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ENTIRE BODY POSTURAL ANALYSIS ASSESSMENT DEVICE FOR COMPUTER OPERATORS

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Abstract: "Smart chair for body posture monitoring" is proposed for assessing the body posture of a person sitting on a chair. The proposed work is about monitoring the body posture of a person sitting on the chair. While sensors are incorporated for identifying the body posture, voice messages and text messages are generated to alert when wrong body postures are sensed. 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, deontological 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: Body posture, posture detection, posture correction, Assessment device.

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 analysing body posture movement; recurring and forceful activities and maximum force, or increasing muscle load over time. 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.

Smart chair for body posture monitoring is a powerful technique for assessing work activities. Musculoskeletal pain can be reduced by maintaining proper body posture. A need for assessing the unpredictable working posture found in industries and other areas lead to the development of body posture analysis. Due to wrong posture musculoskeletal pain is found in nerves, joints, mainly to upper limb and lower back. Musculoskeletal pain is the wide spread occupational hazard in both developed and developing countries, leading to decreasing productivity and lower quality of life. Wrong body posture is observed in people sitting on the chair while studying, operating a computer, corporate industries and other activities. Prolonged wrong body posture leads to lower back pain (LBP), found in 60-80% of adults at some point of their life.

II.LITERATURE SURVEY

Chia-Feng Juang et al. have proposed a neural fuzzy network based method for human posture monitoring to address emergencies caused by accidental falls. Four essential body postures that are used for posture classification, consists of

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standing, bending, sitting, and lying down. All the four postures can be classified with high accuracy in consistency with experimental results. However, the neural fuzzy network implementation is quite complicated.

Mengjie Huang et al. have proposed a practical smart chair system, which is able to monitor the sitting posture of human body. The pressure patterns for sitting postures of human is acquired and transmitted to the computer, to recognize the sitting posture. Artificial neural network method is used for human posture monitoring. The limitation of this system is that the person sitting on the chair is not intimated about the wrong sitting posture.

Won-Jae Yi et al. have proposed a wearable system for posture assessment and fall detection of a person using an Android smartphone. The proposed design architecture utilizes the wireless body sensor network and a smartphone as data gateway and analyzer, in order to provide immediate information in case of medical emergency. However, the usage of smart phone makes the system expensive.

Fengye Hu et al. have proposed an algorithm for human body posture recognition. To recognize human body posture, Back propagation (BP) neural network is implemented, where signals are received from VG350 acceleration sensor. To describe the human body posture, magnitude of human body signal vector and tri-axial acceleration sensor data is used. However, the algorithm related to human body posture is limited to lower back of the human body.

III.SYSTEM DESIGN AND ARCHITECTURE

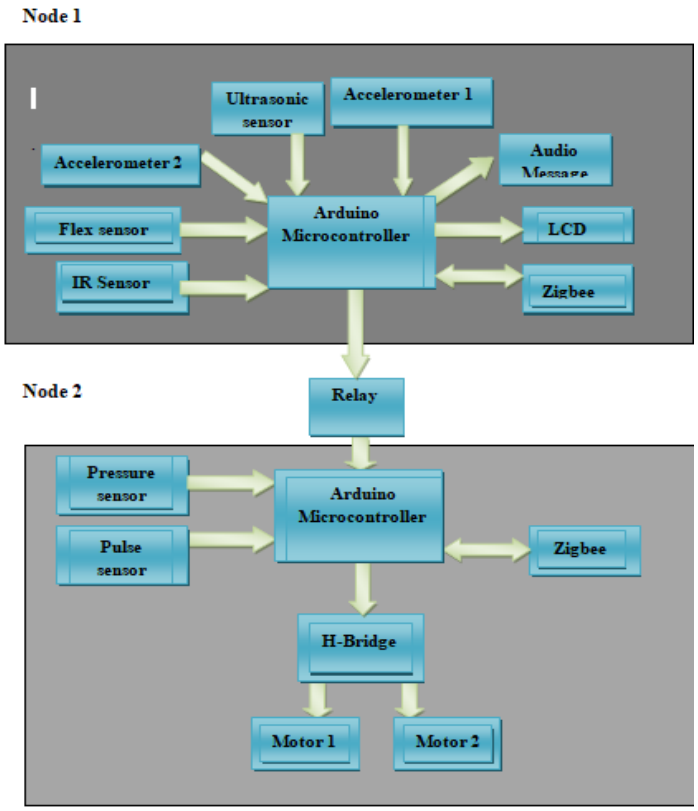

Fig 1. Block diagram

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 microcontroller, Accelerometer, pulse sensor, LCD, MP3 player and speaker.

The work of monitoring of body posture is carried out in two parts, with each part implemented as a separate node or a card. The block diagram, as shown in Figure, includes node 1 and node 2 and a relay between two nodes to support single supply unit.

Node 1: At the core of node 1 is Arduino Microcontroller. While a Liquid crystal display (LCD) is provided to display required messages, a loudspeaker is included to output audio messages. Sensors are used to monitor the movements of

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certain parts of body. A voltage regulator ensures constant voltage for node 1. Table includes sensors used in node 1 and its applications. Zigbee standard is used for serial communication between node 1 and node 2. Upon power up to node 1, the infrared sensor of node 1 senses the presence of a person on the chair, the relay gets energized. The relay, being connected to node 2, powers up the node 2 eliminating the need for an additional source on node 2.

Node2: Arduino micro controller is used in node 2. Sensors are used to monitor the weight and heart beat rate of the person. Table includes sensors used in node 2 and its applications. M1, M2 are DC motors used in node 2, for up and down movement of chair respectively. H-bridge is the driver circuit used for the motor. Zigbee standard is used for serial communication between node 1 and node 2. A voltage regulator provides a regulated power supply to node 2.

V. ADVANTAGES

- 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.
- This type of system can be implemented in regular workspaces and offices, where the employees sit in the same position to work for prolonged hours.
- Also implementable in home offices/chairs.
- It can be implemented in automobile vehicles like cars and trucks where the driver's position is monitored and corrected.

VI.CONCLUSIONS

This project is designed using structured modelling 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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