



SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

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Department of Biomedical Engineering

Course Name: 19BM0302 & WEARABLE TECHNOLOGIES

Topic :Photoplethysmography

Semester :6

19BM0302/ Photoplethysmography /Dr.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

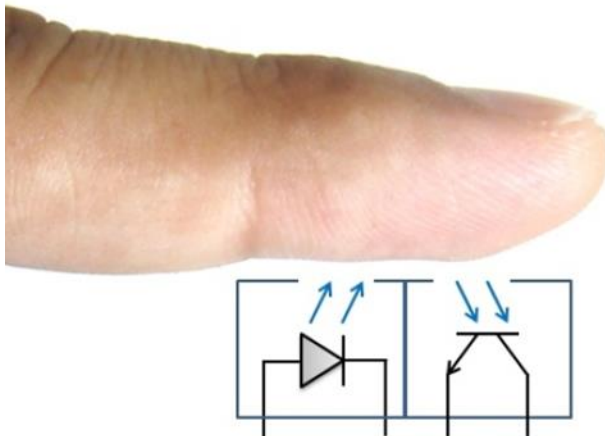
Vision Title 3



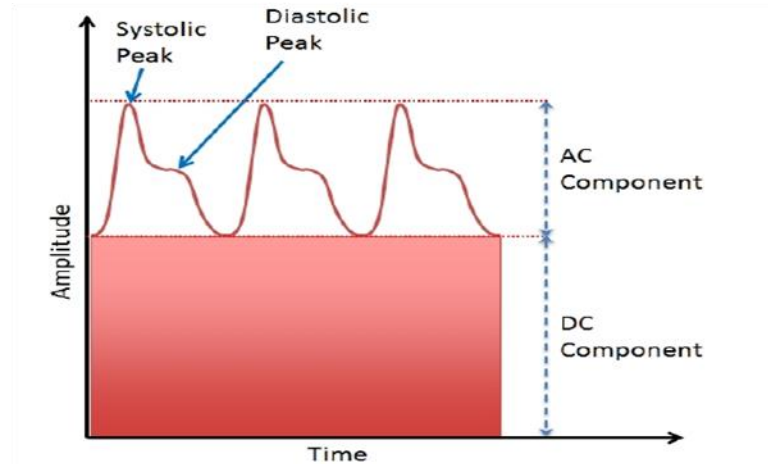
PPG SENSOR

- 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

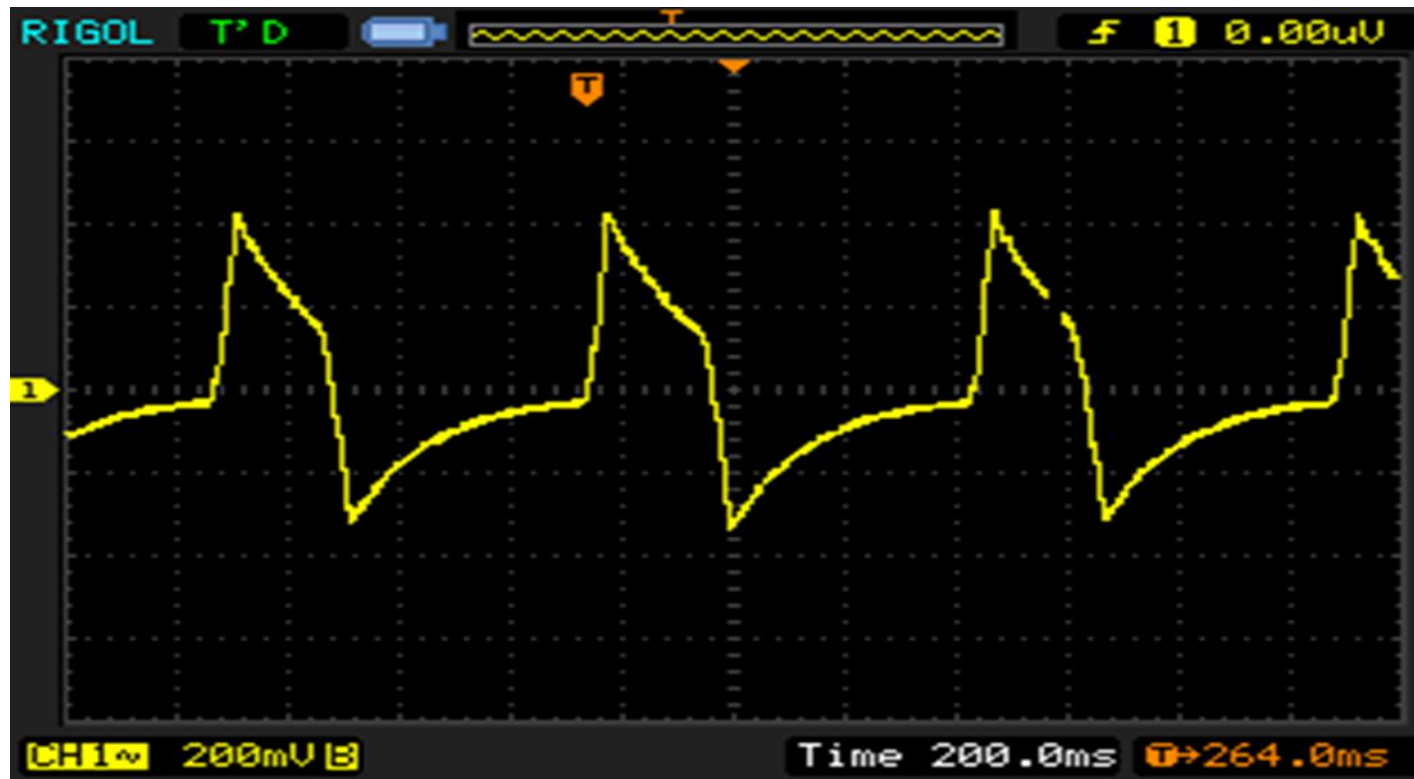


Vision Title 3





WAVEFORM OF PPG



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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_{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.

Vision Title 3



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.

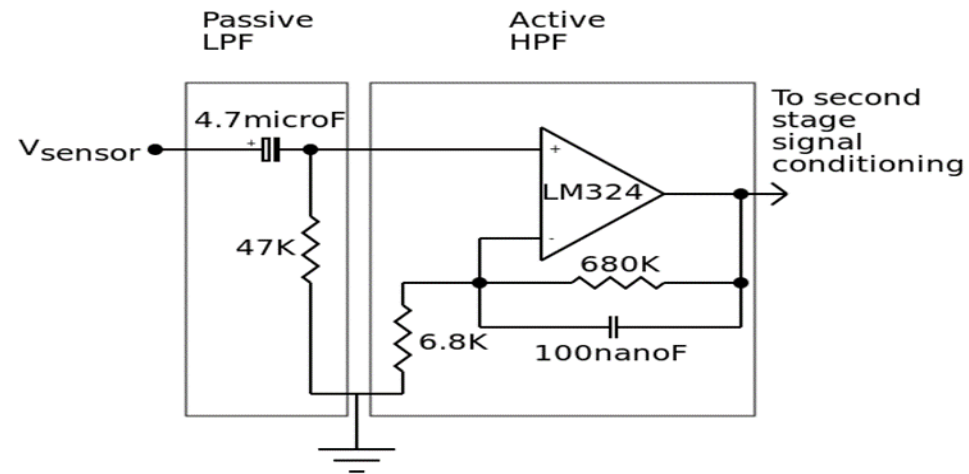


SECOND STAGE CONDITIONING



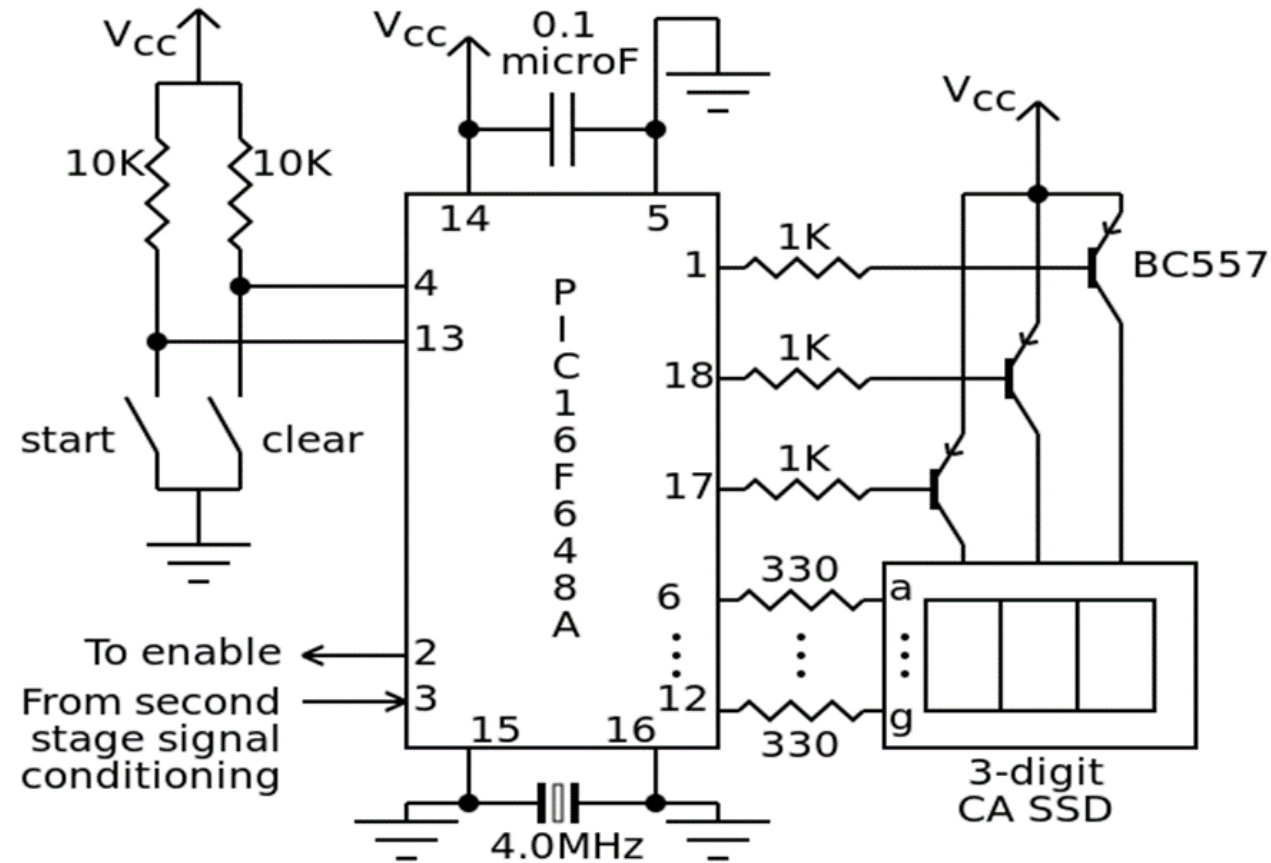
□ Second Stage of Signal Conditioning

- 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.





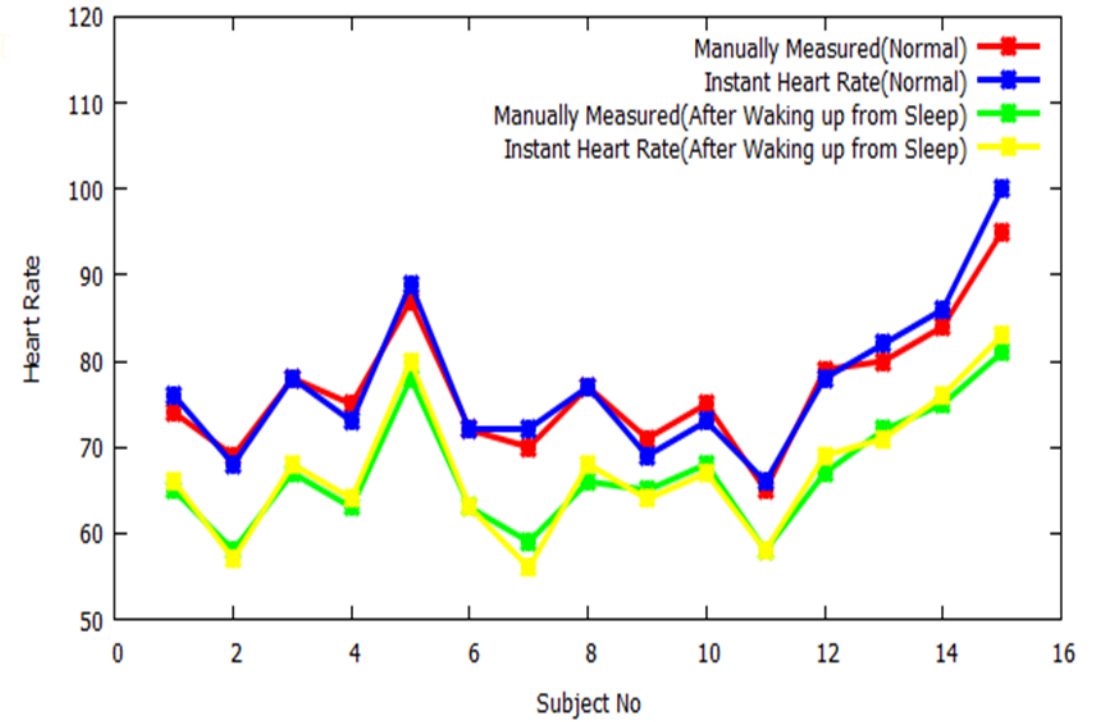
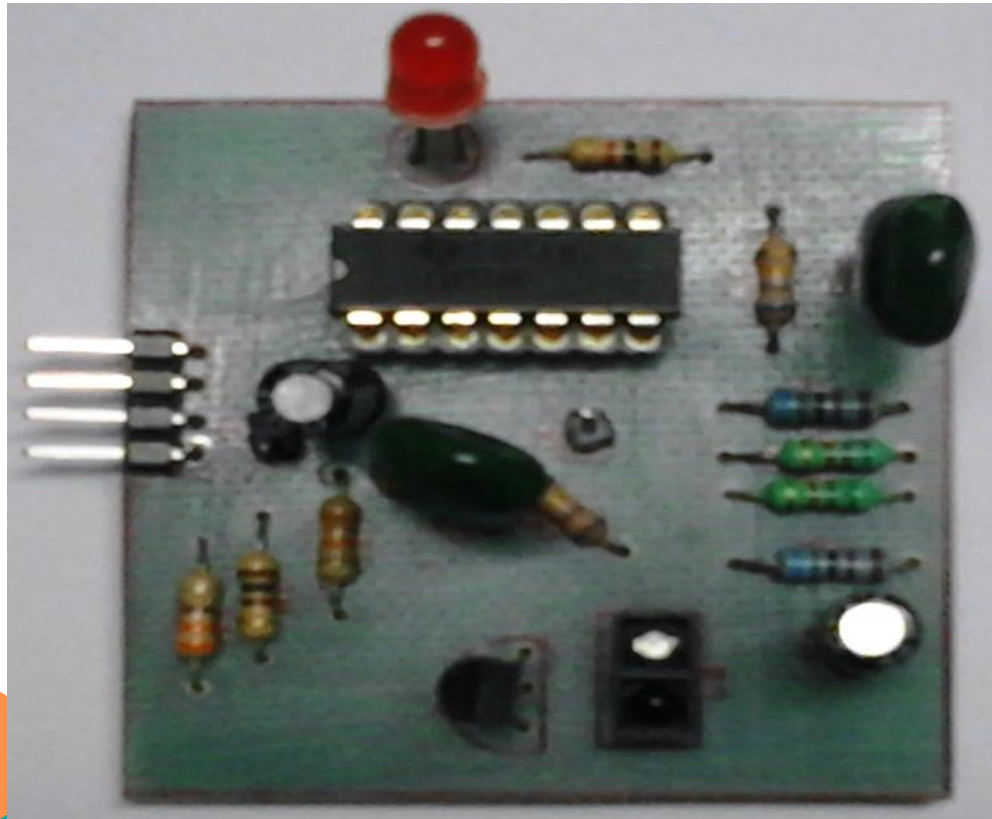
INTERFACING WITH MICROCONTROLLER



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INTERFACING WITH MICROCONTROLLER



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A top-down view of a white card with 'Thank you' written in purple glitter calligraphy. The card is on a white marble surface. To the left is a bouquet of purple flowers. To the right is a gift wrapped in white polka-dot paper with a red and white striped ribbon. A black pen with a white polka-dot grip lies next to the card. A spool of red and white striped twine is in the top right corner.

Thank
you