CHOLESTEROL DETECTION TECHNOLOGY

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INTRODUCTION: Cholesterol parameter in blood, acts as prime factor in detecting early sign of coronary heart disease in an individual. In this paper we are introducing same with most handy tool of present time-ANDRIOD CELLPHONES. A similar technology does exist for smart phone. But due to the better open source operating system present in android phones and fact that all android phones can be smart phone but not all smart phone can be android we are developing an highly user free app.

A reagent strip will contain blood sample for cholesterol analysis. The strip will contain various filter through which serum is separated from blood and directed towards analyses specific reaction pad. At that point , HDL is separated from LDL and VLDL fractions , and precipitated by reaction with phosphotungstic acid.An enzymatic reaction then converts total cholesterol and HDL cholesterol to cholest-4en-3-one and hydrogen peroxide.the peroxide then reacts with disubstituted aniline to form quinoeimine dyes.[4,5,6] The system can quantify cholesterol levels from colorimetric changes due to cholesterol reacting enzymatically on a dry reagent test strip.These reagents contain indicator dyes, enzymes, polymers, antibodies, and various other chemicals dried onto carriers. Carriers used will be polymers with various sample uptake and transporting properties. Polyacrylate polymer will also be used as carrier, since available Polyacryate is in powered form, buffer will be added to acquire desired liquid polymer for developing strip. An assembly attached near the face of camera will capture the picture of strip. We have opted to use flash of smartphone because it provides uniform lightning for accurately measuring colorimetric analysis on test strip.

OBJECTIVE: The most important objective for our project to make the cholesterol measurement very user friendly. Thus we have put our sincere effort to develop an application that can be run on android platform.In doing so we faced technical difficulties in acquiring serum from blood without centrifugation, different flash intensities of different phones and so on.We plan to work on all this problems to develop a smooth running process to measure cholesterol efficiently and quickly.

SCOPE: This is a smart and fast world, the world of pace. Thus everyone wants a instant result. Hence, we have tried to develop an application to aid us measure cholesterol using smart phones or android phones. The results are very fast and one can view his/her result in few minutes without going to hospital, the results are one prick away!! We are also trying to enhance this project further to categorize cholesterol i.e. the ldp (low density) and hd(high density). We may even proceed to apply many other such researches for diagnostic of b-12, bilirubin, proteins etc.

METHODOLOGY:

1.DEVELOPMENT OF TEST STRIP:- In this project we have started from experimenting with rayon filter paper as the teststrip. But due to porous structure and capillary action of paper fibre it was rejected. Also the color effect on filter paper was not very satisfying. Thus we are experimenting the same using agar agar gel and polyacrylate.

2.MAPPING OF STANDARD CURVE:- We are presently working on getting a calibration curve using the various serum samples that we have obtained from resources .This experiment is done to act as a reference in our programming as well as future lookout for further experimentation

3.CORELATION BETWEEN CHOLESTEROL LEVEL AND COLORIMETRIC TEST:-
In order to quantify the colorimetric reaction and to obtain the blood cholesterol concentration value, we have developed a calibration curve linking cholesterol to the HSL (Hue Saturation Lightness) cylindrical coordinate representation of the RGB (Red Green Blue) color values at the center of the cholesterol test strip. The advantage of using HSL coordinates over RGB for smartphone-based colorimetric imaging has been demonstrated[2,3]. Hue (H)

has a piecewise definition and in the region of interest of the cholesterol colorimetric reaction can be written as a function of the red (R), green (G) and blue (B) color values:
H = (B-R)/C + 2 if M= G or H = (R-G)/C + 4

if M= B (1)

In the equation above C=M-m where M= max(R, G, B) and m=min(R, G, B).

In addition the lightness (L) and saturation (S) are described by the following equations:

L = ½ (M + m) (2)

S = (M-m) / (1-|2L-1|) (3)

At each cholesterol concentration in the relevant physiological range (140mg/dl to 400mg/dl) the test strip was first analyzed using the Colorimeter and then imaged using the smartphone technology. hue values can be used to indicate if a test is successful or if it fails due to image acquisition or test strip issues. The relationship between concentration and saturation can be described by a second order polynomial.

[Chol] = 0.08S2-4.56S+196.84 (4)

4 SMARTPHONE IMAGE ACQUISITION AND PROCESSING:-Here we have developed a smartphone application for the android iOS platform that in combination with the smartCARD accessory allows for image acquisition and colorimetric analysis of the cholesterol enzymatic reaction.[1] When the user presses “analyze” on the app, an image of the colorimetric color changes is acquired through the Phone camera.. First, a 100px by 100px calibration area is selected at the bottom right corner of the image.The average RGB value is computed and converted to HSL. This average HSL value is then compared to a reference value and a background shift is computed. The whole image is then is subjected to this background shift. After the background shift, a 100px by 100px area in the middle of the detection circle is then selected and the same computation as before is done to obtain the average HSL value of the test area. The algorithm then verifies if the test is valid by comparing the average hue value to the typical value of the cholesterol test, which as we will show in the Results section is constant across physiological cholesterol values (H~ 180) both for serum samples and blood samples during test trials. In order to decrease fluctuations due to lighting conditions, the strip is imaged 3 times and the average hue value over those 3 images is taken. If the hue value falls within the range of expected hue values, than the cholesterol level is calculated using the calibration curve obtained in the previous section.

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