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New Electronic Acupuncture System using Intelligence

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Abstract .n recent years, scientific studies of traditional oriental medicine are accelrating. Furthermore, researches of medical examinations and treatments through collaboration of oriental medicine and western medicine is in progress. This paper will seek for spots on the body suitable for acupuncture using special features that skin impedance values are different. The computer simulation results have shown that Electro-Acupuncture administered by using the medical diagnosis system developed in this study is more effective than the conventional method.

Keywords: Pulse wave, Fuzzy Rules, Acupuncture,

1 Introduction

In oriental medicine, the term ‘pulse’ has several meanings. The pulse is considered an important factor in herbal remedies, since observation of a person’s pulse rate may reflect their health and illness[1-3]. The observation of heart palpitations is critical as the cessation of a person’s heart palpitations classify them as dead. Therefore, the condition of the instant heart change is observed in both western medication and eastern medication, and we can diagnose it by feeling the pulse. Since ancient times, oriental doctors have considered pulse rate as an important data in diagnosis. Accordingly, a doctor who was competent in checking the pulse of their patient was considered a creditable doctor. However, the current blood pressure pulse analyzer may be considered flawed, since it is uncertain whether the blood pressure pulse analyzing sensor is located precisely on the radial artery. Furthermore, the analogue type blood pressure pulse analyzer has the issue of objectifying the blood pressure pulse. Although some people may have the same forearm length, the thickness of their blood vessel may differ, and therefore there is no set of data that is considered reliable enough to judge the accuracy of blood pressure pulse rates. [4-7] In this paper, in order to calculate the best optimal time of Electronic-Acupuncture, it will consider the patient's physical conditions, age conditions and disease conditions[8-12]. As the

computer simulation resulted, Electronic-Acupuncture using the intelligence had proven to be more efficient than the existing method. The composition of this paper is as follows: section 2 discusses the multipad with a built-in Electronic-Acupuncture ; section 3 discusses the fuzzy rules based on pulse wave analysis. Section 4 reports the results of Electronic-Accupuncture simulation and section 5 concludes this paper.

2 E-Acupuncture pad with built-in multi-active

What is a multi-pad with a built-active JEUNJACHIM (Electronic-Acupuncture) depending on a patient's current body status? Based on this information, the patient meets the voltage and current self-oscillation. The frequency with the ability to automatically advanced procedure is called JEUNJACHIM. In order to perform these functions simultaneously with the sensing of JEUNJACHIM, one is required to possess the ability to perform surgery, derive accurate analysis from fuzzy logic and process statistical data. Electrical resistance of the body including long-term resistance, internal resistance and the surface can be divided into exposed skin. Resistance of the body when the DC voltage is based on the pure resistive component can be considered only based on the basis, when the impedance of the AC voltage should be considered. That body electrical conductors if you think skin, blood, muscles and other body each part of the voltage and current for the resistive component and capacity components are separated by impedance and its size, the electrical conduction path, the contact voltage, the contact area, and energizing time, is applied differently depending on the frequency may occur.

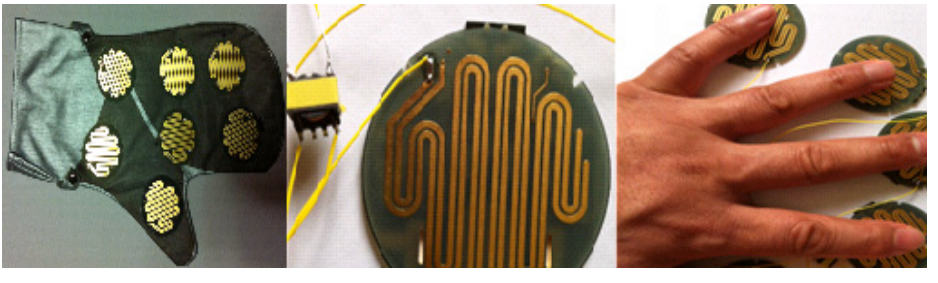


Fig. 1. multipad with a built in electronic acupuncture

Figure1 illustrates the basic theory of Electronic-Acupuncture. In addition, these changes in a person's age, gender, humidity, temperature, weight and fat accumulation is based on the changes. The requirements when considering the electrical resistance of human skin in general is based on the amount of approximately 2500Ω. However, the same voltage and current is applied even if the amount of contact area and pain change in resistance over time are different. In the electrical resistance of human body tissues, regardless of the DC and AC power is almost constantly appear if time longer JUAL heat due to temperature rise of tissue resistance is slightly reduced. When the electricity in the human body typically conduct a minimum of power to feel the flow

of the AC voltage is 1mA ~ 2mA for men. In contrast, direct the flow of power is smaller than the stimulus at least five double-road sensing current flow caused by the voltage applied, even though I do not feel the flow of electricity. Thus, in the treatment of **JEUNJACHIM,** electricity is AC rather than DC voltage with the voltage of the aneurysm and the frequency and voltage, over current change as a real hand acupuncture procedures, a small battery that has the same effect as a treatment is likely to be seen.In the experiment, according to AC current that can safely come off as self a man 16mA (60Hz) women 10.5mA (60Hz) is about the human body can withstand DC current is approximately 74mA men for women is approximately 50mA .But it also including a person's body size and weight may appear slightly different depending on the requirements. In this paper, the voltage between 15V ~ 50V AC voltage to the change of 5Hz ~ 1.2Khz and current 500uA ~ 1500uA given in the current experiments were carried out. Figure 2 illustrates the electronic acupuncture circuit

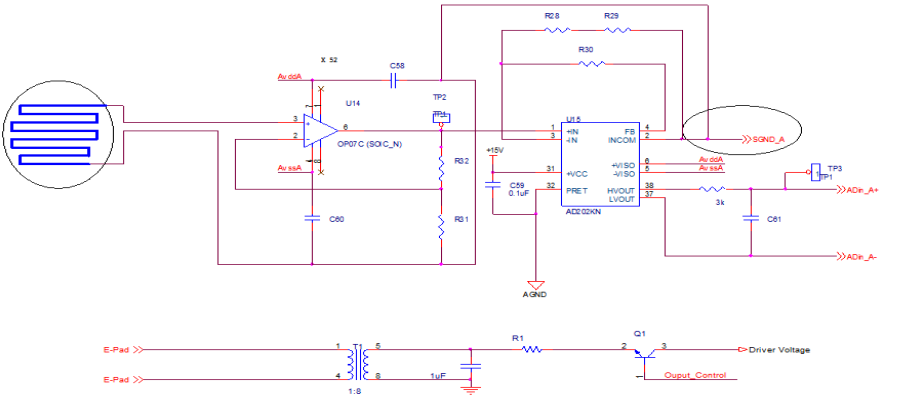


Fig. 2. Electronic acupuncture circuit.

3 Fuzzy rules considering the patient's condition

The general algorithm comes to a conclusion of B on the assumption of 'A → B and equals A'. In this case the latter A should be completely consistent with the former A (of conditional clause). This kind of inference is called Modus Ponens and the Fuzzy algorithm is trying to expand as follows which will be called GMP (Generalized Modus Ponens);

Assumption 1: If x equals A,y will be B.

Assumption 2: x equals A'.

Conclusion : y equals B'.

When you use the Fuzzy Rules, the knowledge to judge a patient's health by using the pulse wave will be expressed in Fuzzy R and you will be able to carry out modeling like the following to observe Output (or Symptom) B to clarify Input (or Cause) A.

If you are not careful for actual pulse feeling, often you may be confused that floating

pulse, sliding pulse, and big pulse are powerful while submerging pulse and small pulse aren't. However, some floating pulse, big pulse, and sliding pulse are weak and some submerging pulse and small pulse are strong.

If 4 patients, a, b, c, and d are in their terminal stage, the left figure will be ranging from 0.8 to 1.0 and if in the middle stage, from 0.4 to 0.7 and if in the initial stage, from 0.1 to 0.3. The figure in the middle indicates the patient's physical condition. For example, if a patient is 150 cm high and weighs less than 45 kg, the figure will range from 0.1 to 0.3, if he is 151 - 170 high and weights 46 - 70kg, from 0.4 to 0.7, and if he is 171 - 200 cm high and weighs 71 - 130kg, from 0.8 to 1.0. This illustrates the Fuzzy conversion factor to adjust the correlation coefficient in consideration of the weight, age, gender, and physical condition when you analyze patient health condition.

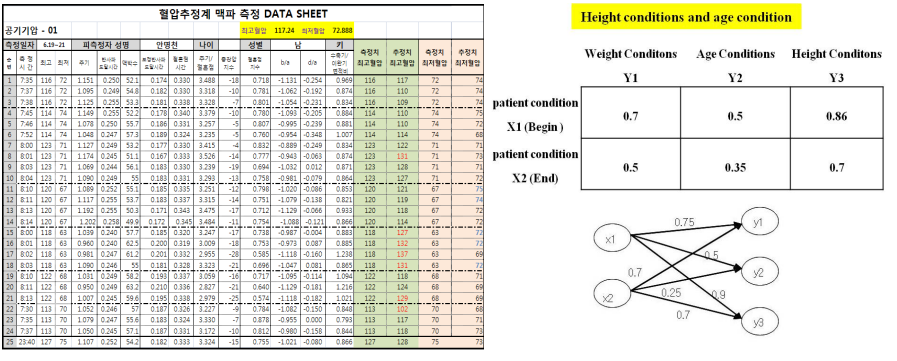


Fig. 3. Patient Health Condition using Fuzzy Rules

The evidences of this kind of hypothesis are atopic disease, acne, and age spot. This skin related troubles happen because the diseased spots have high resistance of electricity. High resistance to electricity means inappropriate oxygen provision therefore the skin disorder occurs in various ways such as atopic disease or age spot. Existing blood pressure pulse analyzing system doesn't consider patient's sex, age, and condition therefore there is an inadequacy of choosing the right amount of pressure to press the needle into patient's skin. It also has a problem of inaccuracy in finding the right acupuncture points. Therefore if a needle is used on an aged patient or a young patient with weak skin it might leave bruises or wounds. In this paper, it tried to solve these problems using intelligent fuzzy rules.

e=R-Y

Ce=e2-e1

Where, Y: optimum pulse feeling judgment

R: Criteria Input

e: Error

Ce: Error Displacement

e2: Current Error

A global priority reflects the importance of an element with respect to the focus of the problem. The derivation of local priorities is carried out through the use of a comparison scale and a pair wise comparison matrix. A comparison matrix for deriving the priority vector

$w^T = (w_1, w_2, w_3, w_4, \cdots)$ is associated with 3 elements in a specific level with respect to a single element in a level immediately about it. Such a matrix is denoted by A.

$$A = \begin{bmatrix} w_1/w_1 & w_1/w_2 & w_1/w_3 & w_1/w_4 \\ w_2/w_1 & w_2/w_2 & w_2/w_3 & w_2/w_4 \\ w_3/w_1 & w_3/w_2 & w_3/w_3 & w_3/w_4 \\ w_4/w_1 & w_4/w_2 & w_4/w_3 & w_4/w_4 \end{bmatrix}$$

In this matrix every element a is the result of a pair wise comparison denoting the dominance of element i relative to element j. A comparison is also being made of the j[th] element with the i[th] element. The fuzzification membership functions in a fuzzy rule base are triangular typed ones defined by equation (1) with $a, b, u \in U$. The fuzzy rule base composes of MISO (Multi Input Single Output) typed rule base. Each fuzzy membership function in a fuzzy rule base has a membership value area $[0,1]$, and should be normalized in this area.

$$y = \begin{cases} \dfrac{2}{b-a}(x-a), & a \le u \le b, \quad u \in U \\ 0, & otherwise \end{cases} \tag{1}$$

This interval includes all possible values for the variable in universe of discourse(U). All fuzzy sets in a fuzzy rule base have the same support interval $[a,b]$. The equation can be represented all types of fuzzy membership functions both fuzzy and non-fuzzy membership functions. The oriental medicine is adopting 4 diagnosis methods such as seeing, hearing, inquiring, and touching but among those is there tongue feeling system in which a doctor will see a patient's tongue for diagnosis. This method has been used to observe the tongue condition or fur deposited on it to diagnose any disease and its kind from the ancient times. Observation of the tongue is mainly used to understand functioning of the heart and spleen. If the tongue fur is white, the corresponding disease is in its initial stage or light, indicating False Symptom, Cold Symptom, and Humid Symptom. If it is yellow, it indicates heat is accumulated in internal organs, most commonly acute fevers.

Fig. 4 illustrates the automatic detection of RGB images which is most similar to the patient's health judgment condition among those tongue feeling images to make the oriental medicine scientific. Moreover, this thesis has developed an algorithm for more accurate judgment of the quantity of tongue furs and the sublingual veins by using the ultraviolet ray and infrared methods.

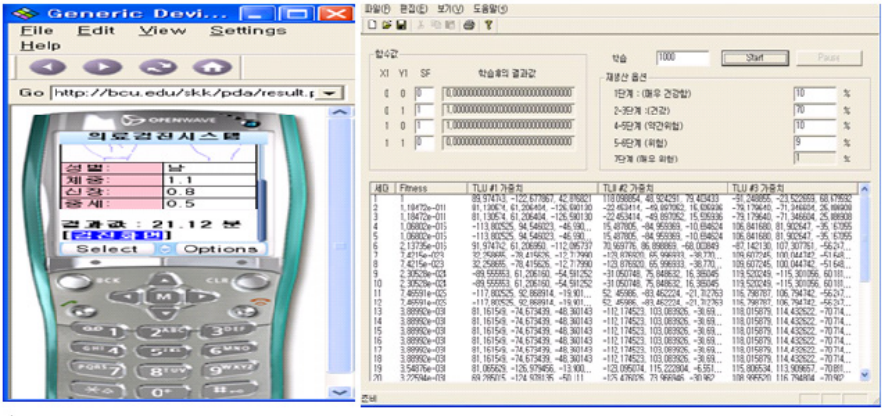


Fig. 4. Pulse wave decision system using fuzzy rules.

Fig. 4 illustrates the Pulse wave decision system using fuzzy rules which depending on the patient's physical condition. In this paper, it is tried to classify the difference in physical characteristics such as thickness of skin and blood vessel, skin impedance, glandular nature of skin in order to come up with an accurate pulse analysis.

4 Simulation

In this paper, in order to solve this kind of problem, it uses compositional inference while using the fuzzy rule. Fuzzy compositional rule of inference is applied to come up with a calibrating constant in order to derive an accurate result (considering the patient's physical condition) in analyzing the blood pressure pulse. In existing method, an oriental doctor infers one pulse wave out of 28 pulse wave and diagnoses the patient. Fuzzy compositional rule of inference is a rule made in order to come up with an inference by using fuzzy production rule which includes fuzzy variables. The form of fuzzy compositional rule of inference is as in the following.

Belief of fuzzy composite function: If fuzzy compositional rule of inference is applied in fuzzy production rule then belief of fuzzy evaluation function can't be used. So in order to calculate the belief of fuzzy function, the belief of fuzzy composite function is used.

$\beta c = \beta comp(\beta(\beta f, \beta r))$

$= \min(\max(\beta(\beta fp, \beta rpq)))$

In here, p=1, 2, ⋯ , m, q = 1, 2, ⋯ , n. m, n are the number of each fuzzy thesis in premise and conclusion. Belief of fuzzy union function in type 1 and 2 of fuzzy production rule which are the minimized version of type 5 and 6 can come up with the same node or conclusion using different inference. In this kind of node, same conclusion has two or more different belief of function. In this type of situation, in order to recalculate the belief of fuzzy function, fuzzy union function is used.

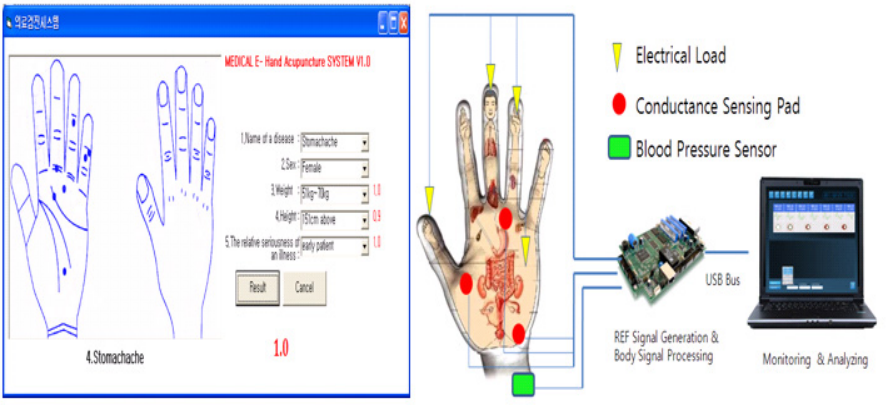


Fig. 5. Intelligence DSP Board Firmware

Fig. 5 shows the sequence of DSP Board Firmware. The sequence can be classified into 4 major categories. They are Main Part for main process, Sensor Signal Input & Processor, Data Indexing Processer to create accurate information data on the basis of the sensed data and Fuzzy Logic Driver to create the result data. After power supply, all the register functions of DSP and related memories and variables are initialized. Then, the electric route creation part outputs the electric pattern by the patient condition and A/D and D/A is executed to process the pattern after delivered from the sensor. In this paper, the blood pressure is converted into a form for facilitating judgement via 1st and 2nd derivative and the electrode to measure the conductivity filters each delivered signal to create the input data required by the Fuzzy logic.

5 Conclusion

This paper calculates the optimal time for Electronic-Acupuncture using fuzzy rules. In order to calculate the exact acupuncture time, it considers physical condition, illness conditions and age conditions. However, this classification scheme depending on the patient's illness conditions vary greatly. To improve these problems, it adjusts the acupuncture time depending on the patient physical conditions. Since the oriental medicine can check human's health and disease condition by observing the pulse beating condition, the herbal treatment considers the pulse very importantly. The oriental doctor has regarded the pulse as an important data in diagnosis from the past. However, the existing pulse stethoscope was not good enough to confirm if the pulse wave detection sensor was positioned exactly on the aorta radial. Furthermore, it was difficult to feel for accurate pulse of a person with a thick forearm and different body type to the person with a thin forearm. The health judgment by using existing pulse feeling has generated ambiguous problems with accurate judgment due to an oriental doctor's subjective data analysis. In this paper, we applied the Fuzzy algorithm to analyze such a problem and draw an inference from objective data in view of pretreatment and applied the electrical characteristics of pain parts which

respond to acupuncture antidune in view of post-treatment to propose the scientific pulse feeling system algorithm and simulation experiment.

Acknowledgments

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