Funky

An Unobtrusive Fingertip Health Tracker

JH3

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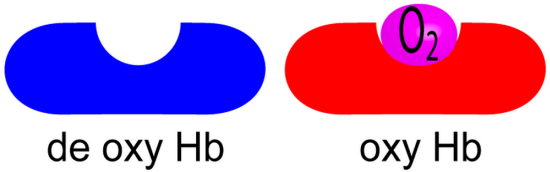
Background

- Blood carries oxygen throughout body using hemoglobin
  - Deoxygenated: Higher red light absorbance
  - Oxygenated: Lower red light absorbance
- Oxygen saturation:indicator of oxygen transport in the body



$$\text{Oxygen saturation} = \frac{C(HbO_2)}{C(HbO_2) + C(Hb)} \times 100\ (\%)$$

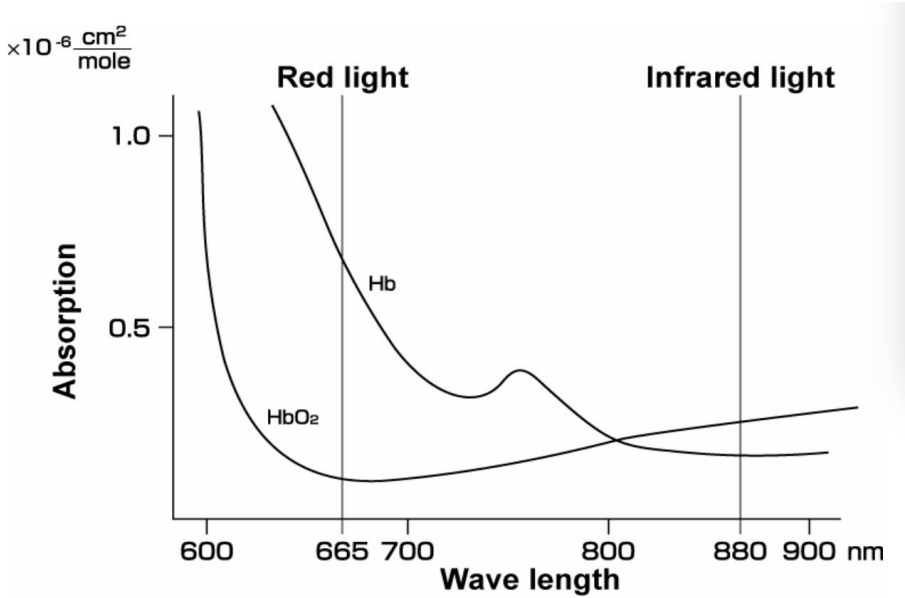
C (Hb) = Concentration of deoxygenated hemoglobin

$C(HbO_2)$ = Concentration of oxygenated hemoglobin

Background

- Different absorbance for deoxy Hb and oxy Hb.

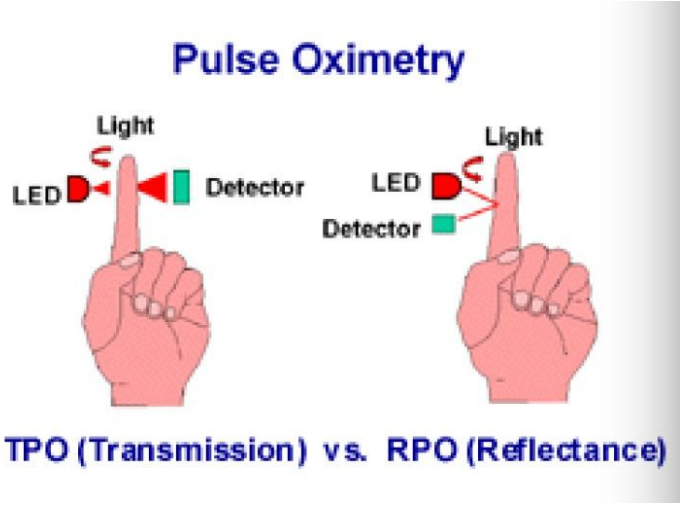
- Each change in amount of red light absorbance is counted as a pulse

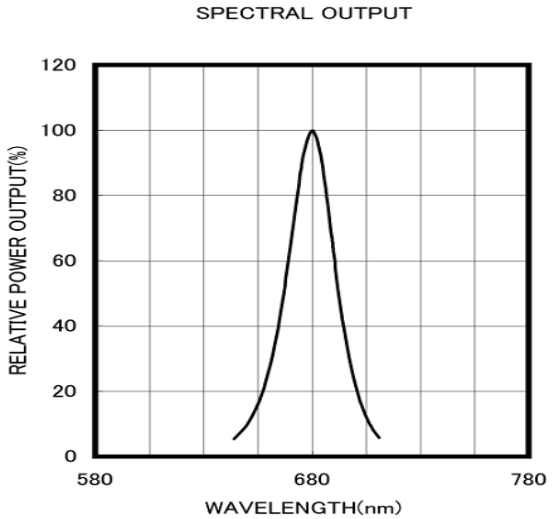


Design Options

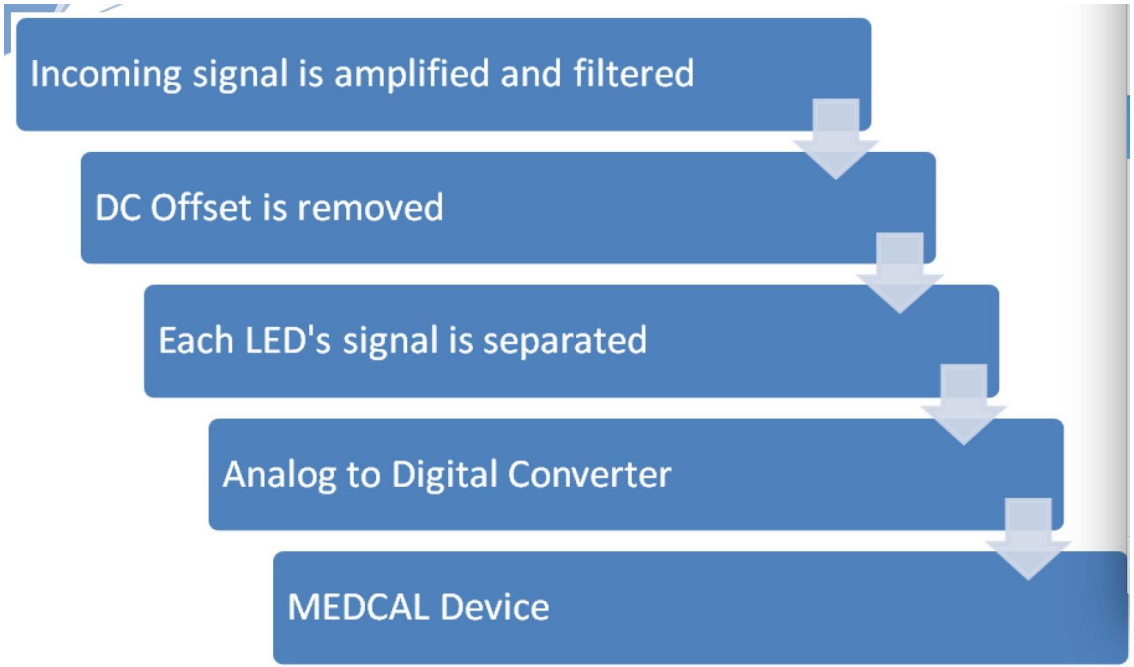
- Method 1 : Transmission
- Method 2 : Reflectance

- Red and Infrared light LED are clocked to blink at different time interval
- Output signal are analyzed based on the property of photodiode

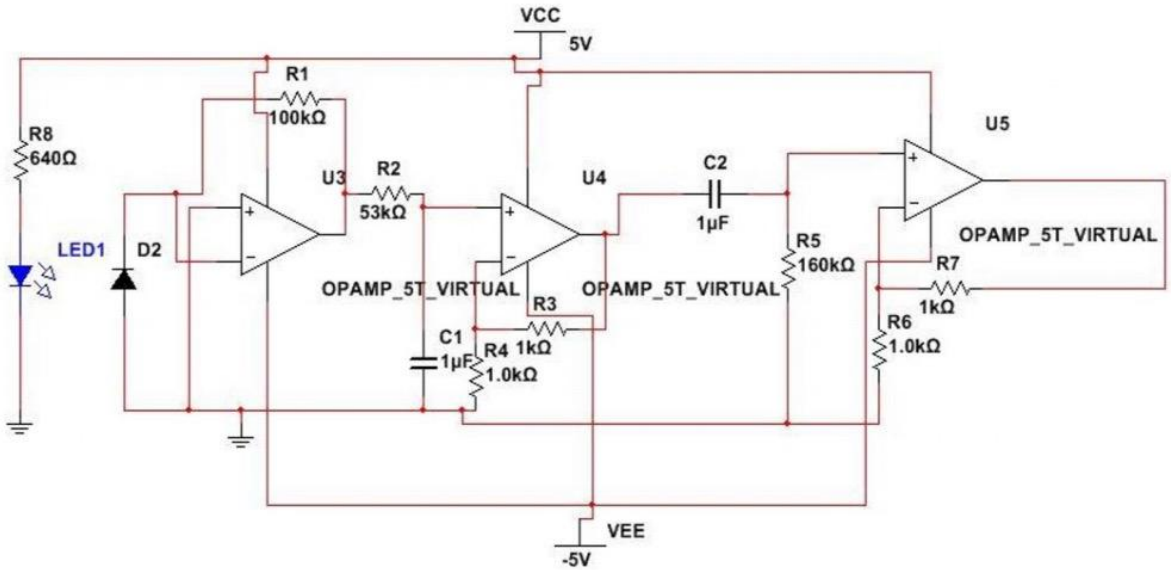




Design Pipeline

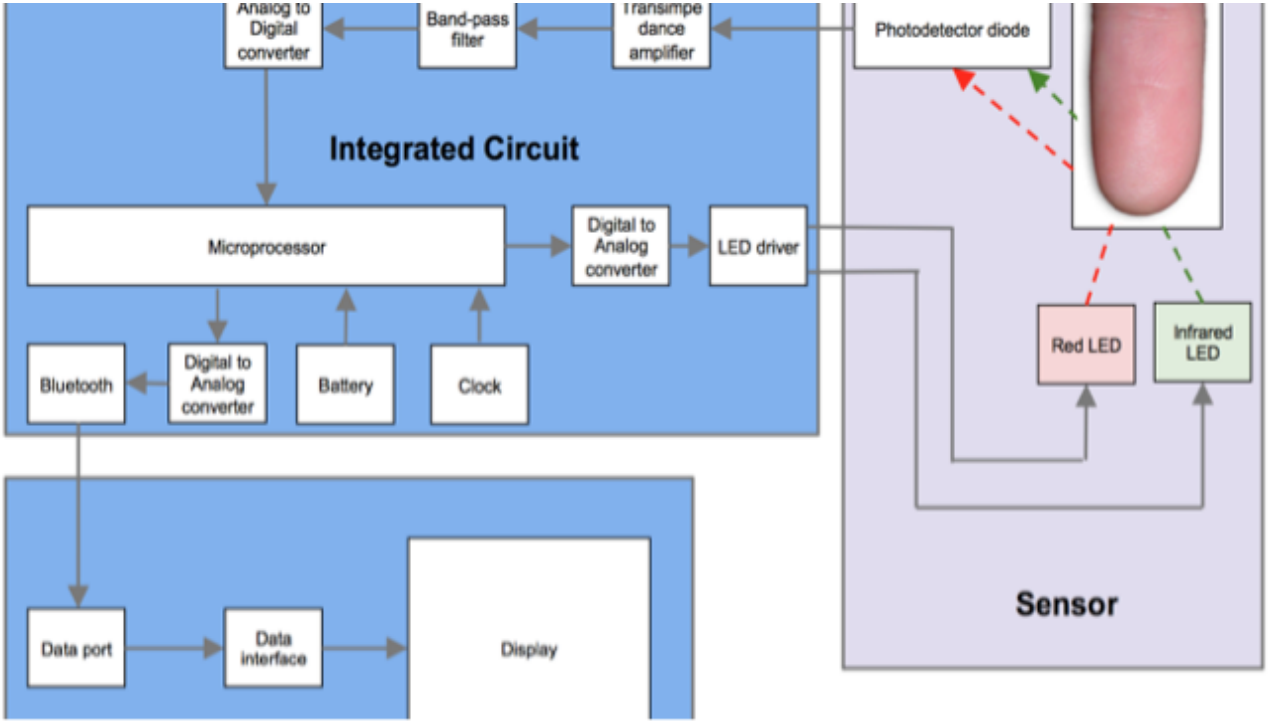


Improvable Analog Circuit Design



Transimpedance Amplifier: Convert Current Signal to Voltage Signal
Low Pass Amplifier: Cut off Frequency 10 Hz;
High Pass Amplifier: Cut off Frequency 0.5 Hz:

Block Diagram



ADC

- Ti LM331

–Sample Frequency full scale from 1KHz to 100KHz

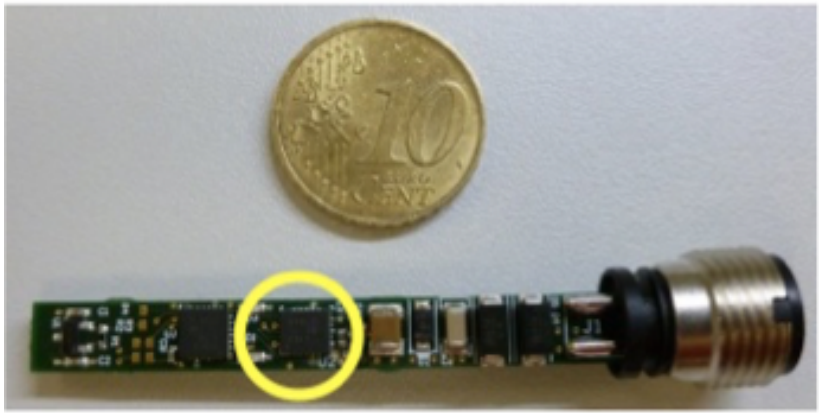
–Low Power consumption

  –15mW at 5V max

  –Adjust to 4.5mW for 10K Hz frequency.

MCU

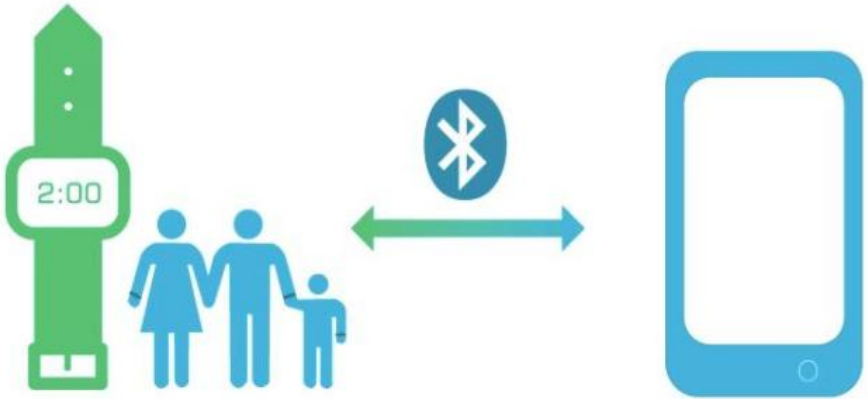
- Ti MSP4305
- Low Power Consumption
  - –9.6mW at 3.6V (160uA/MHz)
- Dimension
  - –231.0 x 191.4 mm
- Three Channels DMA
- Two SPI & I2C bus



Estimate Cost

Item	Quantity	Price	Amount
Micro Controller	2	8.50	17.00
UR Visible Emmiter	2~3	3.15	9.45
ADC	2	3.50	7.00
Package & Design	~	50.00	50.00
Miscellaneous		50.00	50.00
Total			133.45

Software Application



fingertip health tracker device

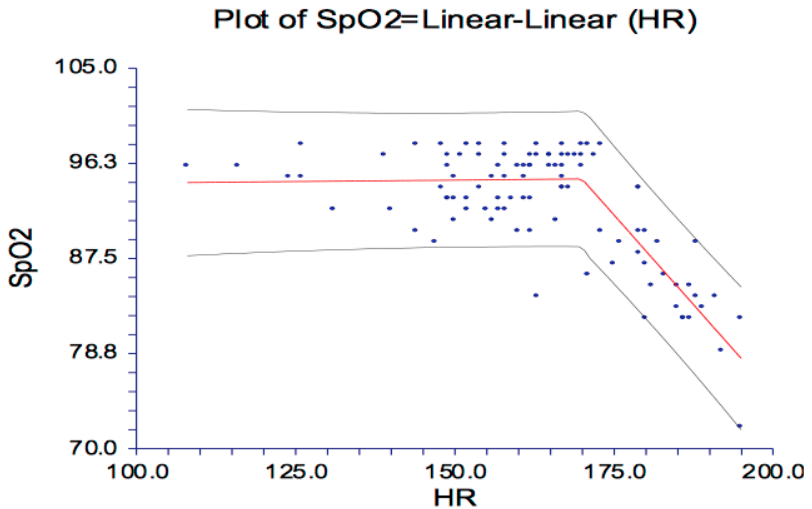
smartphone

Some Applications

1) Smart management of respiratory rehabilitation and exercise therapy.
2) Screening for sleep apnea syndrome.
3) Exercise coach.

Research stated that there would be a stratification or clustering of SpO2 % and HR as workload increased

Variables	Cluster 1	Cluster 2
SpO2 %	95 (s.d. 2.4)	84 (s.d. 4)
Heart Rate	156 (s.d. 14)	183 (s.d 7)
Count	72	26



Q&A

Thank You