

The Design of Ubiquitous Learning System with Energy Sensor

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ABSTRACT

With the progress of network science and technologies, diversified learning method has already changed the learning modes of current learner. The variation of learning mode, not only change the learning environment of learner, also change a traditional instructional assessment mechanism. The traditional E-learning often offers the online examination to assess the learning effect of a student after completion of the online learning. Basically, this traditional learning assessment mechanism is a passive and negative assessment mechanism, which cannot provide an real-time learning warning mechanism for teachers or students to find out problems as early as possible (including such learning conditions as "absence of mind" resulting from poor learning stage or physical or psychological factor), and the post-assessment mechanism also cannot assess the learning effectiveness provided by the online learning system. This research, proposes a design of ubiquitous learning system with wireless learning energy sensor. By wireless brain-wave sensor, the proposed system captures the EEG signal and automatically analyzes the values of learning energy related to learning. The proposed ubiquitous learning system with wireless learning energy sensor not only provides the analysis of learning status for students, but also provides teacher the evidences of their learning performance during online learning. Besides, the system applies Improved Ganglia Agent (IGA) to provide a grid-based flexible extension mechanism for distributed materials. The wireless learning energy sensor is to adopt DC power supply, not only easy to carry, also provide a wireless bluetooth transmission mechanism, therefore it is very easily to be integrated into ubiquitous learning system, effectively provide learner to carry on the mobile learning that is free from time and space restriction.

Keywords : Ubiquitous Learning、 Learning Energy、 Brainwave sensor

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REFERENCES

- [1] “認識核子醫學”，<http://npcc.vghtpe.gov.tw/nmed-guide/chap1/chap1.htm>.
- [2] NeilFraser, “The Biological Neuron.”, <http://vv.carleton.ca/~neil/neural/neuron-a.html>.
- [3] 關尚勇林吉和, “破解腦電波”, 藝軒圖書出版社, 民國91年。
- [4] 王智弘, “The Program Design of EEG Analysis for e-Learning”, 私立大葉大學碩士論文, 中華民國100年1月。
- [5] 胡慕美, “Ganong生理學”, 合記圖書出版社, 200-204頁, 民國80年。
- [6] Attila Nagy, “The Impact of E-Learning”, 2005.
- [7] Bill Schilit, Marvin Theimer, “Disseminating Active Map Information to Mobile Hosts”, 1994.
- [8] Guanling Chen, David Kotz, “A Survey of Context-Aware Mobile Computing Research”, 2000.
- [9] Jochen Schiller, Agnes Voisard, “Location-Based Services”, 2004.
- [10] Vicki Jones, Jun H. Jo, “Ubiquitous learning environment: An adaptive teaching system using ubiquitous technology”, 2004.
- [11] National Research Council, “The Global Positioning System: A Shared National Asset”, 1995.
- [12] Stephen A. Weis, “RFID (Radio Frequency Identification): Principles and Applications”, 2004.
- [13] 輔仁大學理工學院生物技術研發中心, http://brc.se.fju.edu.tw/nobelists/198x/p1981_1.htm.
- [14] Eric H. Chudler, Ph.D., “腦, 一個還是兩個?”, http://www.dls.ym.edu.tw/neuroscience/split_c.htm.
- [15] Larry R. Squire, Eric R. Landel, “Cognitive Neuroscience and the Study of Memory”, *Neuro*, Vol.20, 445-468, 1998.
- [16] “腦功能區”, <http://120.107.166.105/bio98/94230015/www/brainfun.htm>.
- [17] Uwe Herwig, Peyman Satrapi, Carlos Schonfeldt-Lecuona, “Using the International 10-20 EEG System for Positioning of Transcranial Magnetic Stimulation”, 2003.
- [18] Stephen A. Weis, “RFID (Radio Frequency Identification): Principles and Applications”, 2007.
- [19] 美國NeuroSky官方網站, <http://www.neurosky.com/default.aspx>.
- [20] Gargiulo, G., Bifulco, P., Calvo, R.A., Cesarelli, M., Jin, C., van Schaik, A., “A mobile EEG system with dry electrodes”, 2008.
- [21] The MathWork公司旗下產品Mmatlab, <http://www.mathworks.cn>.
- [22] 王翔儒, “The Design of Grid - based Learning System with LEI Analysis”, 私立大葉大學碩士論文, 中華民國101年1月。