PULSE DIAGNOSIS BASED AUTOMATED DIAGNOSTIC SYSTEM

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Abstract- To diagnose disease, western medicine looks inside of patient's body using many devices such as MRI, city scan etc. but oriental medicine does not explore the root cause. Wrist is one of the best parts of our body to detect a pulse signal and in Ayurveda the wrist pulse has been used as a fundamental element for diagnosis. It has many properties and by perceiving these features, doctors can diagnose disease. Ayurveda is one of the most comprehensive healing systems in the world and has classified the body system according to the theory of Tridosha (vata, pitta, kapha) to overcome ailments. Diagnosis similar to the traditional pulse-based method requires a system of clean input signals, and extensive experiments for obtaining classification features. So we briefly describe our system of generating pulse waveforms and use various feature detecting methods to show that an arterial pulse contains typical physiological properties. By reading the signal from the sensors that are send to transmitters and amplifier and a DC (digitizer) for quantifying analog signal.

I. Introduction

Ayurveda is a traditional medicine and natural healing system in India. Pulse diagnosis instrument – "finding any disease using nadi pulse" is an automated system to find and dictate the disease and its related information of the human body.In ancient literatures, be it Ayurveda, Chinese, Unani, or Greek, pulse based diagnosis has its own unparalleled importance. The   organ   under   d istress is zeroed down by feeling the palpation from the three fingers (index, middle and ring) placed on the radial artery. These pulsations dictate the Physiological status of the entire human body. This is a tedious and inconvenient process and hence it takes years of practice to master this art Fig [1]. As a result this approach is
subjective in nature. The system is being evaluated by Ayurveda practitioners as an automated probable   disease output watcher. Fig [1] shows the Pulse diagnosis system followed by Ayurveda practitioners.

Fig 1 Traditional Method

Pulse has been ubiquitously accepted by modern clinicians as well. They examine the pulse using the method of trisection i.e. apply pressure until the pulse is maximal, and then vary pressure while concentrating on the phases of   the pulse. The arterial pulse variants (for example pulsus alternans, bisferiens pulse, bigeminal pulse) are basically used in detecting cardiac disorders. However, alternative medicine practitioners carefully examine pulses at different depths, each connected with a specific part of the body and each believed to register even the slightest physiological based changes. The main Objectives are: To provide a convenient and non-invasive computer aided device which will eliminate all the human errors performed manually by Indian medicine practitioners in the diagnosis of disease.Noi Kanipaan: Diagnose chronic diseases and other related information of the human body. To provide a device which is easy to use, uniform in diagnosis and by quick in response, which the performance will be based on accurate and quantitative information. Ayurveda meaning the 'science of life' believes that cosmos comprises of five basic elements - air, water, earth, fire and space. Human life is considered as a conglomeration of three humors (Vata, Pitta and Kapha), seven dhatus (tissues) and three mains (waste products). According to ancient literatures, any ailment in the body brings about a change in the constitution of these humors. These changes are then sensed by the fingers of a pulse examiner Fig [1]. In this paper we discuss our device, the three sensors of which simulate the human fingers to a large extent. In section II the instrumentall setup has been explained in detail. Section III describes the experiments conducted. The signal processing aspect has been dealt with in Section IV shows the results. References are drawn in Section V.

Ii. Automated Diagnose System

After the long literature study and discussion with the Ayurveda nadi practitioners we developed the electronic setup and nadi reading and dictate the probable disease from the readings that are read from the patients.
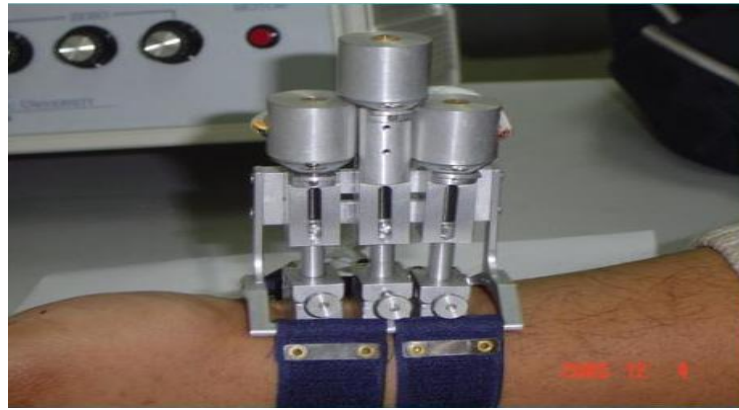
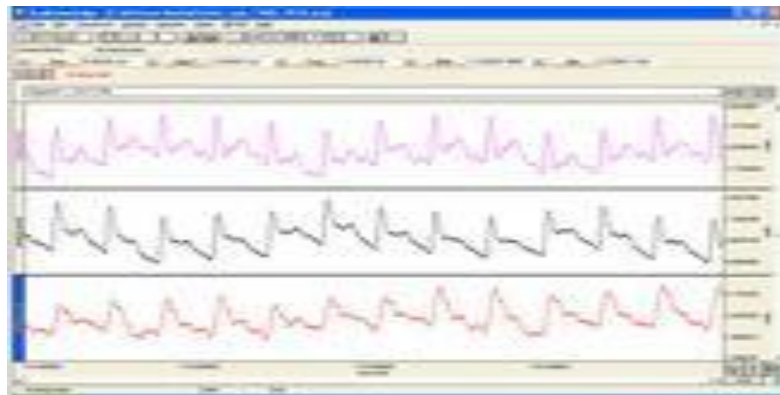Fig 2 shows the setup of reading the (Vata, Pitta and Kapha)

Fig 3 shows that our application plots the pulse graph per time.

1. Signals have been captured for a very small span of the (1-2 minutes) in most of the cases.
2. External pressure applied over the sensors varies while recording especially when a person holds them.
3. Motion artifacts become a reasonable consideration when the recordings are for a longer duration of time.
4. The system should remain steady and errors should not be incurred due to system malfunctioning. No noise should disrupt the nature of the signal.
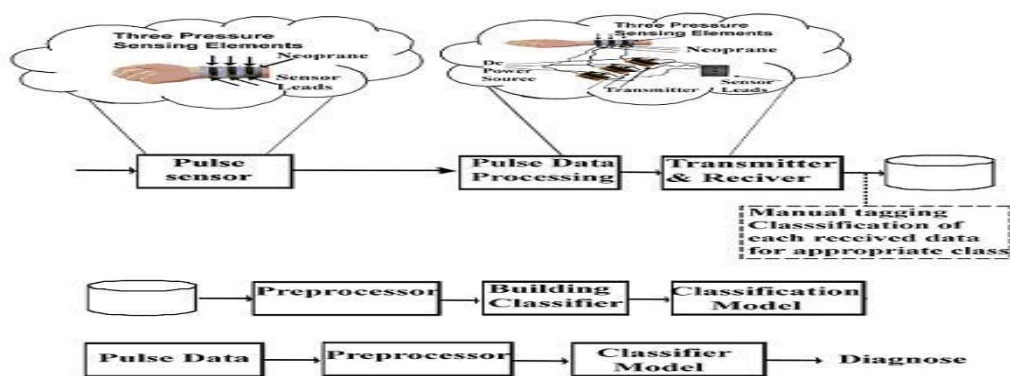

Fig 4 Block Diagram of Pulse diagnosis instrument.

3 different pressure transducers
for *vata, pitta and kapha doshas*
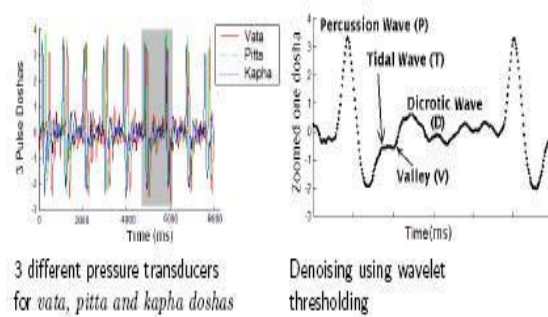
Denoising using wavelet
thresholding

Fig 5 Sample Waveform

Our setup reads the amplified output from the electronic setup and digitizes the signal and the readings are observed by software DVSOFT. In our setup, we have tried to imitate the practitioner's fingers Fig(1). The system has three fingers like projections whose positions can be played with at the tip region to find out the best locations to capture the signal. Springs attached to them help in damping thus imitating the natural damping present due to muscles in the tip region of the practitioner's fingers (Fig 2). In our design, we proposed to use three identical piezo film based sensors to capture the waveform. The raw signal was filtered, amplified, and read by our software application then our DVSOFT software plots the graph according to the signals and dictates the probable disease and the ayurveda practioners can watch the graphs and perform prescribe the medicine for the patients.

Iii.   Implementation

The system need to be test on over 200 students and people . We will chose 10 healthy volunteers to carry out the analysis. Here we are showcasing the variations of an individual when the signals were captured for the entire day.The volunteer was asked to relax for some time and the system was fixed on his wrist. The positions of the three sensors from which the signals were acquired correspond with the humor positions (Vata, Pitta and Kapha) in ayurveda. A pulse waveform is usually composed of important time domain features: percussion wave (P), tidal wave (T), valley (V) and dicrotic wave (D), as shown in Fig(5). These wave parts should be present in a standard pulse waveform with definite amplitude and time duration to indicate proper functioning of the heart and other body organs. These collected pulse waveforms are rich in harmonics and appear superior as compared to previously developed systems .Feature extraction followed by machine learning methods depend not only on clinician's experience but also on the

quality of the pulse waveforms. We e provide some of our normalized pulses from various patients with different disorders, and age groups for the three humors (Vata, Pitta and Kapha) .

We can observe variations in amplitudes, the rising & falling slopes, systolic & diastolic energies, velocities, and so on. We are developing algorithms that will be applied on these waveforms to distinguish major types of nadi defined in Ayurveda Fig (1). The pulse signals read by sensors should be able to provide reproducibility, accuracy and precision. In our system, we would like to check the reproducibility and completeness. In order to check the completeness of the acquired time series t, Nadi Readings was acquired with the same sensor but of a digitizer having an accuracy of 8-bit, 12-bit ,16-bit and 32-bit for same set of patients. The details captured by 8- bit digitizer were less as compared to the 12-bit. As there was no significant new information from 16-bit to 32-bit up gradation, we claim that all the details have been captured. In all the further experiments a digitizer having accuracy of 32- bit is used. In Ayurveda, the readings are sensed by the Ayurvedic practitioners at the wrist with varying pressure. At different applied pressures, different amplitudes, energies etc. are sensed which are then correlated with the body conditions. Further, traditionally in Nadi, the pulse has been classified simply as floating or sinking, according to whether the force exerted to detect the pulse is small or large [6]. We followed similar methodology of applying varying pressure using our system, and were able to confirm the desired behavior .

As the pressure of the sensor over the pulse increases, the amplitude of the pulse signal first increases, reaching a maximum, and then decreases. After a particular threshold value, the pulse dies. All these observations are consistent with the Ayurvedic literature [3]. At each pressure, the pulse gives different insights about the body. However at this point, we consider this finding to be only an appropriate observation which necessitates further investigation with more readings. Finally the signals are captured by the sensors and that read by our software application developed by Ayurvedic literature [1] with applied algorithms to plot the graph according to the three readings per time t.03

Iv. Conclusion And Future Work

We have a lot of proven records in ancient literature that there is not a single disease in the human body which cannot be diagnosed by examining the pulse. However, ancient medical practitioners had to totally rely upon years of clinical experience in order to come to any conclusive diagnosis. Clinicians today have limited examination of the pulse to its rate, rhythm and volume by virtue of which they hardly come to a concrete diagnosis based upon pulse alone. If there could be a system by which

the radial pulse could be critically examined just like the ancient ayurvedic practitioners and others, it could be one of the most useful tools in the field of non-invasive modern medical diagnosis of disease. Thus our system has potential to objectively measure and display the changes occurring in the radial artery in accordance with ayurvedic principles without having to undergo subjective interpretations. Future research will concentrate on the diagnosis of disease like (Cancer types and Sugar level) using our improved version of *an instrument*

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