

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: RENESAS; Accelerometer; LCD; MP3 Module; Speaker.

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. 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.



Fig 1. Right and wrong posture

II. BLOCK DIAGRAM

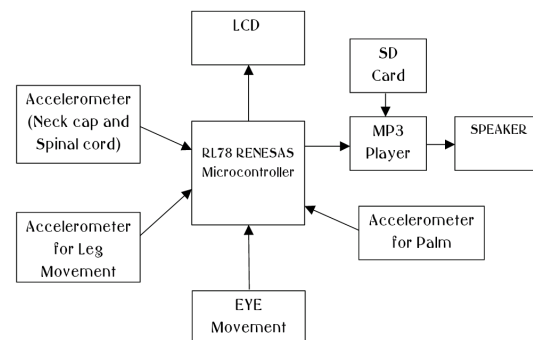


Fig 2. Rapid Entire Body Postural Analysis assessment device for computer operators

Many embedded systems have substantially different designs according to their functions and utilities. The microcontroller located at the center 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.

Accelerometers are 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.

III. LITERATURE

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 a study conducted by San Francisco State University, 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.

IV. RENESAS MICROCONTROLLER

A. Features:

- General-purpose register: 8 bits × 32 registers (8 bits × 8 registers × 4 banks)
- ROM: 64kb KB, RAM: 4 KB, Data flash memory: 4 KB
- On-chip high-speed on-chip oscillator
- On-chip single-power-supply flash memory (with prohibition of block erase/writing function)
- On-chip debug function
- On-chip power-on-reset (POR) circuit and voltage detector (LVD)
- On-chip watchdog timer (operable with the dedicated low-speed on-chip oscillator)
- I/O ports: 16 to 120 (N-ch open drain: 0 to 4)
- Timer □ 16-bit timer: 8 to 16 channels, Watchdog timer: 1 channel
- Different potential interface: Can connect to a 1.8/2.5/3 V device
- 8/10-bit resolution A/D converter (VDD = EVDD = 1.6 to 5.5 V): 6 to 26 channels
- Power supply voltage: VDD = 1.6 to 5.5 V

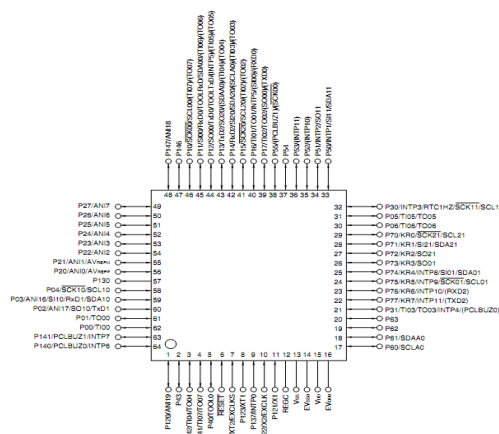


Fig 3. Renesas microcontroller

V. LCD

A liquid crystal display (LCD) is a flat panel display, electronic visual display, based on Liquid Crystal Technology. A liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present information. Liquid crystals do not emit light directly instead they use light modulating techniques.

VI. ACCELEROMETER: (ADXL335)

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ± 3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

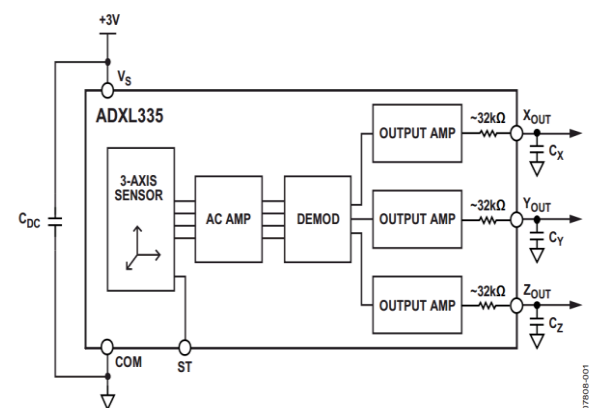


Fig 4. Functional Block Diagram of Accelerometer (ADXL335)

VII. MP3 AUDIO MODULE

A. Features:

1. Supports MP3 and WAV decoding.
2. Supports FAT16 and FAT32 file system.
3. 24-bit DAC output and supports dynamic range 90dB and SNR 85dB.
4. Supports AD key control mode and UART RS232 serial control mode.
5. Supports maximum 32GB micro SD card and 32GB USB flash drive.
6. Audio files are sorted by folders; supports up to 99 folders, and each folder can be assigned to 255 sound files.
7. Supports inter-cut advertisements.
8. Supports playback of specifying folders.
9. Support random playback.
10. Built-in 3W amplifier that can direct drive a 3W/8Ohm speaker.

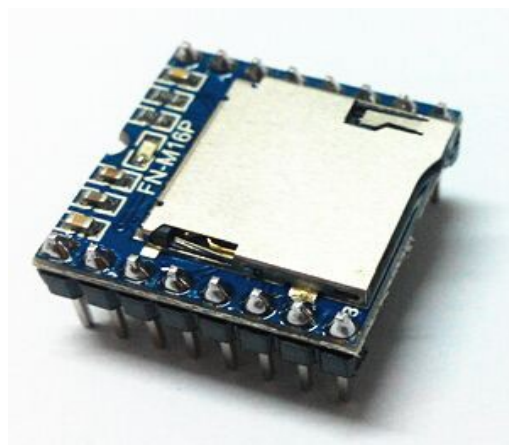


Fig 5. MP3 audio module

VIII. SPEAKERS

A Speaker is an electro acoustic transducer that produces sound in response to an electrical audio signal input. Non-electrical loudspeakers were developed as accessories to telephone systems, but electronic amplification by vacuum tube made loudspeakers more generally useful. The most common form of loudspeaker uses a paper cone supporting a voice coil electro magnet acting on a permanent magnet, but many other types exist. Where high fidelity reproduction of sound is required, multiple loudspeakers may be used, each reproducing a part of the audible frequency range. Miniature loudspeakers are found in devices such as radio and TV receivers, and many forms of music players. Larger loudspeaker systems are used for music, sound reinforcement in theatres and concerts, and in public address systems.

Technical Pro is a brand of speakers, amplifiers and other components for beginner and semi-professional disc jockey, live music, and home audio use. Technical Pro speakers are either active (built-in amplifier) or passive, with a variety of configurations and cabinet types.



Fig 6. Speaker

IX. HARDWARE REQUIREMENT

1. RL78 RENESAS Microcontroller

2. LCD
3. Accelerometer
4. Pulse sensor
5. MP3 Player
6. Speaker
7. SD Card

X. SOFTWARES USED

1. Embedded C
2. Cubesuite+ Tool
3. Renesas Flash Programmer tool

XI. 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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