

Wrist Energy Fuzzy Assist Cancer Engine – WE-FACE

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Abstract - Promotion and propagation of Ancient Indian Medical System has been our aim, as we foresee the usefulness and cost effectiveness of traditional medical system. Even though there has been a tremendous advancement in medical technology, the prediction or diagnosis of diseases are costlier than the treatment. Intelligence can be spotted out in each and every cell in an human body and this intelligence gets communicated throughout the body in the form of vibration which can be examined through Wrist Pulse Examination. Since this wrist pulse signals contains vital information which explicitly points out the pathologic changes in a human body. Here, we propose a new methodology named “Wrist Energy Fuzzy Assist Cancer Engine – WE-FACE” for prediction and diagnosis of diseases using fuzzy logic. We mainly focus on the prediction and diagnosis of cancer through wrist pulse signals with the use of appropriate sensors.

Keywords: Nadi; Tridosha; Fuzzy Logic; Digitizer; Prediction; Diagnosis.

I INTRODUCTION

Diagnosing the disease based on wrist pulse is nothing new but it has been a traditional art that has been followed by our ancestors from ancient times. Nadi otherwise known as wrist pulse makes itself important in our body as it can detect the status of a human soul, body and mind. To a medical practitioner, taking your pulse is more than counting the heart beats. The functioning and health of the entire mind and body, the health of the various organs and signs of potential problems that may crop up can be determined from the pulse. Once we detect the symptoms of imbalance and disease in the body earlier, we can take preventive steps to eradicate the problem before it manifests into a major one. The proposed work aims to present a time series analysis for analyzing wrist pulse signals with the help of a wrist pulse sensor. First, a data normalization procedure, selects a reference signal which matches with the person new signal obtained from a subtle of signals. Second, a fuzzy inference model is created from the reference signal in order to predict the type of cancer.

In this paper, pulse vibratory frequency at various levels on the radial artery can be used to predict cancer. WE-FACE will collect the wrist pulse signals from the person through a wrist pulse signal receiver and the collected wave is to be monitored and cropped to obtain a single-period waveform, which is then employed in fuzzy inference system. Along with the symptoms, it helps us to classify the type of cancer.

Some of the previous works in this area were: diastolic and systolic indices of pulse [1], fuzzy theory for kidney analysis [2], bio-statistical analysis of Ayurveda [3], power spectrum peak [4], augmentation index [5], chinese pulse diagnosis [6], and pulse waveform characteristics [7].

The remainder of the paper is sectioned as follows: Section 2 enlightens the basic concept of Ayurveda and Nadi, Section 3 discusses about the proposed methodology, Section 4 details about the working methodology and Section 4 concludes this paper.

II OVERVIEW

2.1 Ayurveda Theory

In Ayurveda the entire function of the body is based on

- Vata (Wind)
- Pitta (Choler)
- Kapha (Phlegm)

called Tridosh. The proper functioning of the body has been determined by the equilibrium of Tridosh. Any imbalance in these doshes will cause contraction or expansion in the blood vessels carrying blood to the heart

from the normal state. This sort of modulation in the flow of blood is known as Pulse/Nadi. Nadi makes us to know about the physiological wellness of a person. Out of many positions, the root of the thumb is the proximity where we can sense the pulses accurately. 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 (Fig1).

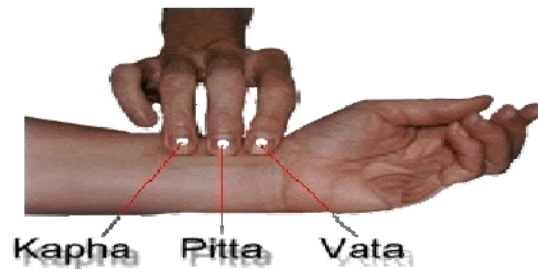


Figure1. Traditional Method

Generally, pulse sensing is be based on

- i. The sensation of pulse at the two wrists can be taken at layers of superficial, intermediate, and deep pressure. The result of these types of pulse reading can be as in Table 1.

Table1. Nadi Characteristics

<i>Vataja Nadi</i>	<i>Pittaja Nadi</i>	<i>Kaphaja Nadi</i>	<i>Vata Kaphaj Nadi</i>	<i>Pitta-Kaphaj Nadi</i>	<i>Vata Pittaj Nadi</i>	<i>Sannipataja Nadi</i>
Snake and leech	Crow, lark and frog	Swan, pigeon and cock.	Snack and swan	Monkey and swan	Snake and frog	Wood pecker

Table2. General characteristics of vata, pitta and kapha

	VATA(WIND) PULSE	PITTA(CH LER) PULSE	KAPHA(PHLEGM) PULSE
Characteristics	Fast, feeble, cold, light, thin, disappears on pressure	Prominent, strong, high amplitude, hot, forceful, lifts up the palpating fingers	Deep, slow, broad wavy, thick, cool, warm, regular
Location	The index finger	The middle finger	The ring finger
Gati	Moves like a cobra	Moves like a frog	Oves like a swimming swan

- i. Pulse at each position indicates the status of our organs like heart, liver and kidney (left wrist) and lung, spleen and kidney (right wrist).
- ii. The sensation of pulse at superficial, intermediary and deep pressure positions at the wrist.

In modern medicine wrist pulse will be counted to estimate the heartbeat. And for blood pressure they will consider the systolic and diastolic pressure.

The pulse category common at the primary versus secondary and tertiary stages of an illness were:

- Original pulses (Primary): Floating, Slippery, Deep, etc.
- Changing pulses (Secondary): Rapid, Slow, Tense, etc.
- Very abnormal pulses (Tertiary): Tremulous, Knotted, Running, etc.

III PROPOSED METHODOLOGY

3.1 Objective

The main objective is to establish the familiarization with the state of the art in Human Computer Interface (HCI) and time frequency to predict the cancer and its type without much intervention of a specialist that too in an accurate and efficient manner.

- a) To overcome inaccurate physician sensation result, we provide a modern device which gives accurate results for pulse diagnosis by using pressure sensors.
- b) To eliminate the human error in diagnosis.
- c) To diagnosis the diseases at the chronic stage along with its related information.
- d) To make the diagnosis result in an easier, faster and accurate way.
- e) To provide a device with accurate diagnosis for all types of cancer.

3.2 System Architecture

In Ayurveda, pulse diagnosis is the first and the best method to diagnosis whether a person is diseased or not. For making the pulse diagnosis as an automated one, consider following steps:

- Data Acquisition
- Classifying parameters
- Relating pulse obtained with the defined pulse in Ayurveda.
- Classification

The hardware components consist of a sensor or transducer, interface and storage device. Factors like accuracy, reproducibility, completeness and security needs to be incorporated. The pulse signal obtained through this hardware should be optimized to pursue with the diagnosis. Nadi measure the pressure experienced by the artery. Here, pressure sensor is coupled with the transmitter, which can amplify the electric signal (pressure \propto electric signal). This signal will be digitized using the digitizer (Analog to Digital conversion) which is connected to the personal computer. Using the data acquisition software, the required data can be collected and stored for future analysis and classification. (Fig 2 & Fig3).

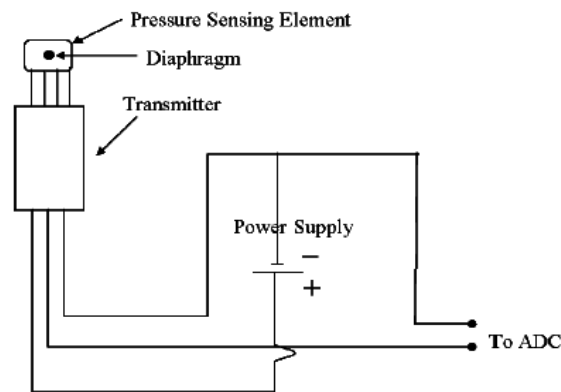


Figure2. The Electrical line diagram of the system developed for measuring the nadi pulses.

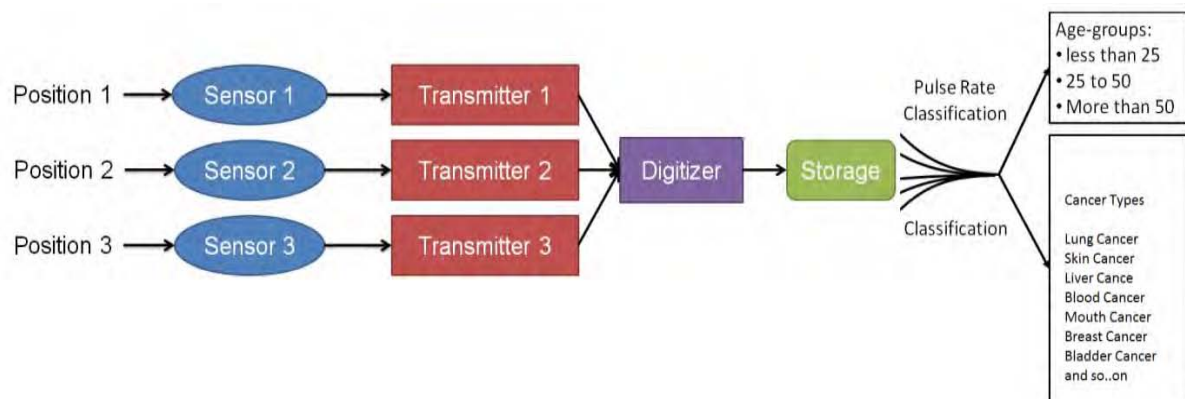


Figure3. Architecture of a Computer Aided System.

i. Pulse Sensor

Acquire accurate pulse from the human wrist.

ii. Data Collection and processing

Pulses named Tridosha (vata, pitha, kapha) will be collected from each and will be stored into the patients database.

iii. Pattern Recognition and Feature Extraction

- Pulse patterns will be searched in the database based on the amplitude, slope and frequency of the pulse.
- The peaks in the pulse series will be identified and then the pulse series will be partitions into pulse cycles.
- Variations among the peak cycles were captured to indicate average value which helps for classification.

iv. Computer-aided-diagnostic system

The feature vector along with the patient's history will be passed on as an input to the advanced classifier which will classify based on the age, gender and disorder information.

3.3 System Specification

- i. With the help of appropriate sensor the system takes on the pulse values for diagnosing disease.
- ii. Embedded Pulse Waveform Measurement is the pressure sensor which captures high-fidelity pulse waveform data it includes
 - a) High resolution and precise array sensing elements offer industry leading performance and sensitivity.
 - b) Pressure transmitters with 4.....20 mA & Voltage output
 - c) 2 D array of pressure sensors in a thin and continuous sheet
 - d) Video recording, editing, and playback are synchronized with tactile data
 - e) USB interface via PPS proprietary T4000 electronics
 - f) Parallel T4000 electronics multiply speed and capacity
- iii. Tactile pressure sensors can be available from the company Eltek Systems, Mumbai
- iv. Evaluation sensor design comprises of twelve 2.5×2.5 mm sensor ordered in a 3x4 array pattern.
- v. Pressure sensor elements acquire the pulse waveform of a person.
- vi. Pulse waveform can be recorded using video recorder and can be converted as digital output using the DigiTacts.
- vii. DigiTacts sensors consist of many pressure sensors to have an accurate measurement of the pulse waveform and produce a digitized signal for some applications.
- viii. The output can either be saved or played or converted to ASCII format.
- ix. Using USB interface the waveforms can be taken and stored in the database after, the data can be classified using classification algorithms to diagnose the cancer types.

IV RESULTS AND DISCUSSIONS

4.1 Working methodology

The working methodology can be explained through (Fig4):

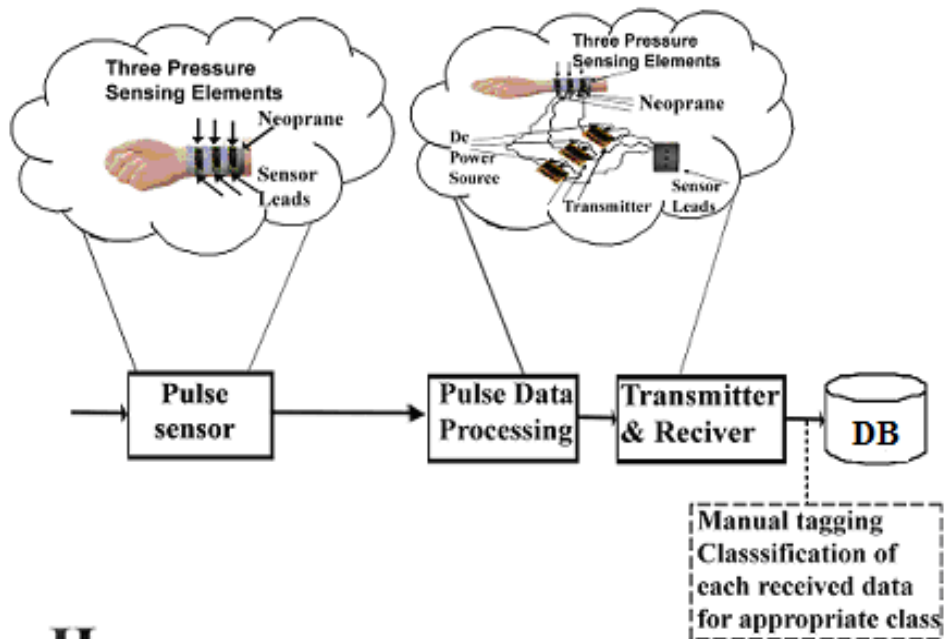
Phase I

- a. Sense the Nadi using three fingers through three pressure sensors.
- b. Acquire the data from the pressure sensors.
- c. Transmit the data, eliminate noise and generate pulse data.
- d. Convert it into a digital signal through digitizers
- e. Store the data in the server.

2. Phase II

- a. Patient information database
- b. Apply machine learning algorithms on the acquired data
- c. Data classification – types of nadi, analysis and diagnosis

Phase I



Phase II

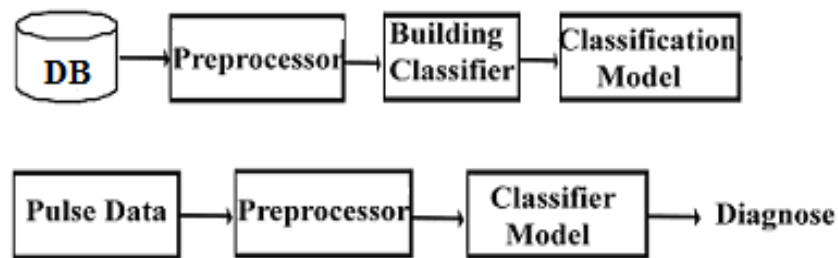


Figure4. Proposed System for diagnose the disease of cancer through nadi pulse.

Nadi pulses are based on the contraction or expansion of the blood vessels carrying blood to the heart (Fig 5). In general, the waves in standard pulse rate are percussion, tidal, dicrotic and valley. The final pulse waveform is shown in Fig 6.

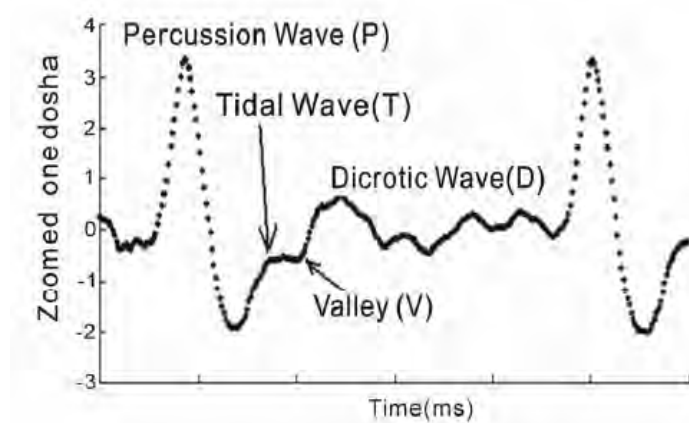


Figure5. Standard wave signal from the radial artery.

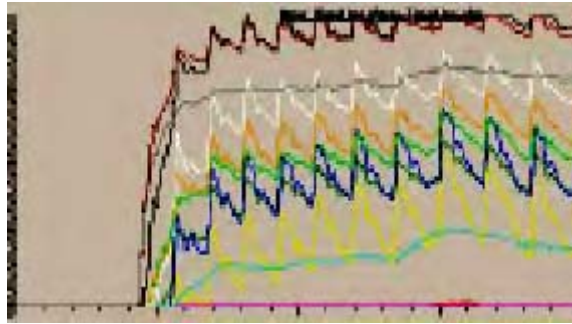


Figure6. Pulse Waveform in Digital Output using Transmitter and Digitizer

VI CONCLUSION

The art of ancient medicine along with the recent advancement in software resulted in developing WE – FACE a diagnosing tool. It helps us to predict the abnormal functionalities in a human body in order to predict the disease. It also produces an accurate prediction as it is based on the Nadi (vital of life), along with it gives out related information for predicting the state of the human body and disease. Diagnosis chronic diseases like cancer, hepatitis in an easier, faster and accurate manner. The future direction of this paper is to diagnosis Acute Immune Deficiency Syndrome (AIDS) in premonitory stage.

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