

Body balance ability monitoring based on acceleration spectrum analysis

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Abstract

Popular human balance ability monitoring methods such as scale scoring and posturography testing have many drawbacks, e.g., subjective judgment, complicated and expensive instrument platform, pre-defined actions in lab environment other than real walking postures in daily living. In order to overcome these weaknesses, the author developed a brand-new balance monitoring methodology. The methodology is developed directly on human real walking postures as follows: (1) the body motion is simplified with a three-spot mathematic model, i.e. the waist, the left foot and the right foot structure. (2) the acceleration data at each spot are collected and processed via Fourier transform to get dynamic spectrums. (3) The spectrum data are further analyzed to interpret the balance condition by reviewing the degree of harmonic restraining, harmonic compensating, and inter-spots spectrum correlation. (4) A specific algorithm was developed to aggregate the specific spectrum features into a general balance ability index. Based on the methodology as above, the author successfully developed the electronic modules, the software system and android application so that a smart wearable balance ability monitoring device was invented. The device is mini scaled and user friendly. It can precisely identify individual balance ability differences that cannot be distinguished by human sense. The invention can be used for older adults, providing imbalance warning in their daily life to avoid injury from falling down. It can be used as well in many other aspects, such as walking recovery training, exoskeleton control and so on.

Biography

Zewei Shi is a grade 11 high school student. He likes invention and has several patents authorized by State Intellectual Property Office of China. Due to his excellent achievement in balance monitoring research, he received China National Top One honorable title in the awarding program for future scientist from the state authorities in November 2016. He likes Biomedical Engineering and wishes to extend his knowledge in corresponding fields.

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