# DETECTION OF HEART BEAT SIGNAL USING OPTICAL FIBER SENSOR

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## ABSTRACT

*In an intensity-based optical pressure sensor, an increase in pressure will cause the source of light to be progressively blocked. The sensor then measures the change in light received. The pressure moves a diaphragm and the attached opaque vane blocks more of the light from the LED. The fall in light intensity is detected by the photodiode and gives a direct measurement of pressure. The heart pressure is detected in term of output of photodiode voltage.*

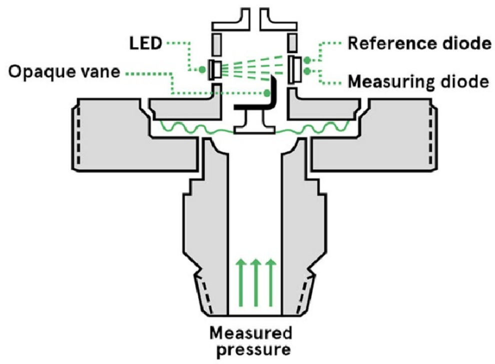
**Keywords:** Sensor, LED, ECG

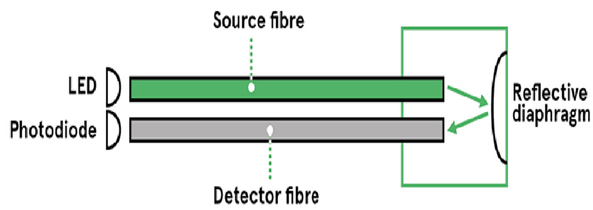
## Design Concept of Sensor

The simple mechanism shown below, the pressure moves a diaphragm and the attached opaque vane blocks more of the light from the LED. The fall in light intensity is detected by the photodiode and gives a direct measurement of pressure.

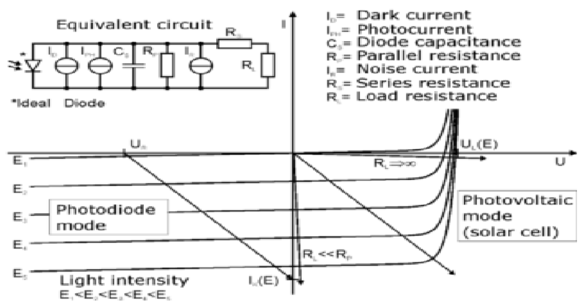
A simple optical pressure sensor like this needs a reference photodiode (as shown to the right), which is never blocked by the vane. This allows the sensor to correct for changes in the light output due to other factors, like aging of the light source, variations in supply voltage, etc.

These mechanical systems are relatively large. Much smaller versions can be constructed with a reflective membrane and two optical fibres, one as a source of light and the other to receive the reflected light. Pressure bends the membrane and changes the amount of light reflected back to the detector (see right). A photodiode is one type of light detector, used to convert the light into current or voltage based on the mode of operation of the device. It comprises of optical filters, built-in lenses and also surface areas. These diodes have a slow response time when the surface area of the photodiode increases. Photodiodes are alike to regular semiconductor diodes, but that they may be either visible to let light reach the delicate part of the device I-V characteristic of a photodiode. The linear load lines represent the response of the external circuit: I-V(Applied bias voltage-Diode voltage)/Total resistance. The points of intersection with the curves represent the actual current and voltage for a given bias, resistance and illumination.




A photodiode is designed to operate in reverse bias to measure voltages.



## Experimental Result

1. The light from LED is focused on source optical fiber and it is transmitted through optical medium(single mode). It falls on reflector and come back again through detector optical fiber.
2. The output photodiode is recorded in term of voltages in microvolt and pressure from the heart beat activities is converted into output voltage of photodiode.
3. The diaphragm of pressure detector is very sensitive that easily vary the light intensity focused on optical fiber end from LED source.
4. The light intensity of optical detector is deleted by photodiode and its output is obtained in term of voltages.
5. The Variable pressure from Heart is converted into variable voltage using the sensor. The Variable voltage is calculated in term of heart beat count.
6. The value of minimum voltages and maximum voltages are recorded. .
7. Time required is recorded for two successive approximate minimum and maximum voltages values.
8. The count is taken of minimum values for a minute and things are repeated for maximum values
9. The heart beat count can be matched with standard one.

**Table-1**

| Sr. No. | Photodiode O/P in micro Volt | Time in Second required to change in voltages(min or Max) | Heart beat count Time=Pulse Count*35 |
|---|---|---|---|
| 1 | 0.6 | | |
| 2 | 0.8 | | |
| 3 | 0.59 | Min=2 | 70 |
| 4 | 0.78 | Max=4 | 140 |
| 5 | 0.61 | Min=2.2 | 77 |
| 6 | 0.77 | Max=4 | 140 |
| 7 | 0.66 | Min=2 | 70 |
| 8 | 0.79 | Max=4.2 | 147 |
| 9 | 0.54 | Min=2 | 70 |
| 10 | 0.92 | Max=4.3 | 152 |

**Table-2**

| Sr.No. | Photodiode O/P in micro Volt | Time in Second required to change in voltages(min or Max) | Heart beat count Time=Pulse Count*35 |
|---|---|---|---|
| 1 | 0.5 | | |
| 2 | 0.9 | | |
| 3 | 0.6 | Min=1.5 | 52 |
| 4 | 1.0 | Max=3.4 | |
| 5 | 0.65 | Min=1.6 | 77 |
| 6 | 0.99 | Max=4.2 | 140 |
| 7 | 0.4 | Min=2 | 70 |
| 8 | 0.9 | Max=4.2 | 147 |
| 9 | 0.6 | Min=2.1 | 70 |
| 10 | 0.92 | Max=4.3 | 152 |

**Table-3**

| Sr.No. | Photodiode O/P in micro Volt | Time in Second required to change in voltages(min or Max) | Heart beat count Time=Pulse Count*35 |
|---|---|---|---|
| 1 | 0.6 | | |
| 2 | 0.8 | | |
| 3 | 0.7 | Min=2.3 | 70 |
| 4 | 0.88 | Max=4.4 | 140 |
| 5 | 0.55 | Min=2.2 | 77 |
| 6 | 0.77 | Max=4.3 | 140 |
| 7 | 0.63 | Min=2.1 | 70 |
| 8 | 0.88 | Max=4.2 | 147 |
| 9 | 0.54 | Min=2.3 | 70 |
| 10 | 0.92 | Max=4.3 | 152 |

**Table-4**

| Sr.No. | Photodiode O/P in micro Volt | Time in Second required to change in voltages(min or Max) | Heart beat count Time=Pulse Count*35 |
|---|---|---|---|
| 1 | 0.7 | | |
| 2 | 0.9 | | |
| 3 | 0.6 | Min=2.2 | 70 |
| 4 | 0.77 | Max=4.4 | 140 |
| 5 | 0.66 | Min=2..1 | 77 |
| 6 | 0.89 | Max=4.3 | 140 |
| 7 | 0.63 | Min=2.4 | 70 |
| 8 | 0.77 | Max=4.5 | 147 |
| 9 | 0.52 | Min=2.3 | 70 |
| 10 | 0.92 | Max=4.4 | 152 |

**Table-5**

| Sr.No. | Photodiode O/P in micro Volt | Time in Second required to change in voltages(min or Max) | Heart beat count Time=Pulse Count*35 |
|---|---|---|---|
| 1 | 0.6 | | |
| 2 | 0.8 | | |
| 3 | 0.45 | Min=2.1 | 70 |
| 4 | 0.79 | Max=4.2 | 140 |
| 5 | 0.64 | Min=2.4 | 77 |
| 6 | 0.73 | Max=4.5 | 140 |
| 7 | 0.62 | Min=2.1 | 70 |
| 8 | 0.79 | Max=4.6 | 147 |
| 9 | 0.54 | Min=2.4 | 70 |
| 10 | 0.92 | Max=4.6 | 152 |

## Conclusion

The Systolic blood pressure are recorded in the range of 140 to 150 which can be matched with standard one and diastolic blood is recorded in the range of 70 to 80.Sensor can be used to measure ECG signal successfully.

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