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Design of Arterial Pulse Detection System for Detection of Prakriti of Person"

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Abstract

In Traditional Ayurvedic Medicine (TAM) and Traditional Chinese Medicine (TCM), diagnosing the disease is based on pulse detection. Arterial pulse diagnosis has been used to the great extent for prediction of the disease for thousands of years. On the basis of balance of the tridosha i.e. Vata, Pitta and Kapha of the pulse, the health of entire body constitution can be determined. In this paper, the prakriti i.e. body constitution of the individual is determined through the questionnaires and pulse detection system. According to the prakriti, the pulses of tridosha are obtained through the sensors. From pulse morphologies, the tridosha pulses for constant pressure in normal and abnormal health conditions are studied for the group of subjects and the disease is detected.

Keywords: Ayurveda, Prakriti, Tridosha, Pulse detection, feature extraction, MATLAB

I. INTRODUCTION

Ayurveda Theory

In Traditional Indian Medicine (Ayurveda), pulse signals carry important information that provides healthy status of the body. Pressure applied while observing the pulse signal plays an important role in the analysis of the body conditions based on dynamic nature of the pulse signal. In pulse diagnosis, doctors use fingertips to feel the pulse and diagnose patients. The fingers represent 3 doshas i.e. Vata, Pitta & Kapha of the radial artery. The index finger (Vata prakriti), middle finger (Pitta prakriti) and ring finger (Kapha prakriti) are placed at the root of the thumb to senses the pulse (Figure1).

Figure1. Classical Method

The Ayurvedic medicine is the concept related to health and balance between three principle doshas such as Vata, Pitta and Kapha. The presence of tridosha in every individual is distinct due to the different characteristics of human being and accordingly prakriti is detected. These three doshas differ in combinations and permutations with every person. This is mainly used to determine the physiological constitution (Prakriti) of an individual.

Vata Qualities: The person with vata quality is active, astringent, dry, cold, clear, and it is dispersing. They have a light body frame, thin, light muscles and underweight.

Pitta Qualities: The person with Pitta quality has sharp, liquid, hot, oily and spreading qualities light. It has a sharp nose, teeth, eyes, mind and while talking uses sharp words. They also have very sharp memory.

Kapha Qualities: The person with Kapha quality will have slow, heavy, oily, liquid, cool and static qualities. Kapha people have thick wavy hair, and big, attractive eyes.

According to characteristics based on body size, hair, weight, appetite, voice, skin, personality, habits the prakriti of the person can be determined.

Many models and the methods are implemented for detecting the diseases on the basis of feature extraction of the pulse. The sensor consisting ultrasound transmitter and receiver pair pressure [1], photoelectric, and ultrasonic sensors[2], strain sensor for detection of blood pressure [3] are used for the detection of pulse through wrist. A method for automatic identification of human pulse

parameters[4] like frequency, strength, rhythm, depth and shape of pulse are identified by Bayesian networks. Lisheng Xu et. al.[5] proposed the pulse acquisition device using pulse sensor in which 17 feature parameters of the pulse image are determined. In this study 4 fuzzy neural network (FNN) classifiers are integrated for extracting position, trend, rhythm, and shape of pulse. For the diagnosis of the other diseases multiple kernel learning (MKL) algorithms [6] can be used. Normal and abnormal health conditions are considered with Dicrotic Notch Suppression Ratio (DNSR) and BAD Notch Ratio [7][9].

II. SYSTEM ARCHITECTURE

The system consists of a set of three force sensitive resistors which are operated on the constant pressure range. These three sensors are attached to the three locations of the arterial pulse namely vata, pitta and kapha of the wrist. Here the sensors measures the pressure experienced by the artery. These signals are then digitized by using anolog to digital converter. The amplitude of the pulse is displayed on LCD. Through the communication protocol unit, by using RS232 the pulse patterns with pulse rate are observed in MATLAB.

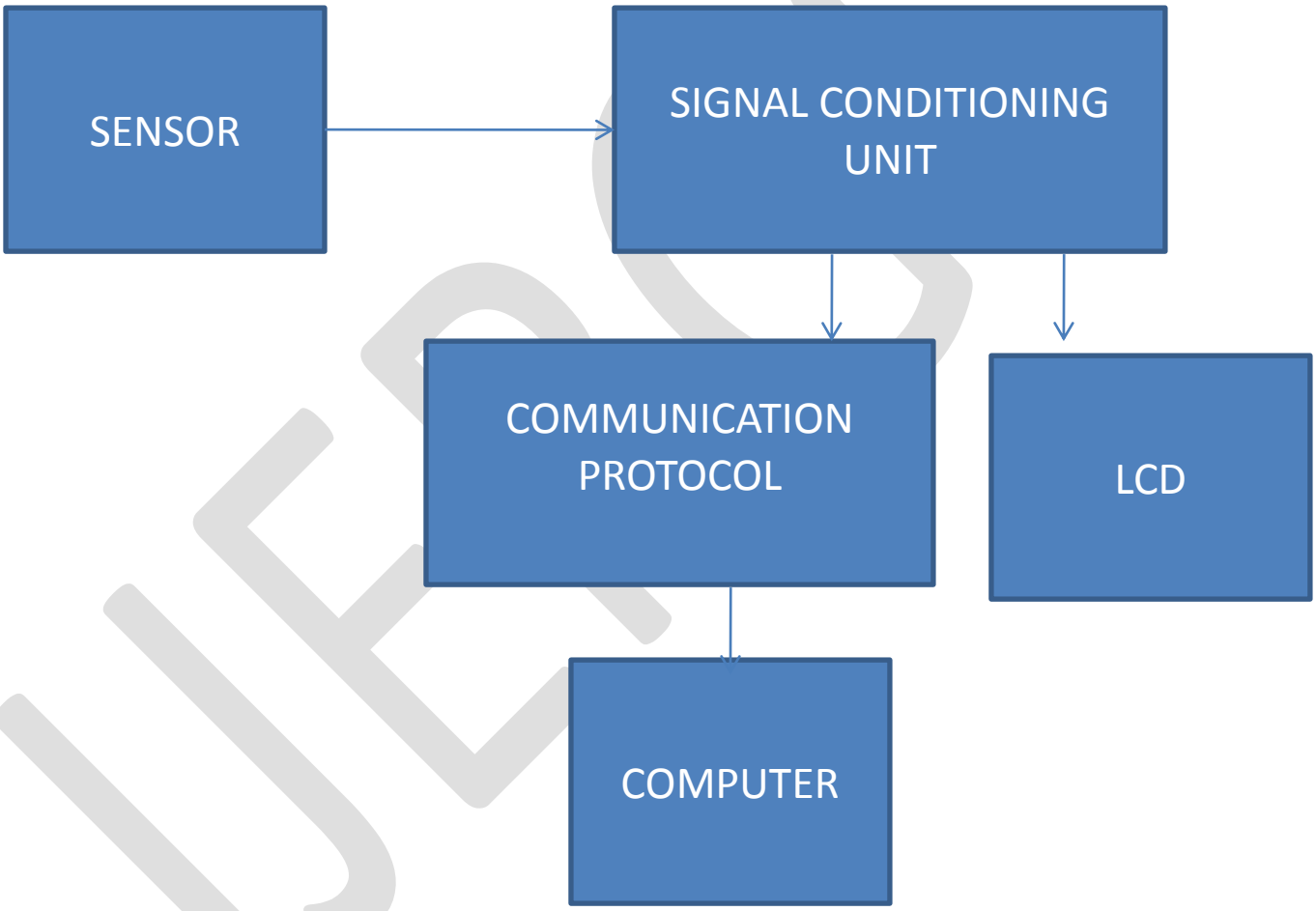

Figure2: Arterial pulse detection system

III. METHODOLOGY

A. Detection of pulse:

The wrist pulse is very weak and it is easily affected by the noise because of movements of the human body, mental overstress and so on [12].By considering these, the Force sensitive resistor is selected for detection of pulse which is sensitive to responses the low frequency signal. Figure3 shows FSR with 10kohm resistor connected to it.

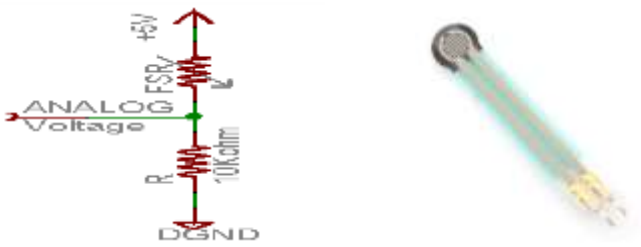

Figure3: FSR with circuit diagram

The sensor is attached to the wrist by using velcro for maintaining constant pressure. It prevents the sensor from moving and getting damage. The sensors are attached to the wrist according to the right position of vata, pitta and kapha. The arrangement of the hardware circuitry is shown in figure4.

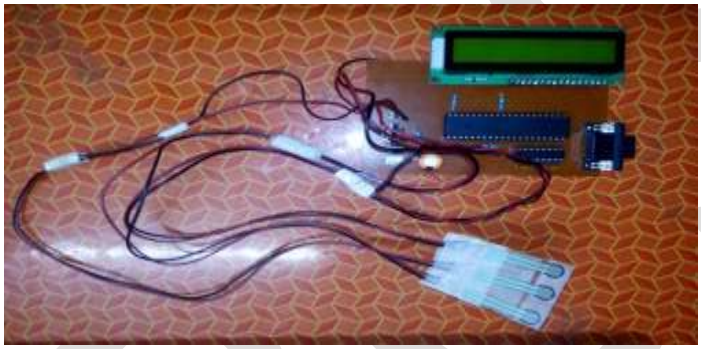

figure4. Hardware design

B. Feature extraction

The pulse is detected in MATLAB and the features are determined. The five parameters of the pulse i.e. shape, rhythm, amplitude, frequency and the pulse rate is determined. The pulse rate for vatta, pitta and kapha can be determined according to the table given in figure5. The pulse rate of the normal person is given as for vata 80-95, pitta 70-80 and kapha=50-60.

	VATA	PITTA	KAPHA
Characteristics	Fast,light,thin, disappears on pressure	Prominent,strong,high amplitude,forceful	Deep,slow,broad, regular
Location	Index	Middle	Ring
Gati	Sarpa(cobra)	Manduka(frog)	Hansa(Swimming Swan)
Rate	80-95	70-80	50-60
Force	Irregular	Regular	Regular

figure5: Characterise of VPK

C. Data collection

The data is collected on the basis of gender, age group, blood group, weight, blood pressure of the person. It also includes the person's medical history.

IV. RESULTS AND ANALYSIS

For the detection of prakriti of a person, the questionnaires are provided to the person. For getting the pulse pattern of specific prakriti, the groups are classified as female and male candidates with the specific age group. As mentioned before, the data has been collected on the basis of different parameters of the individuals. Two classes for the same age groups are considered, one for normal class and another for abnormal class (who is having some diseases like hyper tension, indigestion etc). For the individuals, data is collected for 1 minute to check the pulse rate. According to the prakriti, the pulse patterns are determined. The threshold value is determined for measuring the pulse rate of the person. The amplitude and frequency spectrum is considered for determining irregular pulse. Following result shows pulse pattern for vata, pitta and kapha. The sensor system is attached to the left hand of the

female. Here, Total 350 samples are taken in 60 seconds from which pulse rate can be detected. The pulse pattern of female for the age 25 is detected and the prakriti of same lady is predicated as pitta-vatta prakriti depending on pulse rate and answers of questionnaires given to her. The pulse rate V=96 P=62and K=54 is given in the figure.

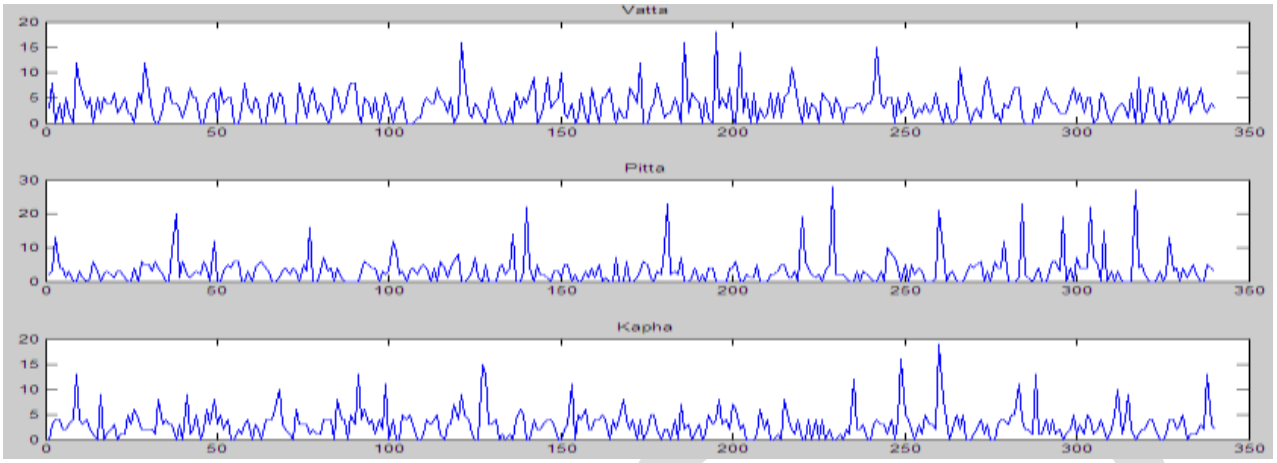

Figure6: Pulse pattern for female

In figure7, pulse pattern for male is taken. The sensor system is attached to the right hand of the male. Total 350 samples are taken in 60 seconds from which pulse rate can be detected. Here, the pulse pattern of male for the age 25 is detected and as per the questionnaires, prakriti of the same male is predicated as pitta-vatta prakriti. The pulse rate V= 102 P=72 and K=57 is given in the figure7.

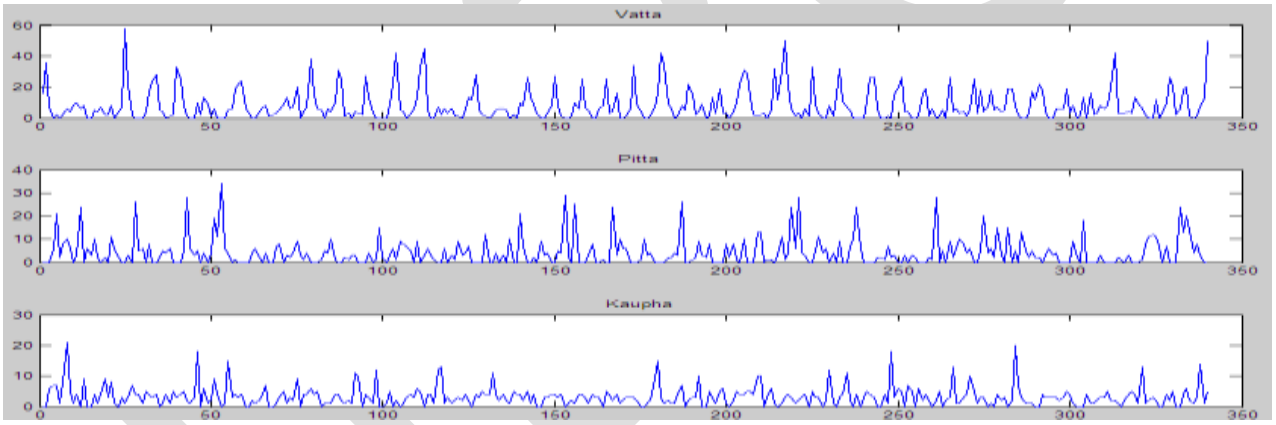

Figure7: Pulse pattern for male

If the person is suffering from any type of disease then the pulse rate of the person is varying with the pulse pattern.

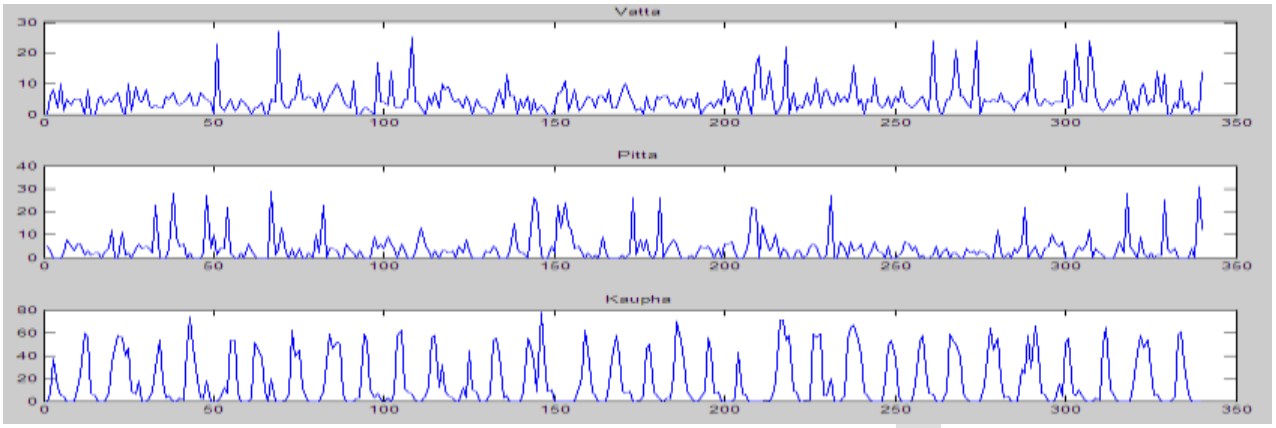

Figure 8: Pulse pattern for male having imbalance in kapha dosha

Figure 8 shows pulse pattern for abnormal functionality in kapha dosha. The pulse rate from figure7 is V= 85 P=77 and K= 79. In this pattern we are getting high amplitude with high peak values and the pulse pattern is broad due to imbalance of kapha dosha. The person was predicted as abnormal person as he was suffering from indigestion on that day.

V.CONCLUSION

In this paper, the prakriti of a person is predicted according to the characteristics of individuals. Due to imbalance of tridosha, the irregularity of the pulse is obtained by which the disease can be detected. From the results; the normal health condition shows the same pattern of the pulse while in the abnormal health condition the pulse patterns are having broadening effects in the pulse. Further research work can be enhanced with prediction capability of fuzzy logic system.

REFERENCE:

[1]Yusuke Yamana, Sosuke Tsukamoto, Koji Mukai,Hiromichi Maki, Hidekuni Ogawa, and Yoshiharu Yonezawa, "Sensor for Monitoring Pulse Rate, Respiration Rhythm, and Body Movement in Bed" *Members, IEEE*,33rd Annual International Conference of the IEEE EMBS, August 30 - September 3, 2011

[2] Peng Wang, Hongzhi Zhang, Wangmeng Zuo, David Zhang, Qiufeng Wu, "A Comparison of Three Types of Pulse Signals: Physical Meaning and Diagnosis Performance" 2013 6th International Conference on Biomedical Engineering and Informatics (BMEI 2013)

[3] Tse-Yi Tu, Paul C.-P. Chao,Yung-Pin Lee "A New Non-Invasive Cuff-Less Blood Pressure Sensor" ©2013 IEEE

[4] Hui-yan WANG1, Pei-yong ZHANG ,"A Model for Automatic Identification of Human Pulse Signals", Received Apr. 30, 2008; revision accepted Aug. 15, 2008

[5] Lisheng Xu, Max Q- H Meng, kuanquan Wang, Wang Lu, Naimin Li, "Pulse Image Recognition Using Fuzzy Neural Network" Proceedings of the 29th Annual International Conference of the IEEE EMBS Cité Internationale, Lyon, France August 23-26, 2010.

[6] Lei Liu, Wangmeng Zuo, David Zhang, Naimin Li, and Hongzhi Zhang, "Combination of Heterogeneous Features for Wrist Pulse Blood Flow Signal Diagnosis via Multiple Kernel Learning",IEEE Transactions On Information Technology In Biomedicine, Vol. 16, No. 4, July 2012

[7] Bhaskar Thakker , Anoop Lal Vyas, D M Tripathi, "Radial Pulse Analysis at Deep Pressure in Abnormal Health Conditions" 2010 3rd International Conference on Biomedical Engineering and Informatics (BMEI 2010)

[8] Sharmila Begum M, Nivethitha S, Sharmila Begum M et al. "Wrist Energy Fuzzy Assist Cancer Engine – WE-FACE" International Journal of Engineering and Technology (IJET), Vol 5 No 2 Apr-May 2013.

[9]Bhaskar Thakker ,Anoop Lal Vyas, Omar Farooq , David Mulvaney and Sekharjit Datta "Wrist Pulse Signal Classification for Health Diagnosis", 2011 4th International Conference on Biomedical Engineering and Informatics (BMEI)

[10] Po-Chun Hsu, Hou-Jun Wang, and Hsien-Tsai Wu "Poincaré Plot Indexes of Pulse Rate Variability Capture Dynamic Adaptations after Reactive Hyperemia in Type 2 Diabetic Patients", ©2012 IEEE

[11] Gaozhi Xu , Jianqing Li , Lei Wang, Jianfeng Wu , Kan Luo , Yinggao Yue , Feng Ran " Hardware Design of A Body Sensor Network System Used for Elder Care" 2013 Ninth International Conference on Natural Computation (ICNC)

[12] So-Youn Park, Ju-Jang Lee "Self-Diagnosis Device Using Wrist Pulse" The 33rd Annual Conference of the IEEE Industrial Electronics Society (IECON) Nov. 5-8, 2007, Taipei, Taiwan