



# **SNS COLLEGE OF TECHNOLOGY**

## **(AN AUTONOMOUS INSTITUTION)**

Approved by AICTE & Affiliated to Anna University  
Accredited by NBA & Accredited by NAAC with 'A++' Grade,  
Recognized by UGC Saravanampatti (post), Coimbatore-641035.



## **Department of Biomedical Engineering**

**Course Name: 19BM0302 & WEARABLE TECHNOLOGIES**

**Topic :Photoplethysmography**

**Semester :6**

19BM0302/ Photoplethysmography /Mr.S.Prince Samuel /AP/BME



# INTRODUCTION



Constructing a device to measure heart rate, respiratory rate, blood pressure and oxygen saturation level in blood that is

- Cost-effective
- Noninvasive
- Simple and efficient
- Possible to interface with computers
- **One major objective is to measure these using only Smart Phones**

Vision Tit 2

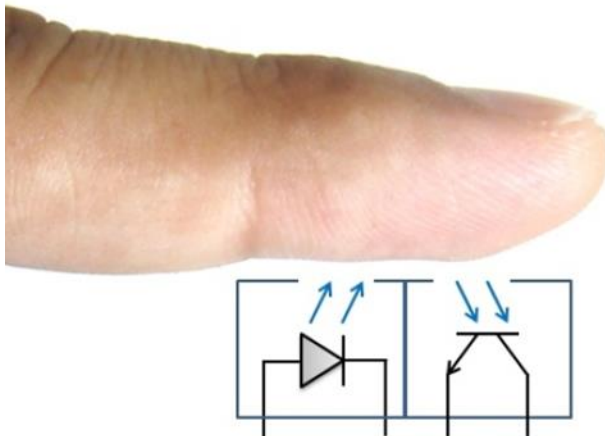
Vision Title 3



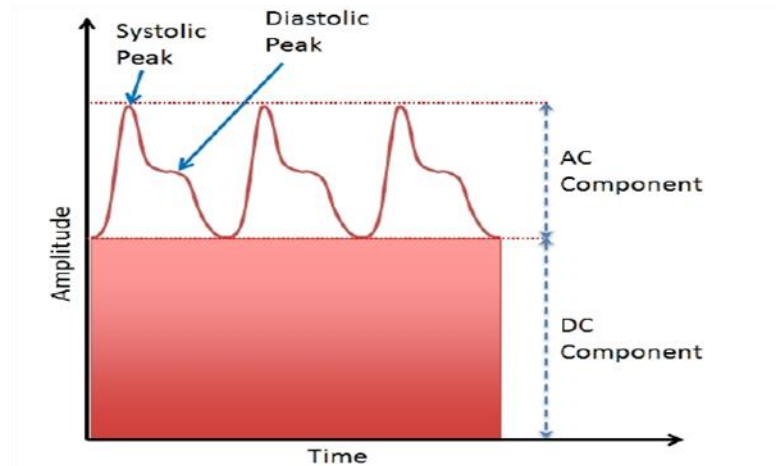
# PPG SENSOR

- Photoplethysmography (PPG) is the volumetric measurement of an organ through optical means, resulting from fluctuations in the amount of blood or air it contains.

Vision Tit 2

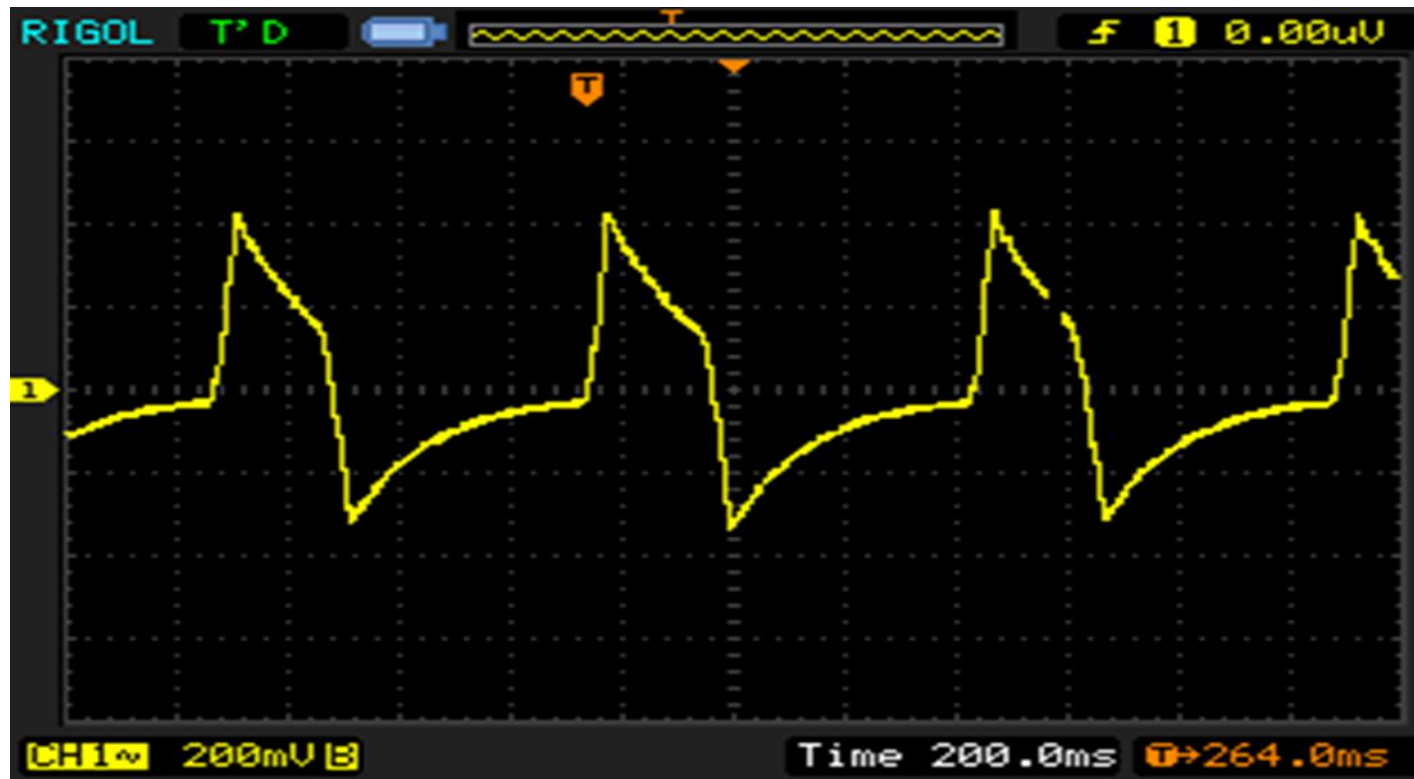


Vision Title 3





# WAVEFORM OF PPG



ion Title 3

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## FORMULA TO CALCULATE BP

- ❑ Blood pressure is strongly related to Pulse Travel Time (PTT)
- ❑ Formula for measuring Blood pressure follows :

$$P_{\text{sys}} = [k_1 \times (C_{\text{dx}})^2] + k_2$$

$$P_{\text{dis}} = [k_3 \times (C_{\text{dx}})^2] + [k_{\text{HR}} \times \text{HR}] + k_4$$

- ❑  $C_{\text{dx}}$  is related to ECG Signal and PPG signal which is strongly related to  $T_1$  and  $T_2$ .
- ❑ We derived a formula and take some measurements which produced very promising results.



# NEED FOR SIGNAL CONDITIONING



## External Biasing Circuit

- This part of the circuit provides reading from a sensor (TCRT1000, TCRT5000, and LTH1550-01) to detect change in volume of blood.

Vision Tit 2

Vision Title 3

## First Stage of Signal Conditioning

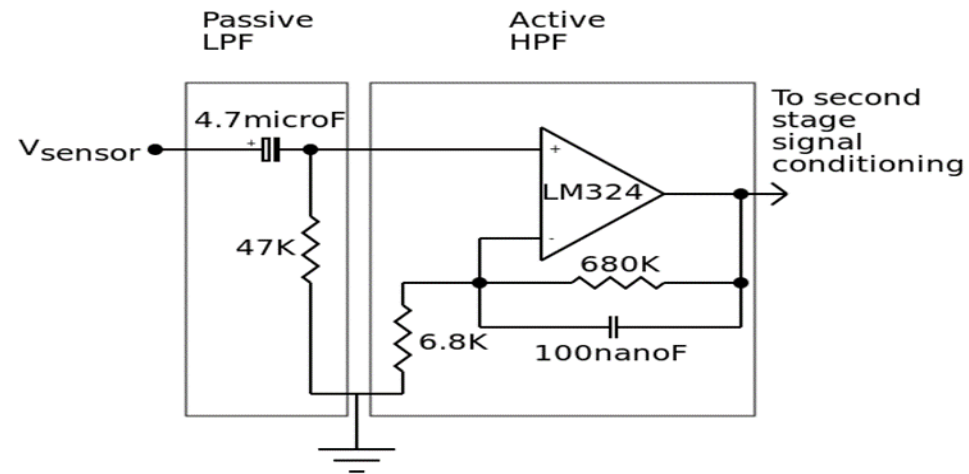
- This stage of the circuit removes the DC component of PPG signal using a high pass filter and it also amplifies the AC component by a factor of 101.
- An active low pass filter having a cutoff frequency of 2.34 Hertz is used to boost the AC component.



# SECOND STAGE CONDITIONING

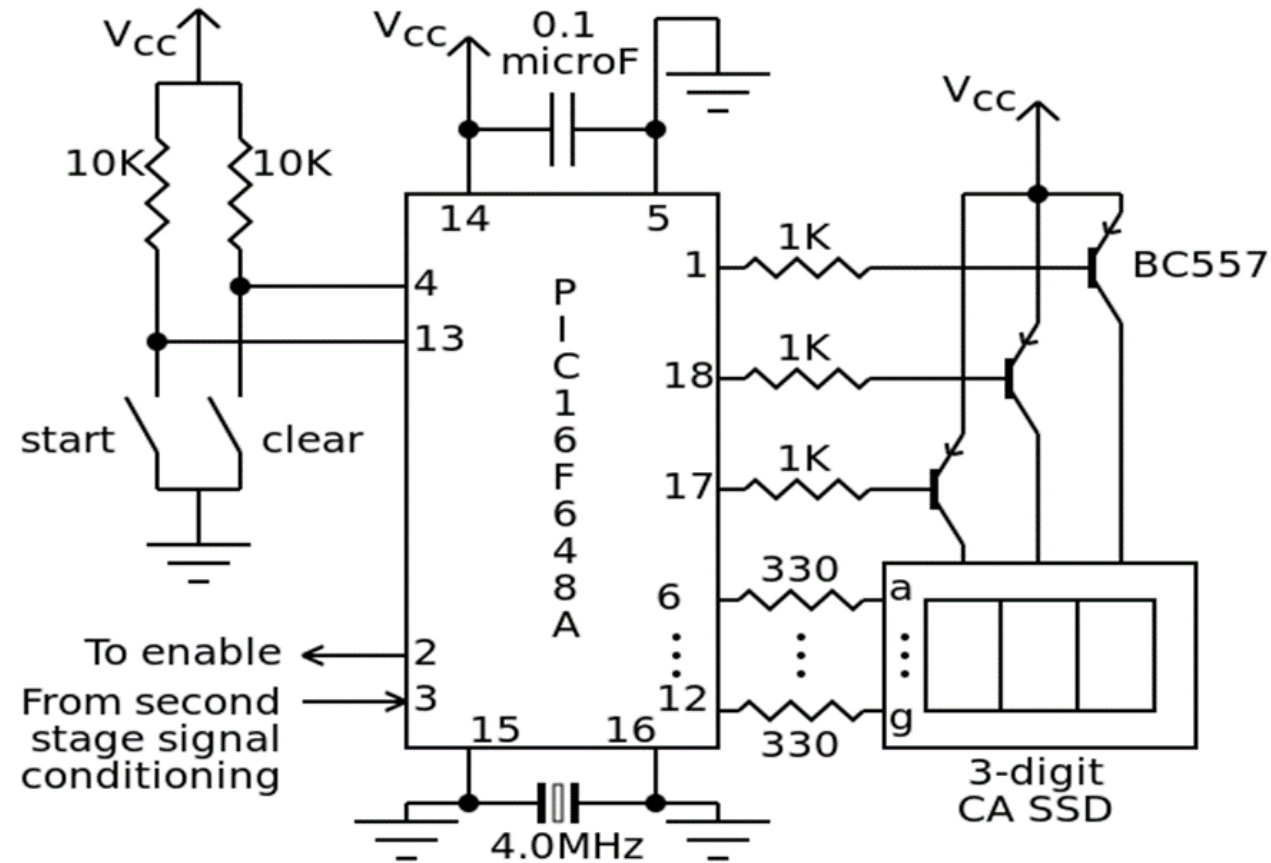
## □ Second Stage of Signal Conditioning

- The second stage of signal conditioning is actually a clone of the first stage. This stage also provides a gain of 101, resulting in final gain of 10201.





# INTERFACING WITH MICROCONTROLLER

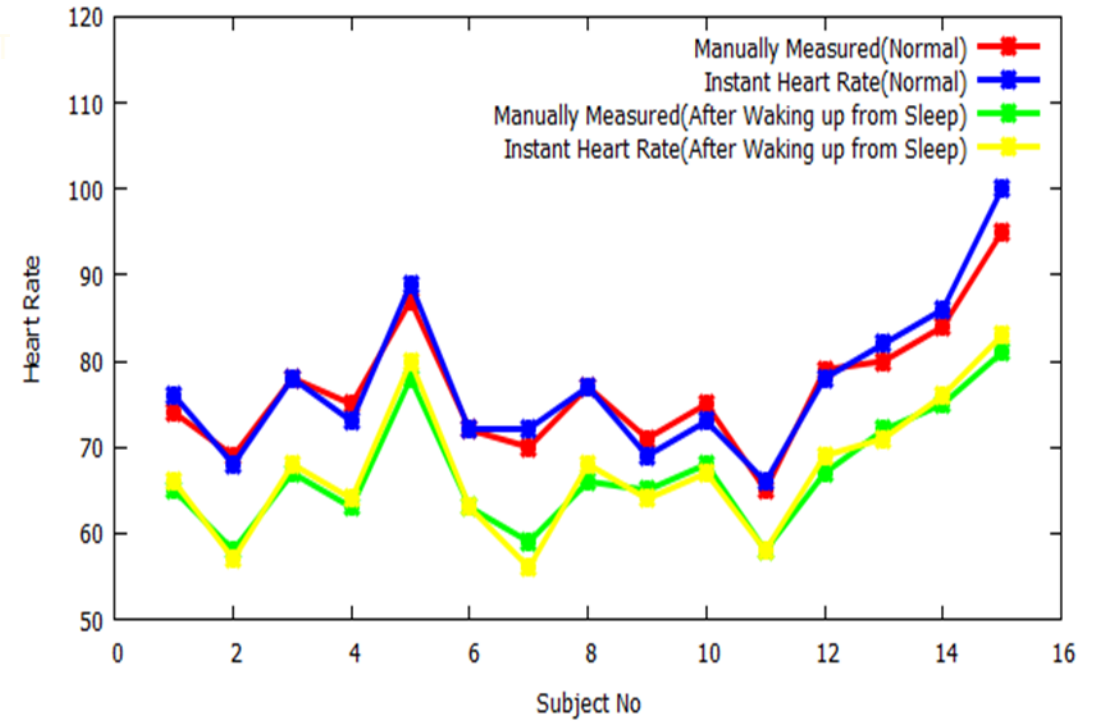
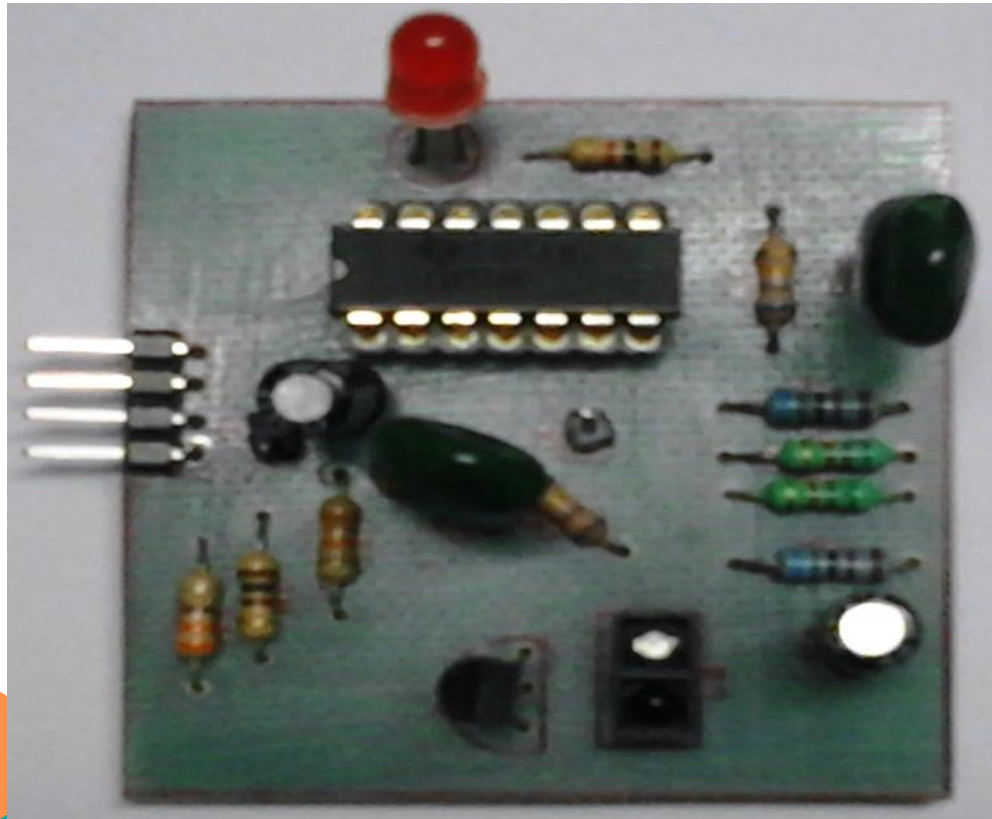


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# INTERFACING WITH MICROCONTROLLER



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A top-down photograph of a white card with the words "Thank you" written in purple cursive. The card is placed on a light-colored marble surface. To the left of the card is a bouquet of small purple flowers with green leaves. To the right of the card is a black pen with a white polka-dot grip. Further to the right is a small gift wrapped in white paper with a grey polka-dot pattern, tied with a red and white striped string. A spool of this same string is visible in the top right corner.

Thank  
you