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Measurement of Human Sensibility by Bio-Signal Analysis

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Key Words : Emotion(), HRV(), GSR()

Abstract

The emotion recognition is one of the most significant interface technologies which make the high level of human-machine communication possible. The central nervous system stimulated by emotional stimuli affects the autonomous nervous system like a heart, blood vessel, endocrine organs, and so on. Therefore bio-signals like HRV, ECG and EEG can reflect one's emotional state. This study investigates the correlation between emotional states and bio-signals to realize the emotion recognition. This study also covers classification of human emotional states, selection of the effective bio-signal and signal processing. The experimental results presented in this paper show possibility of the emotion recognition.

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*

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CAD/CAM

(1-2)

2

. Fig. 1

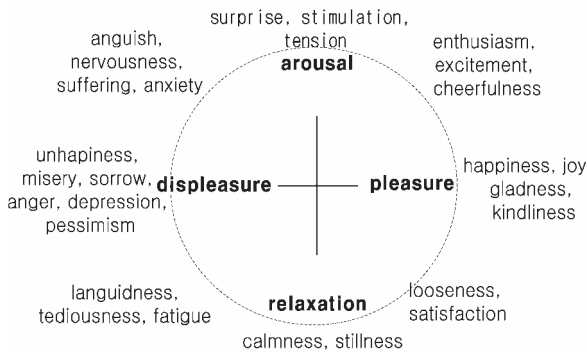


Fig. 1 Classification of emotional states

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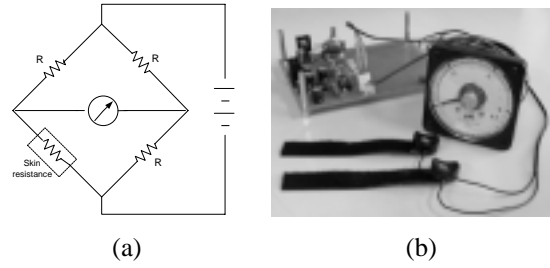


Fig. 2 GSR measurement system (a) The basic circuit for measuring GSR (b) Measurement system configuration

Ohm

2.2

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(Wheatstone bridge)

Fig. 2

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3.2 HRV

(Electrocardiogram, ECG)

R-R

(Electroencephalogram; EEG), (Cortical evoked potentials; CEP), (Electromyogram; EMG), (Electrooculogram; EOG), (Electrocardiogram; ECG), (Heart rate variability; HRV), (Respiratory volume and rate), (Galvanic skin response; GSR), (Photoplethysmogram; PPG),

HRV LF(Low frequency : 0.1Hz), MF(Medium frequency : 0.1~0.15Hz), HF(High frequency : 0.15~0.5Hz)

HRV GSR

MF

(4)

HRV

ECG

Fig. 3

3.1 GSR Fere(1888)

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Fig. 3 complex

P wave

QRS T wave ECG

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(3)

Fig. 4

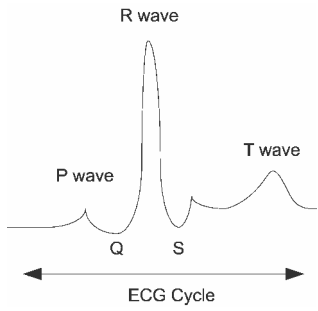


Fig. 3 Main parameters of the ECG signal

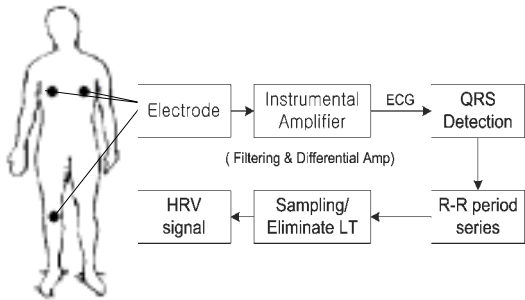
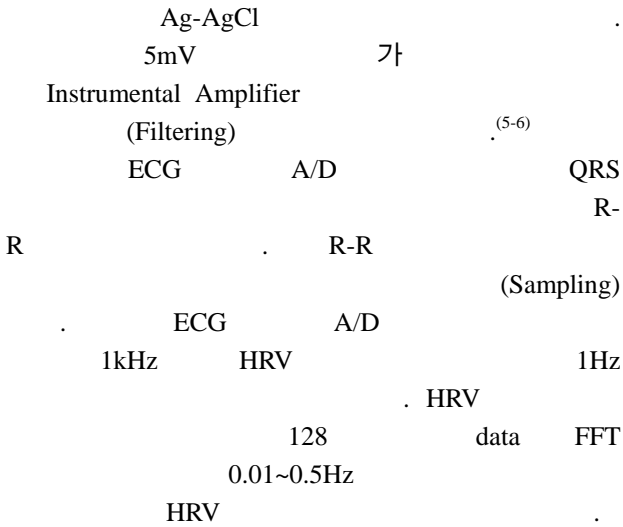


Fig. 4 ECG nodes and signal process for HRV



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4.2

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manekin) SAM
 Fig. 5
 (1, 3, 5, 7, 9)

4.3

(International Affective Picture System, IAPS)
 IAPS 823
 SAM
 (7-9)

4.4

25~30 30
 IAPS
 1 30
 30
 SAM 가 SAM 가

4.5 SAM

IAPS

가

SAM

Table 1

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Table 1 SAM result for the visual stimuli

S A M \ No		No								
		1	2	3	4	5	6	7	8	9
The subject Means	The pleasure	7.25	4.75	2.75	4.75	5.75	6	3.25	2	7.57
	The arousal	4.25	3.75	4.25	5	2.25	6.5	2.25	6	1.29
IAPS Manual	The pleasure	7.1	5.69	2.31	5.34	4.78	8.25	3.41	2.21	6.79
	The arousal	4.46	3.96	4.94	6.13	1.55	7.8	3.74	6.92	3.28

SAM IAPS SAM
 . 1 . 9 ,
 . SAM
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 4.6 GSR IAPS
 . Fig.
 5 Fig. 6 SAM
 . 2 3
 - SAM
 가 5 ,
 , SAM 가
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 - SAM
 가 . Table 2 - , - SAM
 , HRV

4.7 HRV
 Fig. 7 Fig. 8 SAM HRV
 . SAM
 가 . Table 2 LF
 - SAM
 5.
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 2
 HRV GSR
 GSR

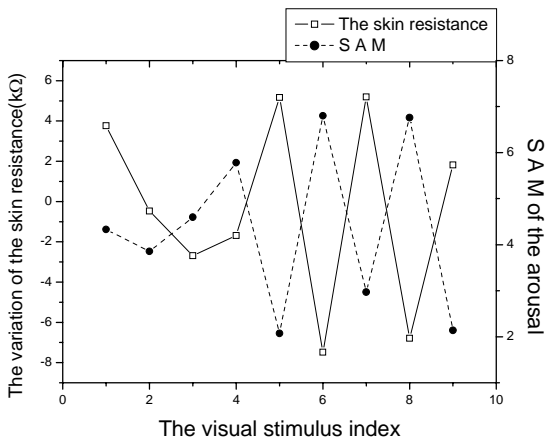


Fig. 5 GSR and SAM for the arousal stimuli

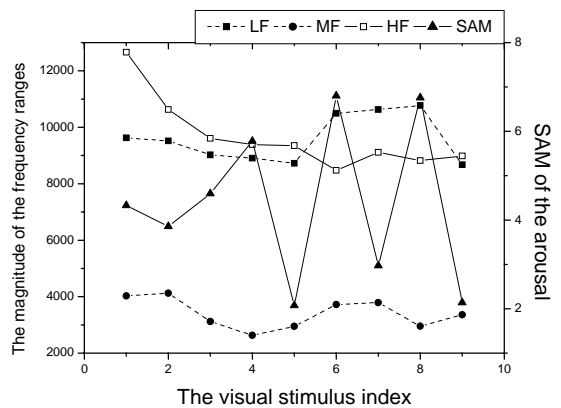


Fig. 6 HRV and SAM for the arousal stimuli

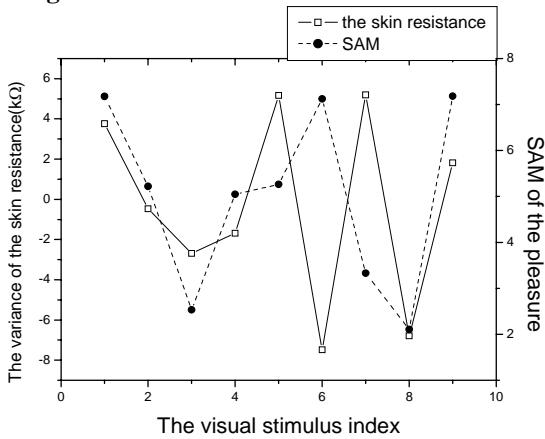


Fig. 8 GSR and SAM for the pleasure stimuli

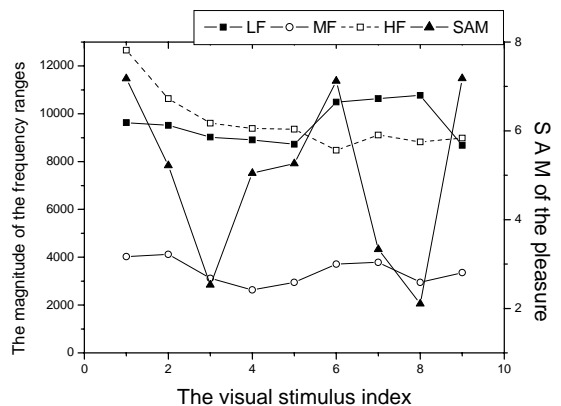


Fig. 7 HRV and SAM for the pleasure stimuli

