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Rapid Entire Body Postural Analysis & Assessment Device for Computer Operators

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Abstract:
The aim of this review is to provide a summary of one of the observational postural analysis ergonomic assessment tools; Rapid Entire Body Assessment (REBA) in terms of its development, applications, validity and limitations. Research showed REBA's convenience for postural assessment of jobs in numerous professional settings, including industrial and health care jobs, construction, sawmill tasks, supermarket industry, food industry, computer based jobs, packaging, school workshop, odontological services and for firefighters and emergency medical technicians. Face validity is established in two stages. In terms of concurrent validity, several studies used REBA to compare the results with other observational and direct methods so that the level of conformity between the two is determined. The limitations discussed in this review did not hold the method's implementation back, on the contrary, it is currently used and remains a rapid to use tool with computerized checklist and tables available in public domain.

Keywords: Ergonomic Assessment, REBA, Postural Analysis.

I. INTRODUCTION

Ergonomic assessment of Work-Related Musculoskeletal Disorders (WMSDs) involves the evaluation of risk of developing a range of disorders to muscles, nerves and joints, primarily to the upper limb and low back, associated with occupational tasks. Musculoskeletal disorders are among the most widely spread occupational problems for both developed and developing countries, in industries and services, with increasing expenses of salary compensation and health costs, declining productivity and lower quality of life. These disorders are caused by different risk factors' interactions resulting from several factors, which can be categorized into individual, psychosocial and physical factors. Physical load of work is usually evaluated by analyzing body posture, movement; recurring and forceful activities and maximum force, or increasing muscle load over time.

Figure 1. Correct and Wrong Postures.

Observational and instrument based techniques are proposed in research to provide a quantitative measure for the degree of discomfort and postural strain caused by different body positions. The angular departure of a body segment from the neutral posture in the observational technique is acquired through visual perception, whereas recordings of the body positions done continuously in the instrument-based techniques are taken using a device attached to a person.

II. LITERATURE REVIEW

Poor posture is the new first-world problem that's causing more mental and physical health complications than most people realize. The human body was designed to move – not to sit in a chair for several hours at a time. Over time, bad habits lead to fatigue, depression, pain and headaches. There's a reason your mother told you to sit up straight – poor posture destroys your health. In, students were asked to walk down the hallway in a slouched position or by skipping. Those who slouched while they were walking experienced increased feelings of depression and decreased energy levels. When the body is slouched and constricted, it prevents it from working optimally which results in a poor mood. When the body remains in a seated position for an extended period of time, all of your internal processes slow down. As a result, your energy levels decrease. You may start feeling irritable, tired or aggravated. Slouching also causes your body to compress and constrict. When in this position, your heart and lungs are forced to work harder to pump blood and circulate oxygen. This causes undue stress on your internal organs and your muscles. Sitting in an upright position with your shoulders and chest broad makes it easier to breathe. Sitting does more than just constrict your heart and lungs, it also constricts your intestines. This can make digestion uncomfortable and cause a host of issues. If you are experiencing digestive distress, you may want to take a closer look at your posture and how much time you are spending sitting each day. Slouching has even

been attributed to digestive issues such as acid reflux and hernias. Poor posture may do more than just weaken your digestive system; it may also cause you to develop that unsightly belly pouch that women dread. This paunch affects both heavy and thin women and can be attributed to slouching and poor sitting habits. Back, shoulder and neck pain are the most common effects of poor posture, and the most noticeable. Sitting in a slouched position at your desk for an extended period of time puts a great deal of stress on your upper body, especially if your body is not properly supported. The most common pain areas include:

- Lower back – 63%
- Neck – 53%
- Shoulder – 38%
- Wrist – 33%

In time, poor posture can also cause a misalignment in the spine and lead to even more pain. In addition, it also causes joint stress. Joints are protected by connective tissues that create a supportive cushion. If the spine is misaligned, weight or stress needs to be redistributed to compensate for your slouching. As a result, your joints are forced to bear a heavier load that may be more than it can handle. Eventually, this leads to pain and degradation of the tissues surrounding your joints. Your eyes represent a complex part of your central nervous system, connected directly to the brain. To see the way you do, your eyes accept light beams. These beams hit the photoreceptors, known as rods and cones, located in your retina at the back of your eyeball. The signals the retina receives translate into electrical impulses, which travel on the optic nerve into the brain's visual cortex. When impulses reach the visual cortex, your brain interprets them and uses them to determine how the body should respond. The brain sends messages down the spinal cord to tell the rest of your body how to react to what the eyes see. When you have good posture, the communication your brain sends via your spine comes fast and uninterrupted. Your brain stays in constant command of your body, using information gathered from each of the five senses, including sight. Over time, slumped or hunched posture affects the connection quality between the spinal cord and the brain. This creates a lag between your eyes seeing an object, your brain interpreting the image of the object, and your body responding to the object. In fact, poor posture can result in many health issues, including slowed circulation, shallow breathing, and blurred vision. But the relationship also goes the other way. If you have poor eyesight, you may squint, lean forward, or tilt your head into an unnatural position to see more clearly. These movements create muscle tightness in the shoulders, neck, and head. Over time, this maladjustment can decrease blood flow to and impulse connection with your eyes.

III. DESCRIPTION OF THE METHOD

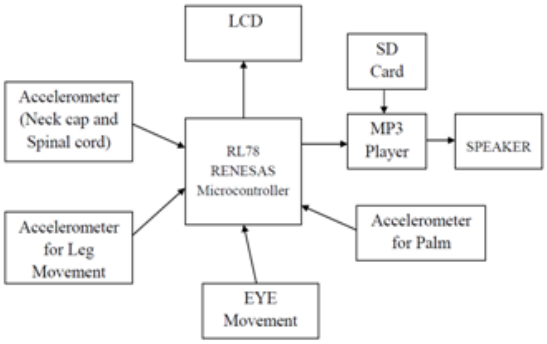

Figure 3. Block Diagram of REBA

Many embedded systems have substantially different designs according to their functions and utilities. The microcontroller located at the centre of the block diagram forms the control unit of the entire project. Embedded within the microcontroller is a program that helps the microcontroller to take action based on the inputs provided by the output of the sensors. This project consists of Renesas microcontroller, Accelerometer, pulse sensor, LCD, MP3 player and speaker. Accelerometer is mounted on Neck cap, spinal cord and on thigh. The output of these accelerometers are given to the ADC unit of the microcontroller. Based on the program embedded within the microcontroller the voltages generated by the accelerometer are displayed on the LCD. If the output voltages cross the respective threshold value, corresponding voice output is generated through MP3 player via speaker. If the person wearing these devices is sitting for a long time, also then a voice output will be generated until the person changes from sitting position to standing position or doing some physical activity. Voice output indicating change in position is activated on a periodically basis from time-to-time. Even sitting posture is corrected using this equipment. Say the person wearing this device is bending more rather than sitting upright, then also a voice output will be generated insisting him to sit upright. Accelerometer is placed on the back of the palm. When the palm is twisted more towards the right or left side the accelerometer generates an output voltage. This output voltage is fed to the microcontroller. Based on the variation of the output voltage from threshold value, the MP3 generates voice output through the speaker. Pulse sensor is placed above the eye to gauge for change in eye pressure. If the sensor output changes from the threshold value embedded within a microcontroller, voice output is generated from speaker connected to the MP3 player. For demo purpose LCD is used to display the changes in output voltages of accelerometer and any event occurring.

IV. ADVANTAGES AND DISADVANTAGES

Advantage

- This type of system helps to eliminate hunchback effect occurring due to much bending of the spinal cord.
- Helps eliminate poor moods such as depression and stress resulting from slouched position.
- Energy levels are also increased since internal processes of the body are well maintained, thereby eliminating moods like irritation, tiredness or aggravation.
- Sitting upright position with chest and shoulder broad makes breathing easier.
- Digestive distress occurring due to improper posture can also be eliminated by using this technique.

Disadvantages

- Carrying power supply.
- In the absence of power supply the entire unit is a failure.

V. CONCLUSION

The project is designed using structured modeling and is able to provide the desired results. It can be successfully implemented as a Real Time system with certain modifications. Science is discovering or creating major breakthrough in various fields, and hence technology keeps changing from time to time. Going further, most of the units can be fabricated on a single along with microcontroller thus making the system compact thereby making the existing

system more effective. To make the system applicable for real time purposes components with greater range needs to be implemented.

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