Optical Non-invasive Technique for Cholesterol Detection in Blood

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ABSTRACT

To design and develop a non-invasive cholesterol sensor based on the principle of light absorption. The current existing invasive methods can be replaced with non-invasive techniques. The interaction of light with matter has been utilized to design a smart device that measures blood cholesterol without collecting blood samples. It portraits developing an optical sensor focuses on the use of near infrared (NIR)-LED.

Keywords: Non-invasive; Blood cholesterol; NIR –LED; Beer- Lambert's law

INTRODCUTION

Redundant cholesterol in human blood can cause severe health problems. This could be anticipated by monitoring cholesterol levels frequently. The continuous monitoring is an important aspect for health care. The existing methods are invasive which are painful and not advisable for frequent monitoring. Hence, a simple device is needed to measure/monitor cholesterol levels without collecting blood samples. The aim is to design and develop a non-invasive sensor at fingertip by using light absorption principles in the NIR wavelength range (700~1400 nm). This method will be user friendly, easy monitoring, painless, disinfectant, and low-cost etc,.

LITERATURE & OBJECTIVE

Non-invasive technique would mitigate earlier issues and would provide painless and accurate solution. The cholesterol measurements in blood using optical method are observed to be more reliable and precise. The development of a non-invasive measurement device should be much more convenient for the user's perspective. The main objective of this study is design & develop a non-invasive sensor at fingertip by using light absorption principle in NIR wavelength range.

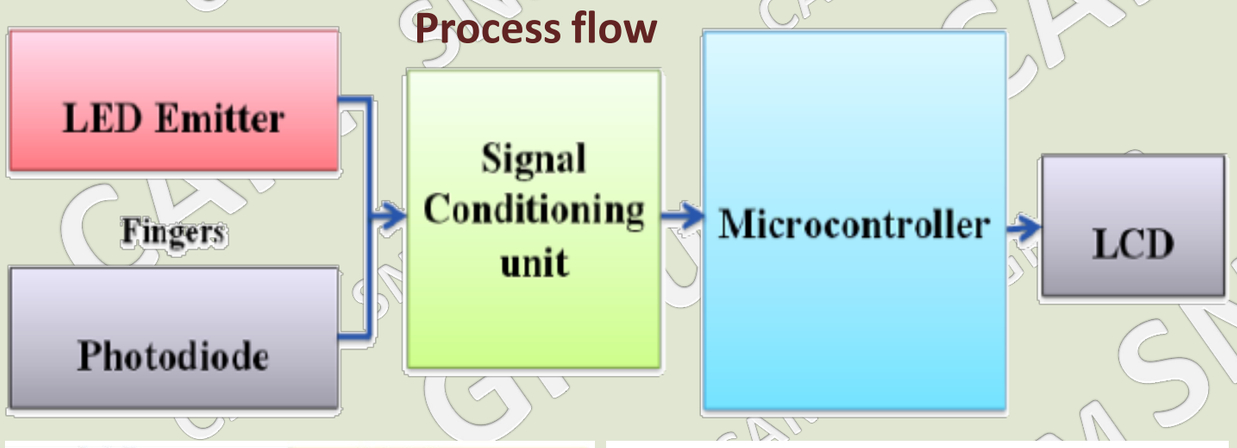

Fig 1.: Schematic representation of comparison of invasive & non-invasive approaches

METHODOLOGY

When radiation interacts with biological tissue, the light is weekend by absorption and the concentration evaluated by using the equation (1) (by Beer-Lambert's law).

$$I = I_0 10^{-\varepsilon lc} \text{ and Absorption } A = -log\frac{I}{I_0} = \varepsilon lC \text{ --------(1)}$$

I& I_0 are intensities, ε- absorption coefficient l-length of the light path & C-concentration

The change in voltage w.r.t reflected light intensity is estimated and the correlation is $\frac{V_{in}-V_{out}}{V_{in}} = 10^{-\varepsilon lc}$ ----------(2)

- **Measurement**
  - Start & Initialize
  - Keep finger between IR-LEDs
  - Read the voltage & Signal send to ADC microcontroller
- **Calculation**
  - Convert voltage value in ADC
  - Calculate the concentration in blood
- **Data processing & Result**
  - Read the total value on LCD display
  - Process data for monitoring

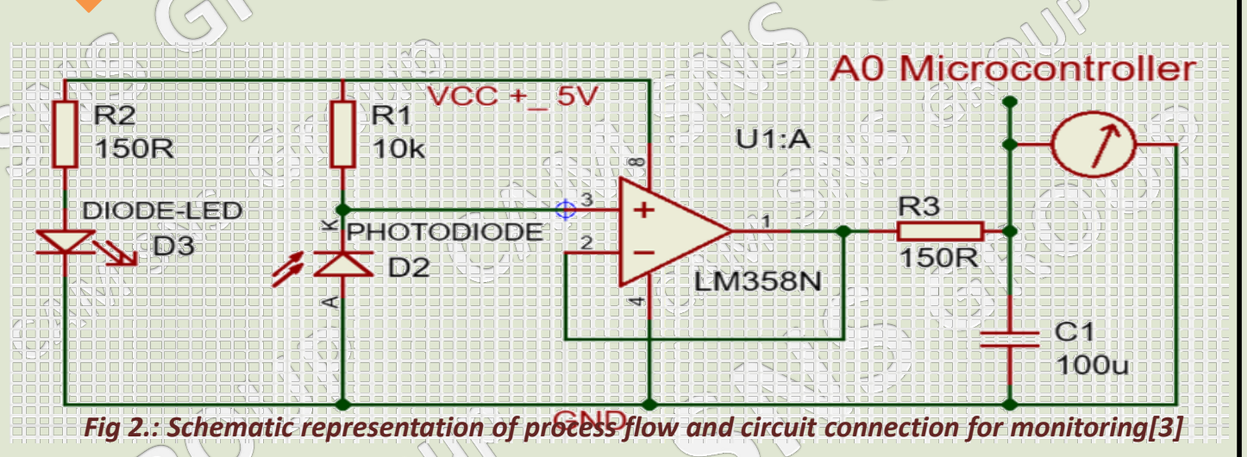

Fig 2.: Schematic representation of process flow and circuit connection for monitoring[3]

CONCLUSIONS & FUTURE SCOPE

- It is a unique method based on the transmittance property of IR light to monitor the blood cholesterol.
- It is an alternative innovative tool for frequent monitor and easy to use.
- The optical detection is useful approach to have precise measurements and NIR had good performance in vitro testing.
- The device will be integrated with advanced IoMT (internet of medical things) framework. Unification of measurements on a single device is possible with optical technique which would have a significant impact on smart healthcare domain.

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