-AIRS).



4 Conclusion

It can be concluded that the developed interactive monitoring system is capable in informing an unnatural posture to a worker through output devices such as mobile phone or computer. This device is also usable and beneficial for worker to improve work posture to be natural position so as discomfort can be prevented.

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