30 Dec.'21

Non Invasive NIR Glucometer

→ Unit : mg/dl (Blood sugar level = Glycaemia) or mmol/L

→ Glucose ⇒ Molecular weight = 180

→ Normal : → 70 to 130 mg/dl (fasting)
  ↳ 125 (non-fasting)
  ↳ 140 (just after meals)

| Diabetics → 90-130 (fasting)
  ↳ <180 (non-fasting)

→ For inaccuracy treatment, device can initially (→ multiple times a day) be calibrated before being used non-invasively; by feeding invasive & non-invasive data.

→ Intensity received ⇒ Won't it depend on other chemicals presence

→ NIR λ ⇒ (750-2500) nm
  ↳ can penetrate through skin at λ range : (50-1550) nm

→ NIR transmitter LED → 950nm

~~→ Photo diod~~

Pencil, Hammer, ~~Breadboard~~, ~~[illegible]~~ Soldering Iron (& Stand), Screwdriver (6 piece), Wire cutter, Desolder, Tweezers, ~~Jumper wire~~, ~~Fevicol~~, ~~LCD Screen~~

NJ - NIR - 6 - Details

- Attenuation due to → other blood components [NIR spectroscopy]
  - → skin color
  - → skin width/depth [NIR: 750–2500 nm; Skin Penetration 650–1350 nm]
  - → injury
  - → external visible light [Black Tape]

- How can you improvise the project?

- Other factors →
  - → No. of people tested for dataset creation
  - → Degree of attenuation due to unwanted factors
  - → Polynomial Regression Approach/Method
  - → Quality of equipments used, especially sensor module
  - → Region of Testing [Earlobe]

- Alternate Approaches to NI Glucose Measurements:-

I. Optical :- ① NIR spec. ② MIR spec. ③ Optical Polarimetry (OP) ④ Raman spec. ⑤ Fluorescence Method ⑥ OCT (Optical coherence Tomography)

II. Microwave :-

III. Electrochemical :- ① Reverse Iontophoresis (RI) ② Biofluid Based (Saliva/Tears/Sweat/ISF)

ISF = Interstitial Fluid

→ NIR LED = Digital Output

→ Photodiode = Analog Input

Q. Why using (i) Arduino Nano (ii) TSAL 5300 (LED) + 950nm (iii) BPW 34 (Photodiode) + 900nm ?

Helps avoid the limitations of laser {Costly, Tissue affected, Danger}

• Why NIR ?
  ↳ Non-invasive ∴ Pain-free
  ↳ High skin Penetration

• Why earlobe ?
  ↳ Bonelss ∴ High sensitivity & accuracy

→ Less Glucose ⇒ More Scattering ⇒ More Path Length ⇒ Less Absorption by Tissues ⇒ High Intensity of Ref. Light

→ More Glucose ⇒ Less Scattering ⇒ Less Path Length ⇒ More Absorption by Tissues ⇒ Less Intensity of Reflected Light

Intensity of Received Light (attenuated) $\propto \frac{1}{\text{Glucose conc}^n}$

Attenuation $\propto \frac{1}{\text{Intensity}}$