Virtual Lab

Expt. 04

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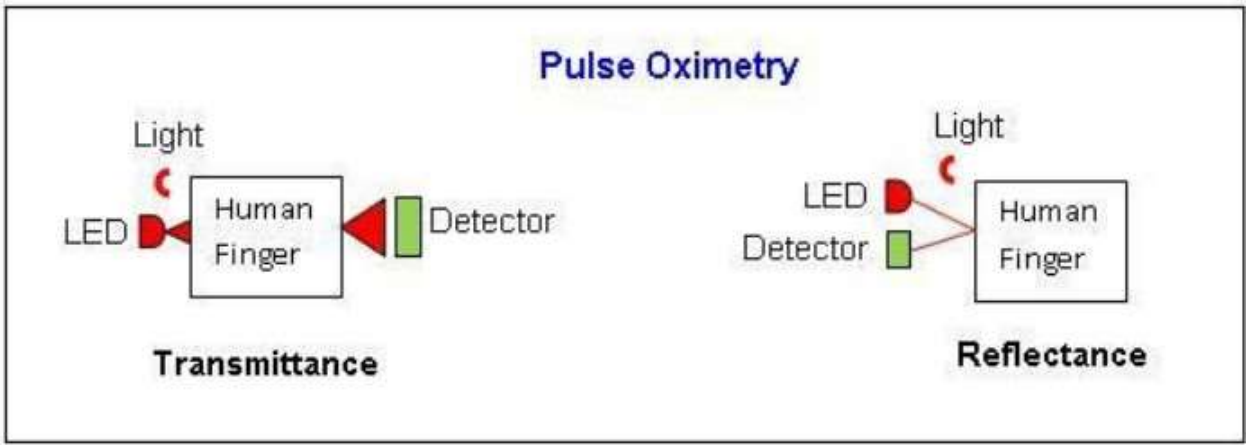
Div: J1 **Batch:** Computer Science

Aim: To study the performance of Biosensor (Pulse measurement technique)

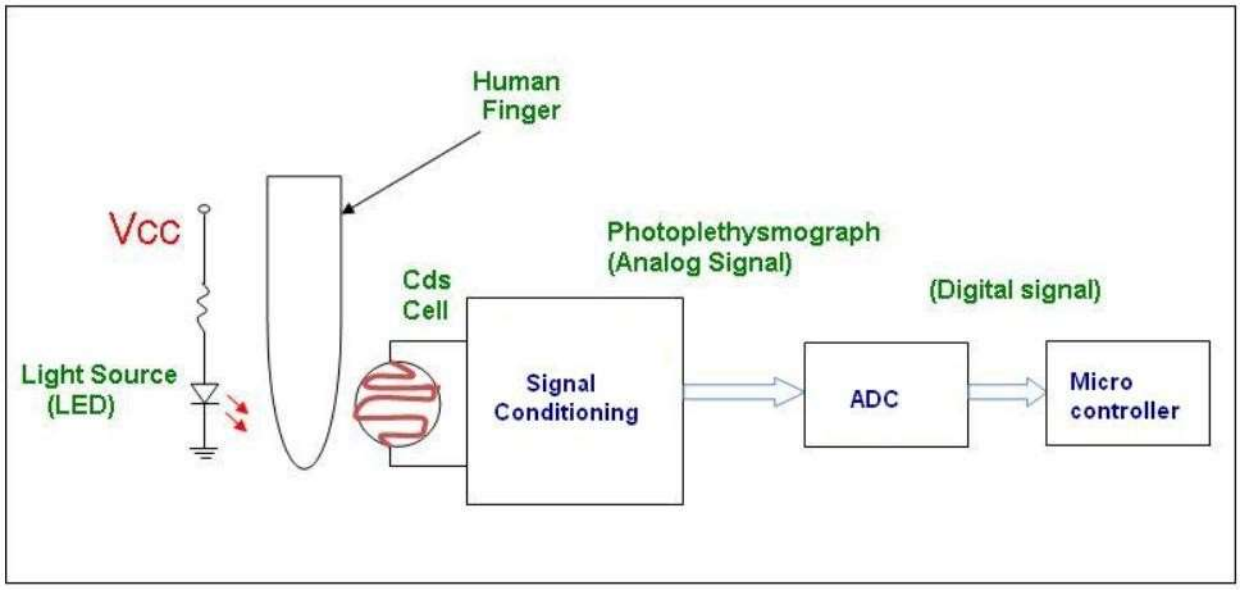
Theory: Pulse is the rate at which human heart beats. Pulse is also commonly called Heart Rate, which is the number of times the heart beats each minute (bpm). As the heart pumps blood through human body, one can feel a pulse in the blood vessels close to the skin's surface, such as wrist, neck, or upper arm. Counting pulse rate is a simple way to find out how fast the heart is beating. Our pulse changes from minute to minute. It will be faster when one exercises, have a fever, or is under stress. It will be slower at resting condition.

Measurement: There are two approaches to developing a probe for pulse measurement. The first is transmittance, the second is reflectance. The difference is in the way the elements within the probe are positioned. A transmittance probe has a LED on one side and a photodiode (light detector) on the other. The tissue to be imaged (commonly a finger or an ear) is inserted between the two.

A reflectance probe has the LED and the photodiode on the same side. It must be placed over a point with underlying bone. Light is emitted by the LED, passes through tissue and blood vessels, reflects off bone and passes through the tissues again .A significant amount of light will reflect off the skin in the reflectance setup, and, unlike in the transmittance setup, this light will be detected. Thus, reflectance probes have a high offset and a lower signal-to-noise ratio than the transmittance probes. Reflectance setups also require a significantly greater amount of light. Thus, either more LEDs or more photodiodes need to be used.

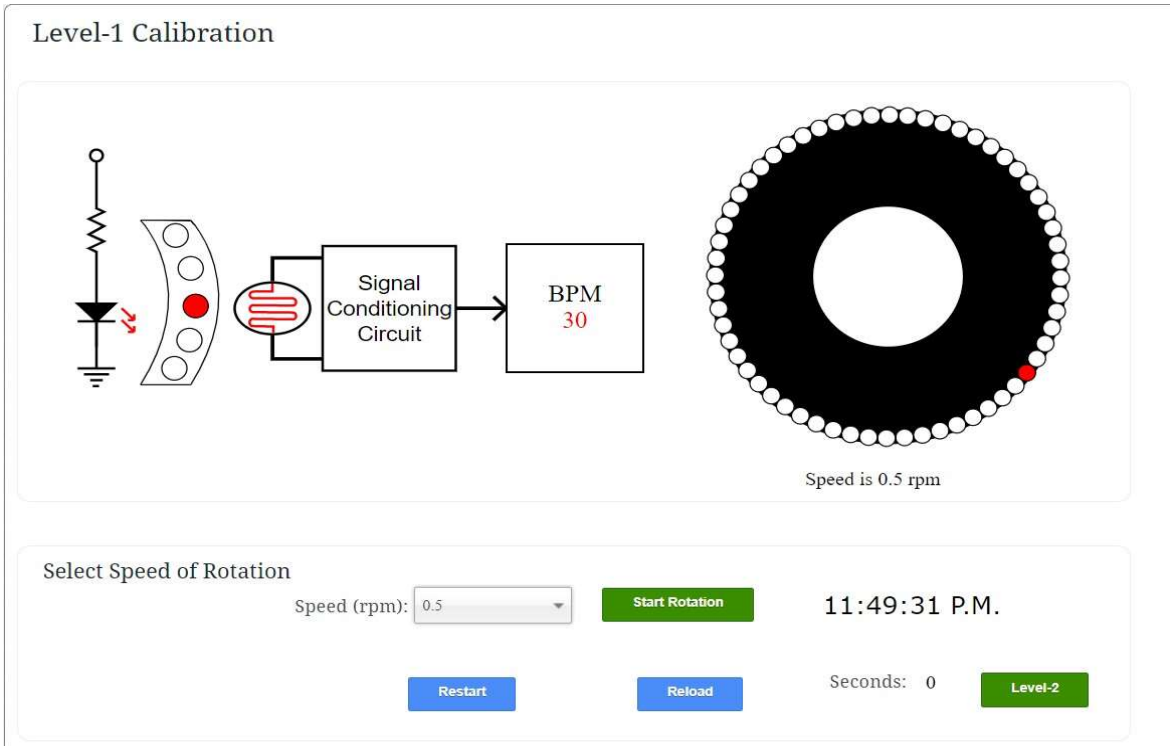


Photoplethysmograph: The device used to measure the amount of blood in part of the body using light is commonly known as photo-plethysmograph. It measures the variation in amount of light passing through your finger caused by the pulsatile nature of blood flow. A light source is placed on one side of the finger, and a light sensitive transducer like LDR (Cadmium Sulfide (CdS) cell) or a photo diode or a phototransistor, on the other side. By monitoring variations in the output of the transducer an indication of blood flow in the finger is obtained. A simple block diagram of one such system is shown here.



SIMULATION:

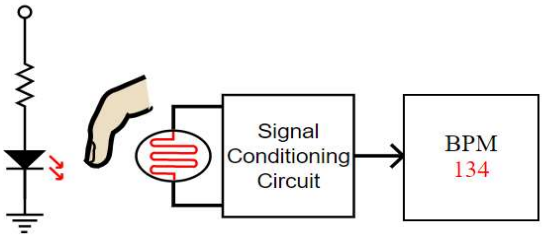
- **When RPM = 0.5**



A) AGE GROUP : NEW BORN

Level-2 Measurement

<--Level-1



Select Age to see Heart Beat range

Age : New Born

Show Range in this Group

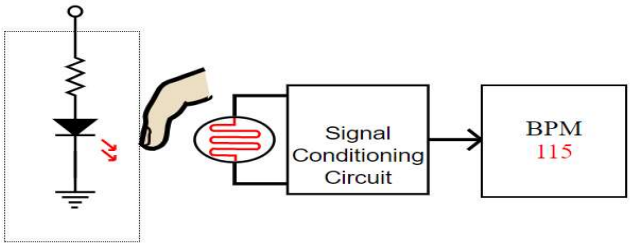
Reload

Heart beats in this group are: 120 to 160

Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

Error : Effect of Misa...

Drag LED to Read Error

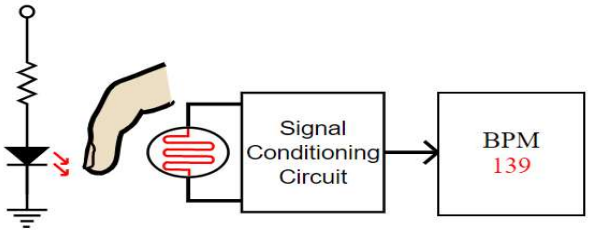
Selected Range is : New Born

Reload

B) AGE GROUP : 1-12 MONTHS

Level-2 Measurement

<--Level-1



Select Age to see Heart Beat range

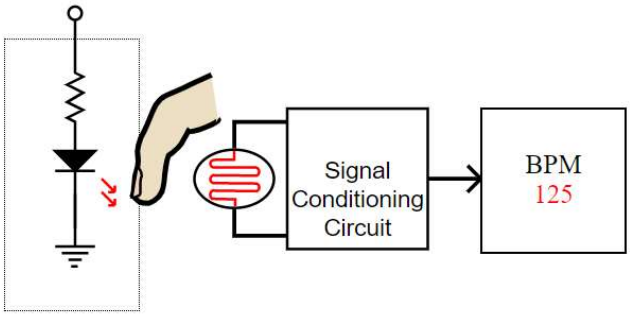
Age : 1 - 12 Months | Show Range in this Group | Reload

Heart beats in this group are: 80 to 140

Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

Error : Effect of Misa... | Drag LED to Read Error

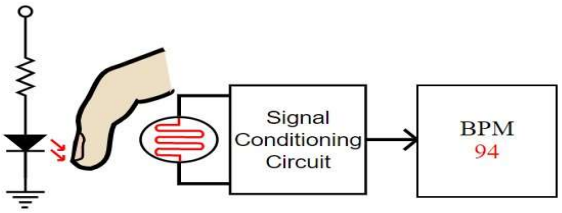
Selected Range is : 1-12 months

Reload

C) AGE GROUP : 1-2 YEARS

Level-2 Measurement

<--Level-1



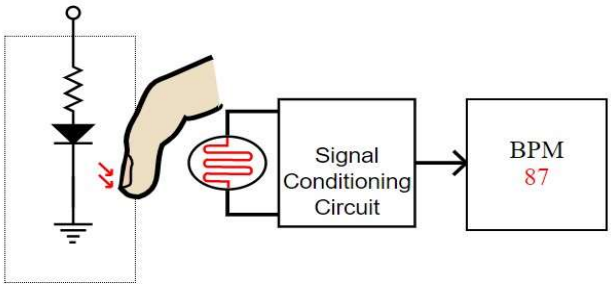
Select Age to see Heart Beat range

Age : 1 - 2 Years | Show Range in this Group | Reload

Heart beats in this group are: 80 to 130 | Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

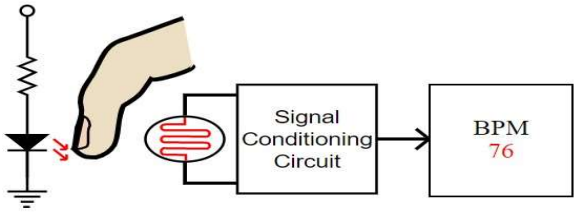
Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : 1-2 years | Reload

D) AGE GROUP : 2-6 YEARS

Level-2 Measurement

<--Level-1



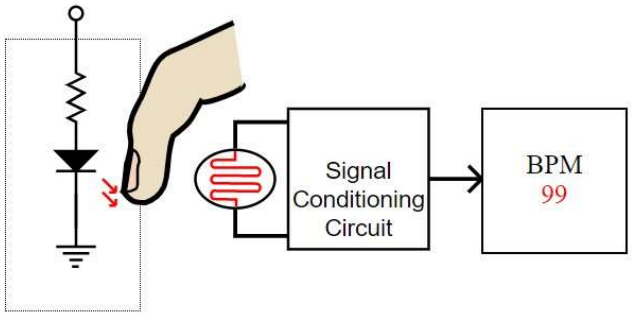
Select Age to see Heart Beat range

Age : 2 - 6 Years | Show Range in this Group | Reload

Heart beats in this group are: 75 to 120 | Level-3

Level-3 Error

<--Level-2

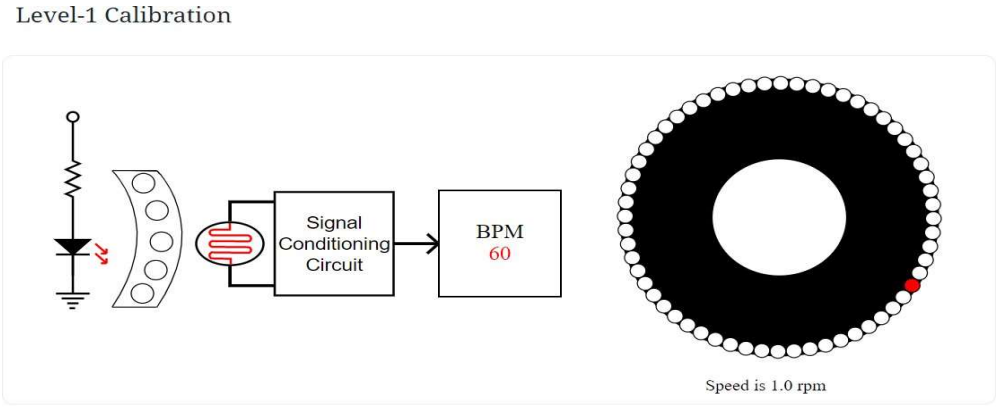


Select Error to see Difference in BPM

Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : 2-6 years | Reload

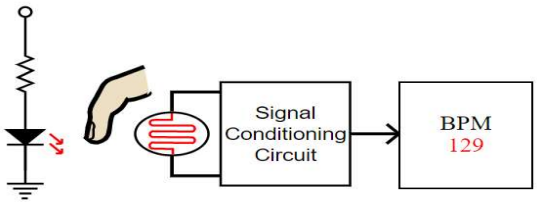
- **WHEN RPM = 1**


Level-1 Calibration
Signal Conditioning Circuit
BPM
60
Speed is 1.0 rpm
Select Speed of Rotation
Speed (rpm):
1
Start Rotation
11:52:25 P.M.
Restart
Reload
Seconds: 0
Level-2

A) AGE GROUP : NEW BORN

Level-2 Measurement

<--Level-1



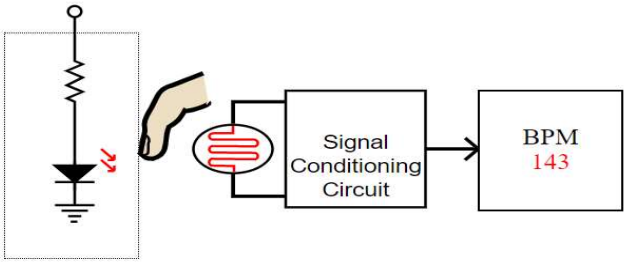
Select Age to see Heart Beat range

Age : New Born | Show Range in this Group | Reload

Heart beats in this group are: 120 to 160 | Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

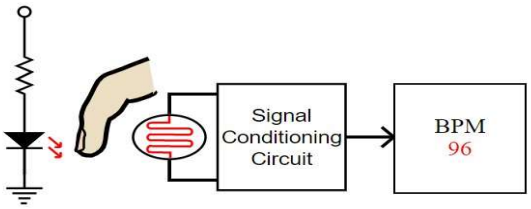
Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : New Born | Reload

B) AGE GROUP : 1-12 MONTHS

Level-2 Measurement

<--Level-1



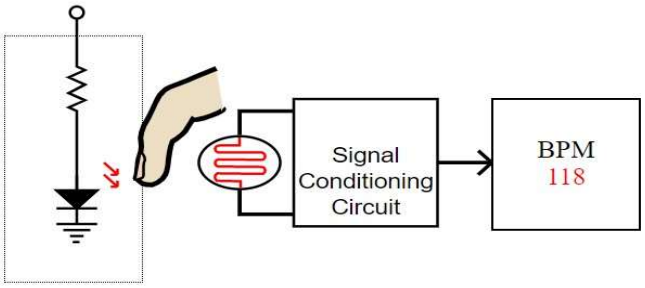
Select Age to see Heart Beat range

Age : 1 - 12 Months | Show Range in this Group | Reload

Heart beats in this group are: 80 to 140 | Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

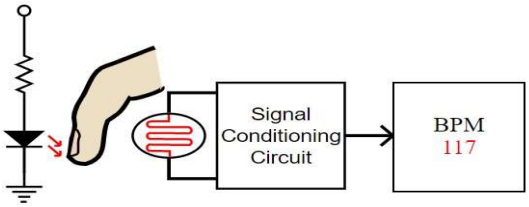
Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : 1-12 months | Reload

C) AGE GROUP : 1-2 YEARS

Level-2 Measurement

<--Level-1



Select Age to see Heart Beat range

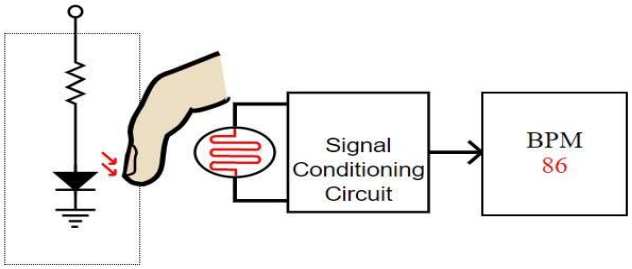
Age : 1 - 2 Years | Show Range in this Group | Reload

Heart beats in this group are: 80 to 130

Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

Error : Effect of Misa... | Drag LED to Read Error

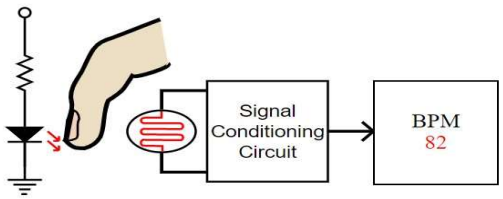
Selected Range is : 1-2 years

Reload

D) AGE GROUP : 2-6 YEARS

Level-2 Measurement

<--Level-1



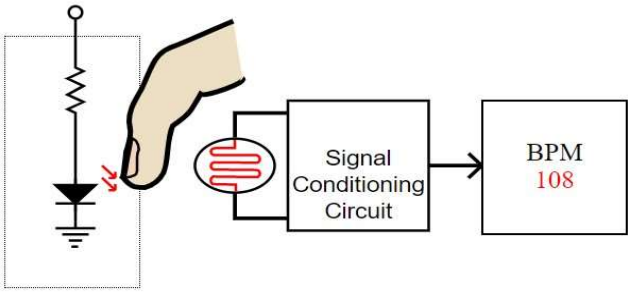
Select Age to see Heart Beat range

Age : 2 - 6 Years | Show Range in this Group | Reload

Heart beats in this group are: 75 to 120 | Level-3

Level-3 Error

<--Level-2



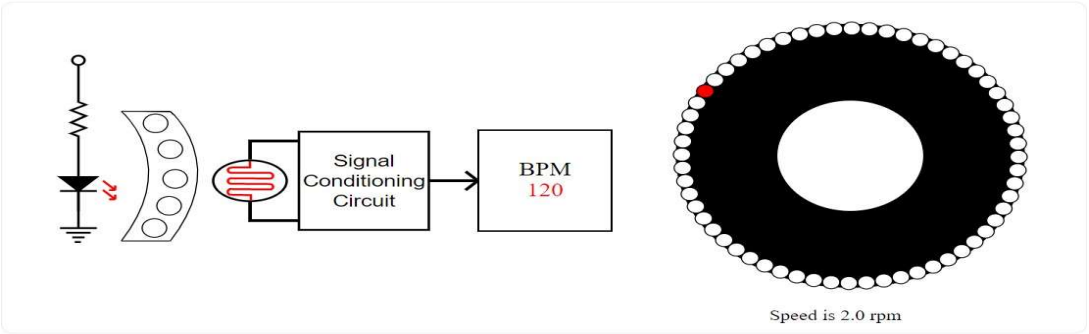
Select Error to see Difference in BPM

Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : 2-6 years | Reload

- **WHEN RPM = 2**

Level-1 Calibration



Select Speed of Rotation

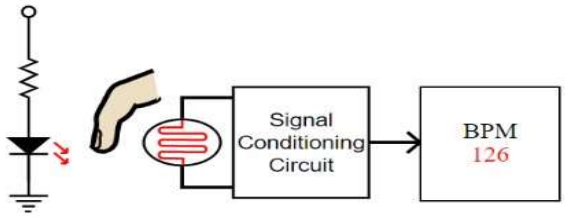
Speed (rpm): 2 Start Rotation 11:53:41 P.M.

Restart Reload Seconds: 0 Level-2

A) AGE GROUP : NEW BORN

Level-2 Measurement

<--Level-1



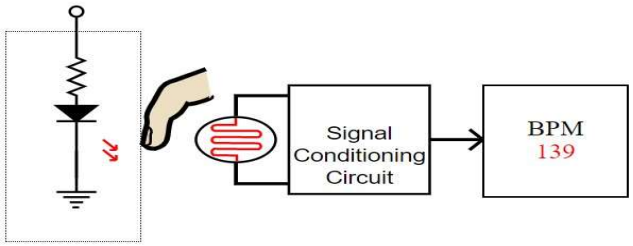
Select Age to see Heart Beat range

Age : New Born | Show Range in this Group | Reload

Heart beats in this group are: 120 to 160 | Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

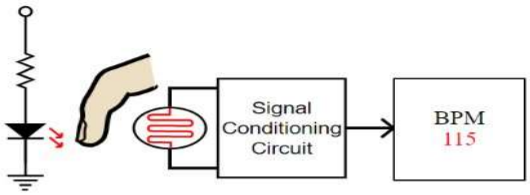
Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : New Born | Reload

B) AGE GROUP : 1-12 MONTHS

Level-2 Measurement

<--Level-1



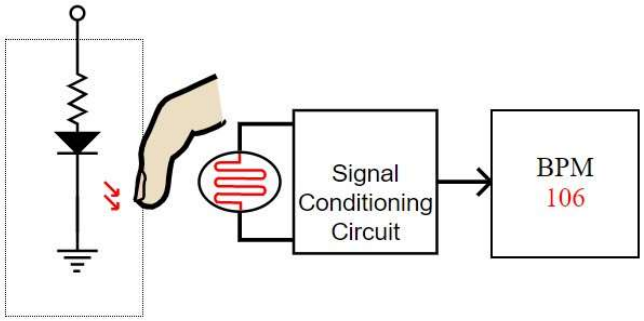
Select Age to see Heart Beat range

Age : 1 - 12 Months | Show Range in this Group | Reload

Heart beats in this group are: 80 to 140 | Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

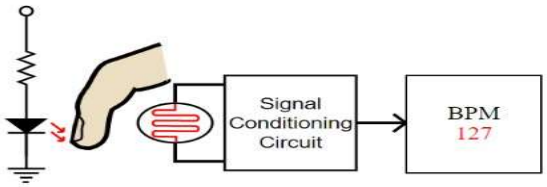
Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : 1-12 months | Reload

C) AGE GROUP : 1-2 YEARS

Level-2 Measurement

<--Level-1



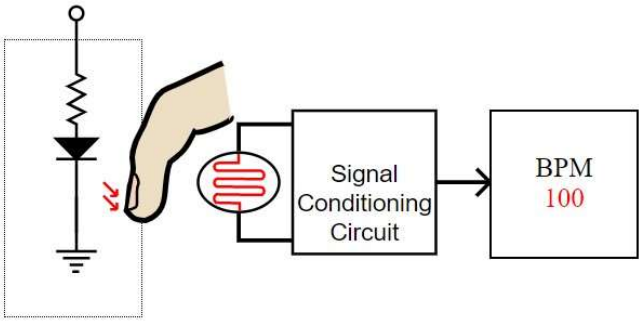
Select Age to see Heart Beat range

Age : 1 - 2 Years | Show Range in this Group | Reload

Heart beats in this group are: 80 to 130 | Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

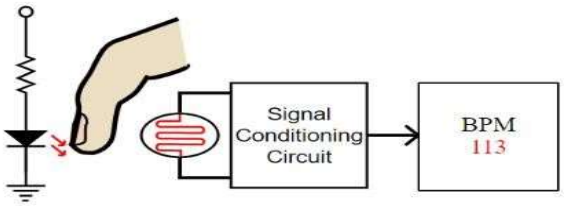
Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : 1-2 years | Reload

D) AGE GROUP : 2-6 YEARS

Level-2 Measurement

<--Level-1



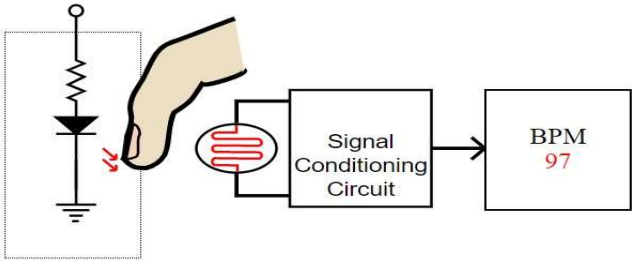
Select Age to see Heart Beat range

Age : 2 - 6 Years | Show Range in this Group | Reload

Heart beats in this group are: 75 to 120 | Level-3

Level-3 Error

<--Level-2



Select Error to see Difference in BPM

Error : Effect of Misa... | Drag LED to Read Error

Selected Range is : 2-6 years | Reload

OBSERVATION TABLE:

RPM	AGE GRP	BPM	HEART BEAT RANGE(BPM)	ERROR IN BPM
RPM = 0.5	NEW BORN	134	120-160	115
	1-12 MONTHS	139	80-140	125
	1-2 YEARS	94	80-130	87
	2-6 YEARS	76	75-120	99
RPM = 1	NEW BORN	129	120-160	143
	1-12 MONTHS	96	80-140	118
	1-2 YEARS	117	80-130	86
	2-6 YEARS	82	75-120	108
RPM = 2	NEW BORN	126	120-160	139
	1-12 MONTHS	115	80-140	106
	1-2 YEARS	127	80-130	100
	2-6 YEARS	113	75-120	97

CONCLUSION: Hence we have studied the performance of Biosensor by noting down the readings of BPM for different age groups and comparing them with the range of the of the heart beat of that particular age group.