



Detecting Drowsiness using PPG sensor.

OUR TEAM



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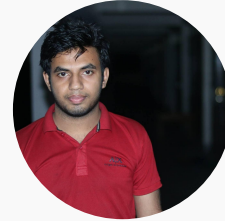
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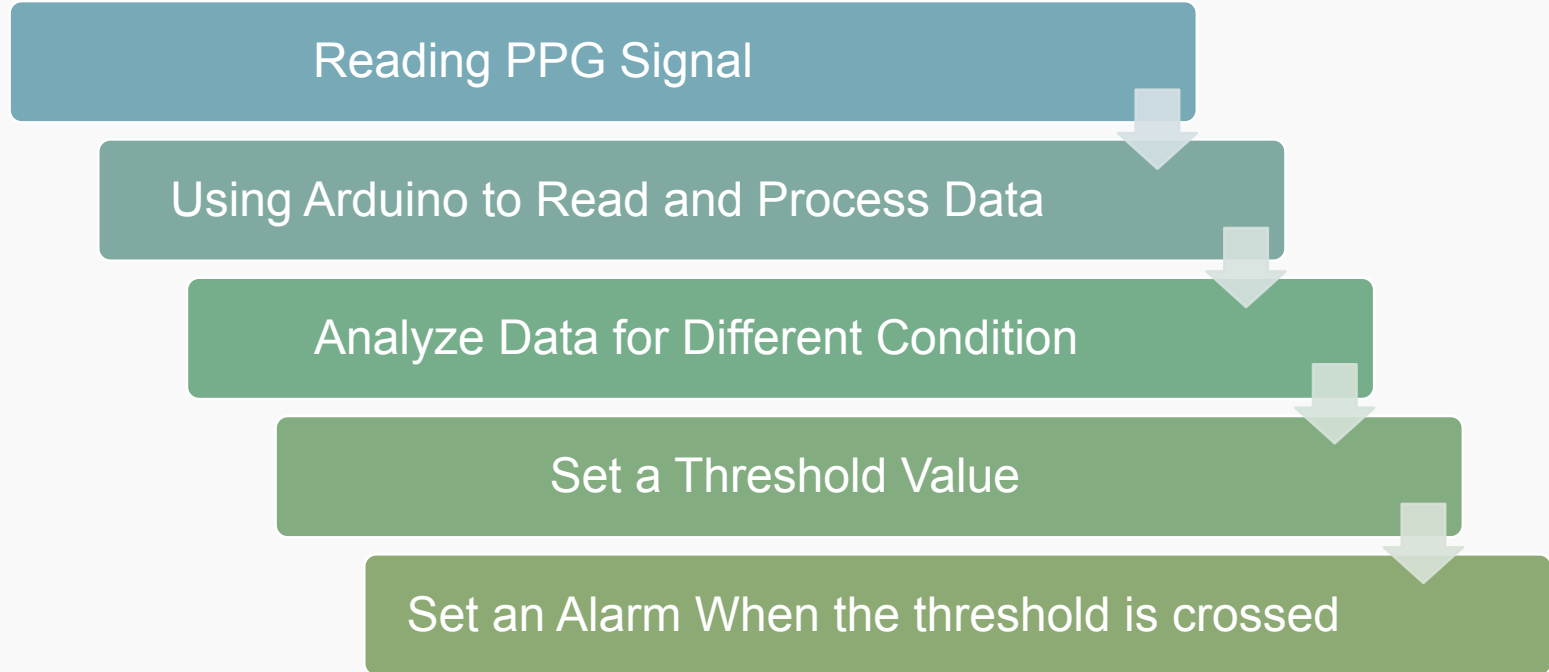
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Motivation

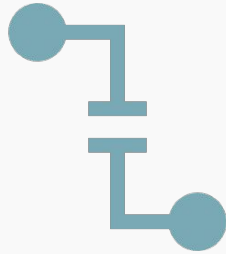
- Developing a reliable drowsiness detection system can be a life-saving solution, especially for long-haul truckers, night-shift workers, and others who are at high risk of drowsy driving.
- By promoting driver safety, a drowsiness detection system can help reduce accidents, injuries, and fatalities on our roads.
- This device can help students trying to study in PL

Flowchart



Methodology

STEP - 1



The process of developing this system starts by reading PPG signal from user.

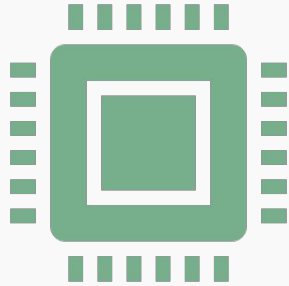
STEP - 2



The signal is amplified, and the beat is counted according to certain interval.

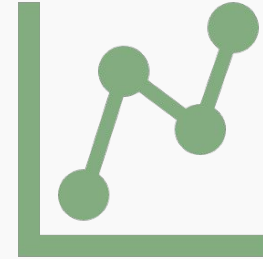
Methodology

STEP - 3



The PPG sensor is interfaced with Arduino Controller to read and process data in frequency domain.

STEP - 4



After that, the data is analyzed for different conditions i.e. awake and drowsy state for its HRV frequency.

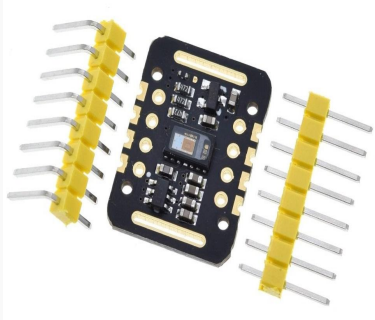
Methodology

STEP - 5

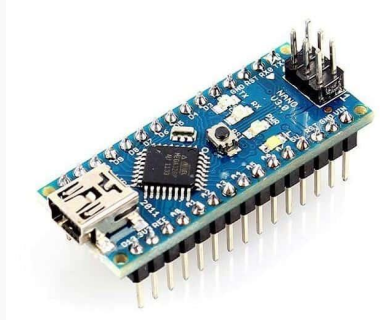


Drowsiness HRV frequency is determined and later it is used in another part of Arduino program to alert driver.

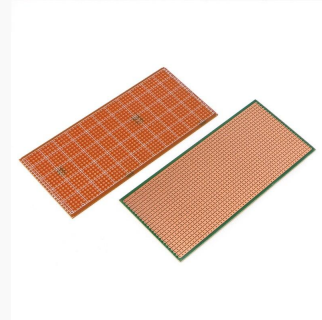
Equipment used in the Project



PPG sensor(MAX 30102)



Arduino Nano

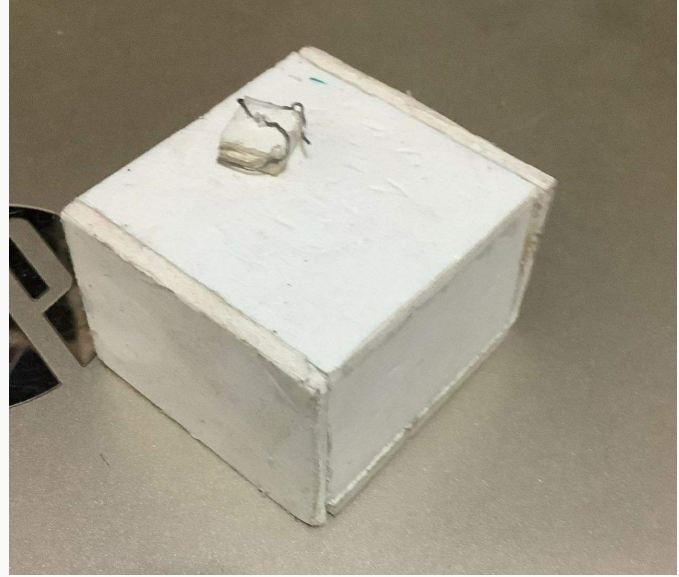
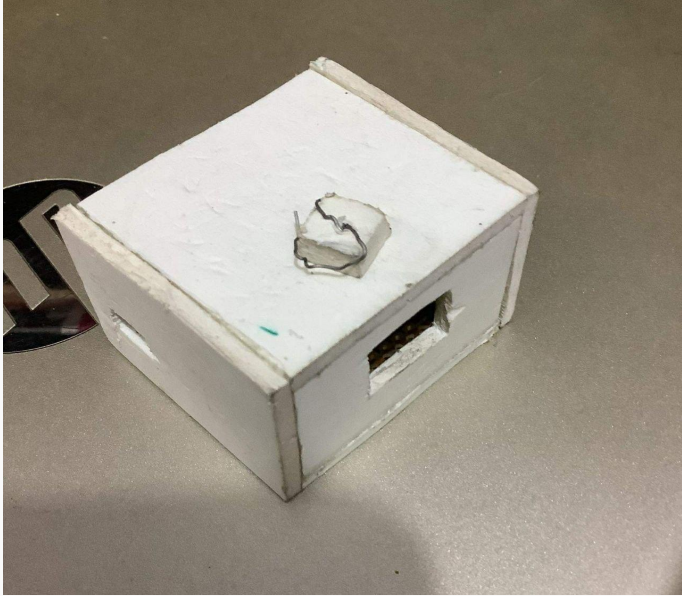


Vero-Board

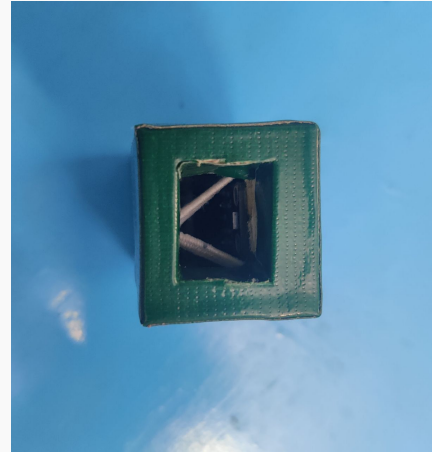
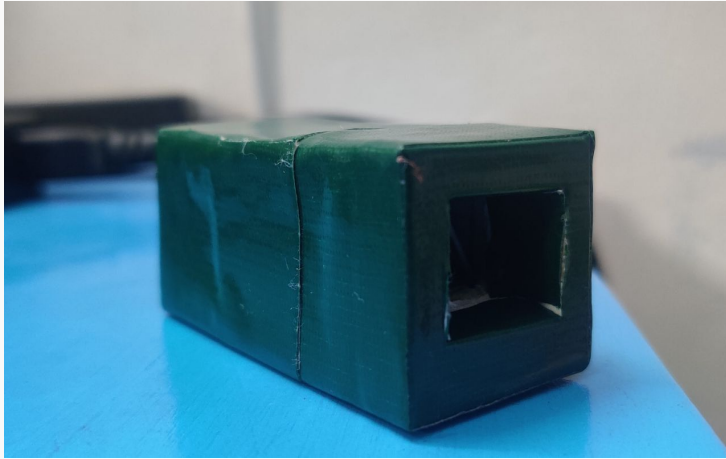


Buzzer

Our designed Device



Our designed Device (2nd)



Signal Aquisition

We collect the ppg signal from the subject using a max 30102 ppg sensor. And the raw output from the ppg sensor looks like the following.



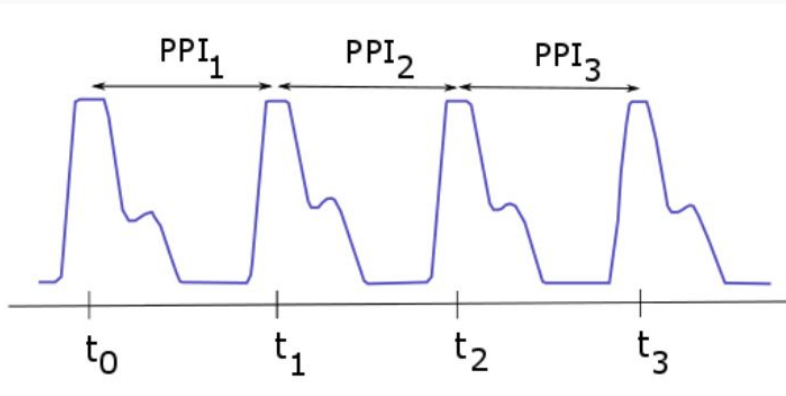
CoolTerm

The name of the software that we used for acquiring data from arduino is "Coolterm"



Signal Processing

At the first stage of processing , we filtered out the noisy data, then applied the peak detection algorithm and after that we measured heart rate from the peak distances.



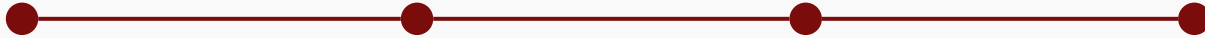
Processing Algorithm

PPG signal

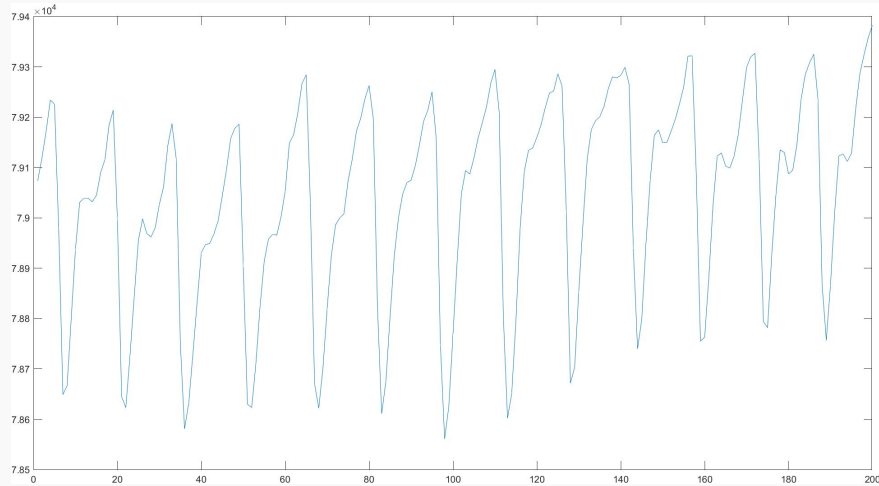
**Calculation of
Heartbeat**

**Windowing
the signal**

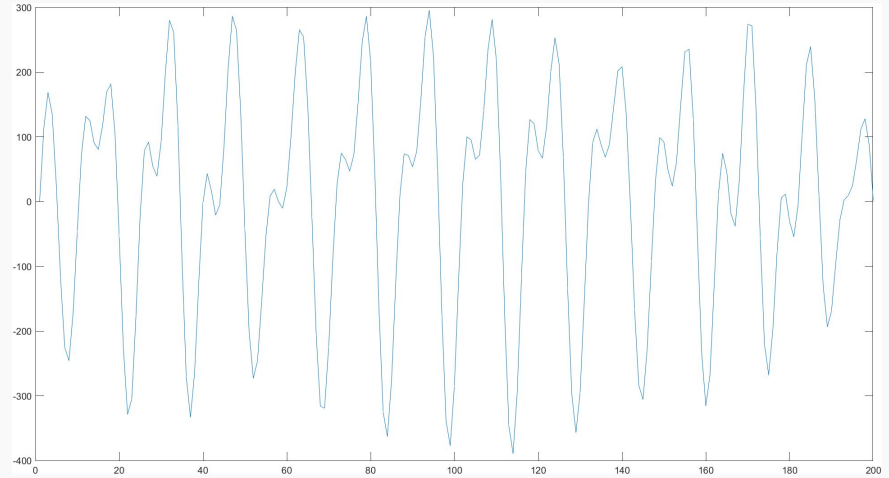
**Comparison
to threshold**



Signal Analysis and filtering

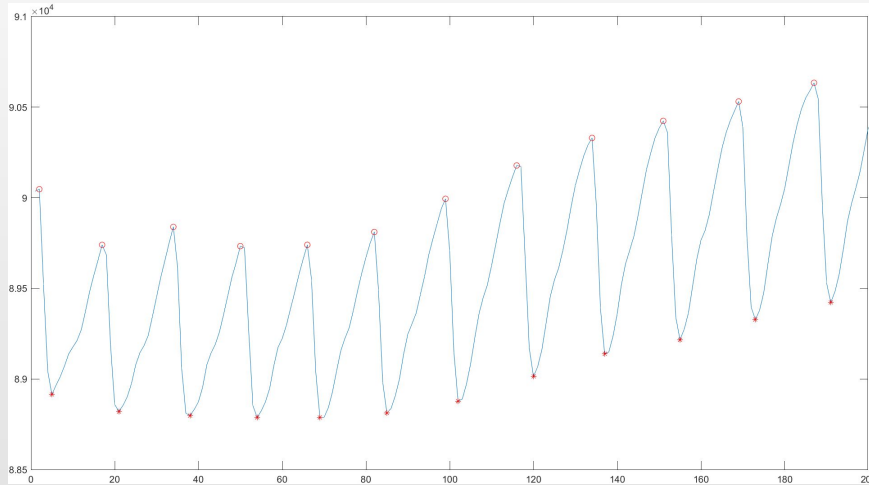


PPG Signal : Before Analysis

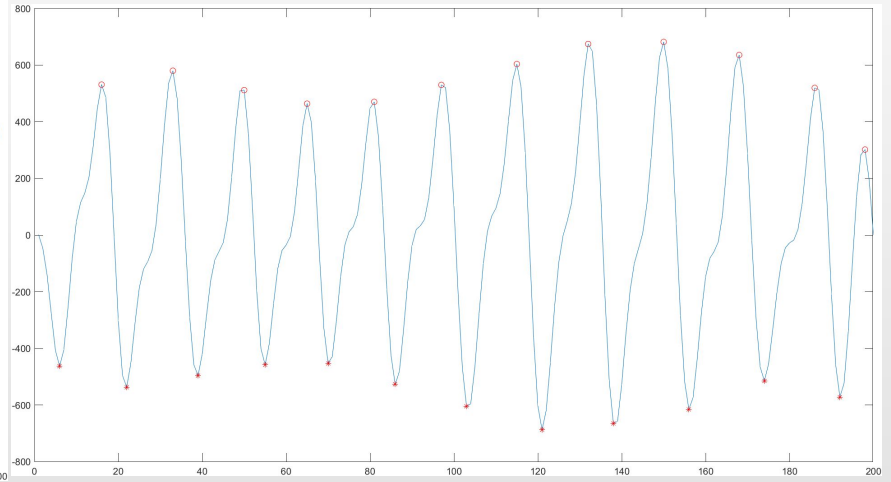


PPG Signal : After Analysis

Signal Analysis (Peak Detection):



PPG Signal : Before Filtering



PPG Signal : After Filtering



Observation

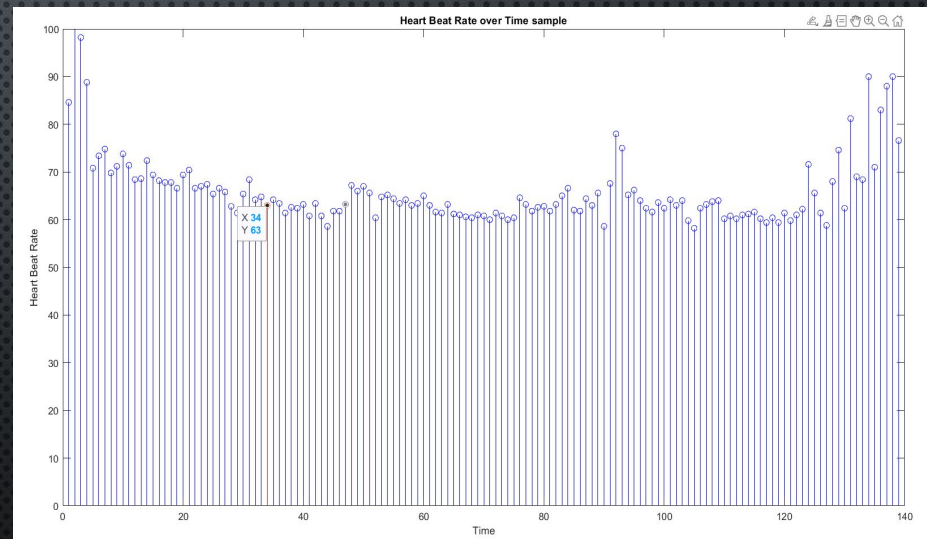
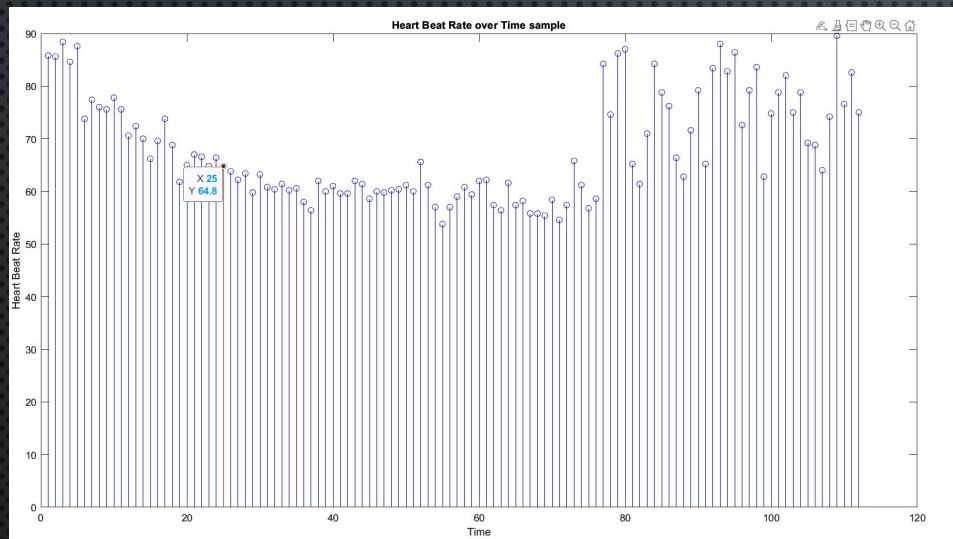
From the experimental data we have seen that the heart rate of a person decreases when he starts to sleep. The supporting data trends are shown in the next slides.

We took enough experimental data to set our threshold for our decision for drowsiness.



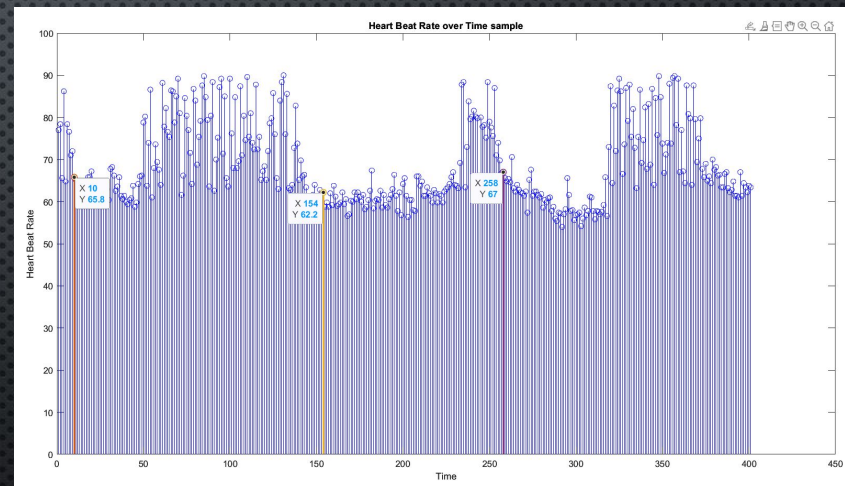
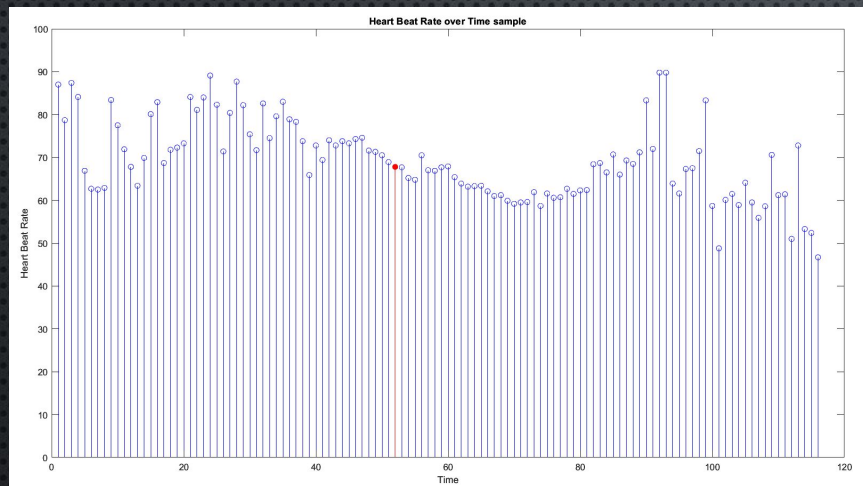
Ground Truth data

Subject 1 & 2



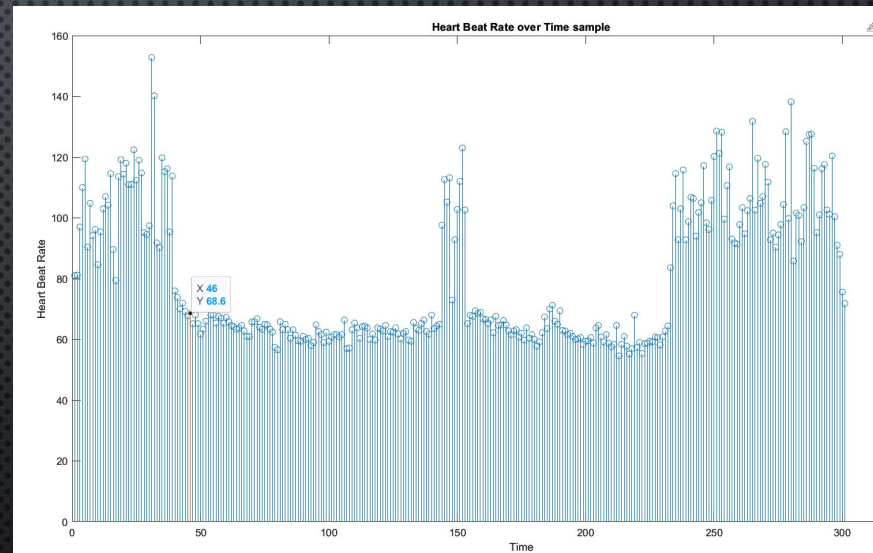
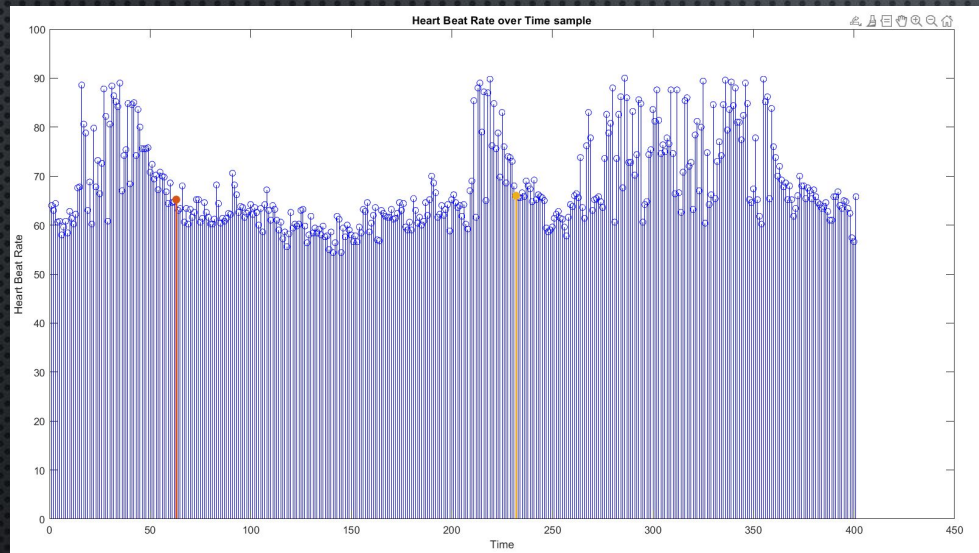
Ground Truth data

Subject 3 & 4

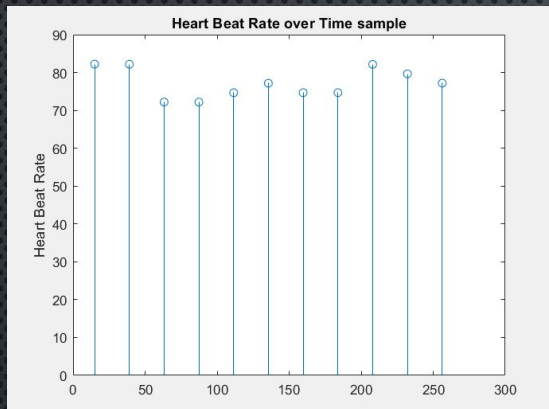


Ground Truth data

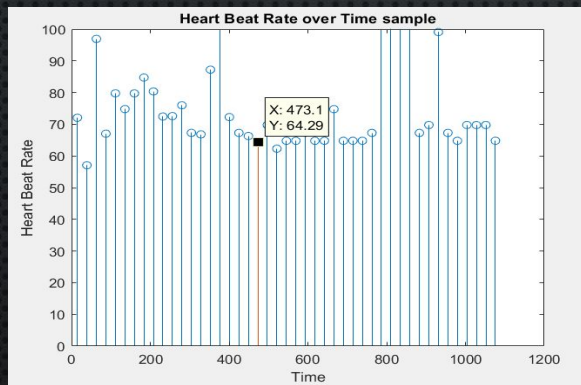
Subject 5 & 6



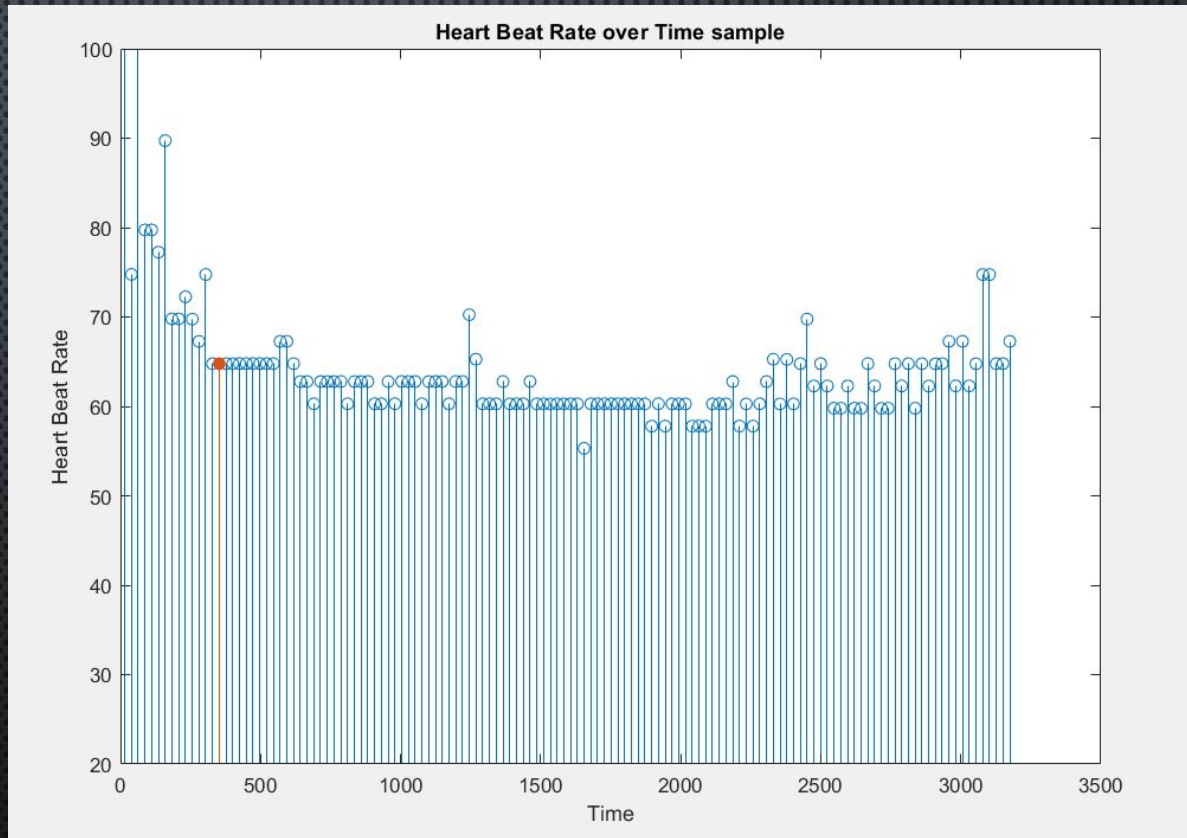
Experimental Data: Subject 1



normal

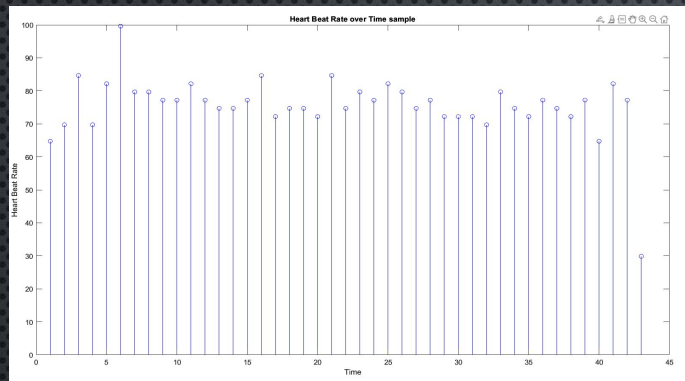


With transition

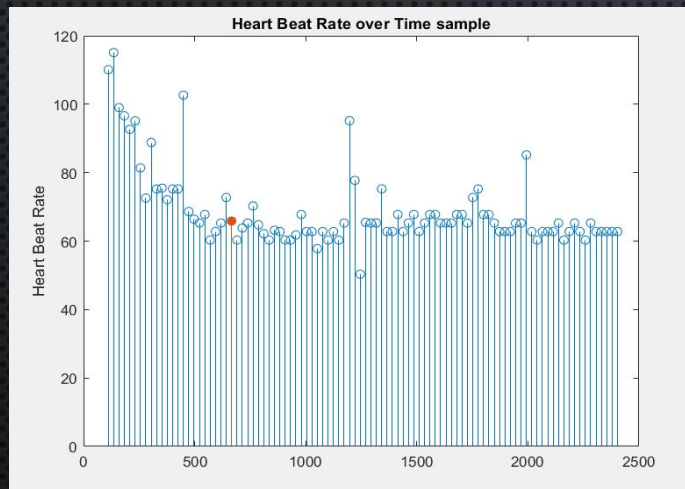


With transition

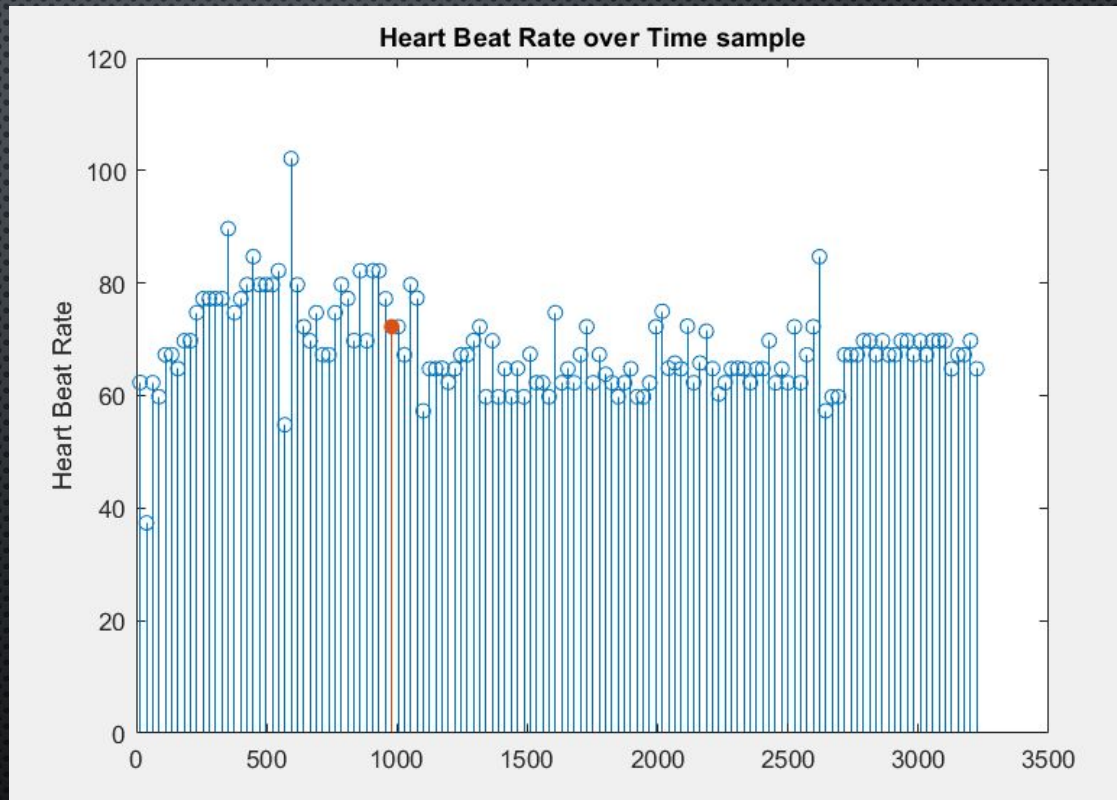
Experimental Data: Subject 2



normal

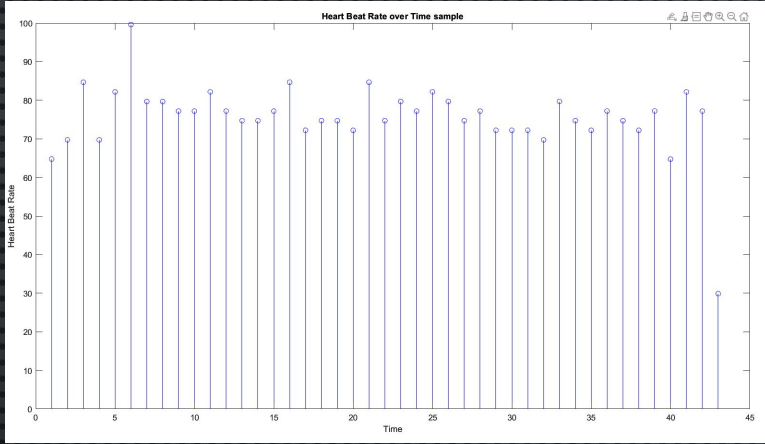


With transition

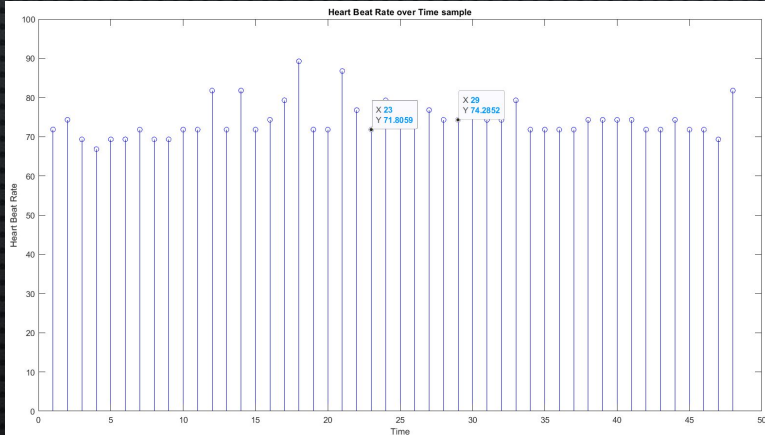


With transition

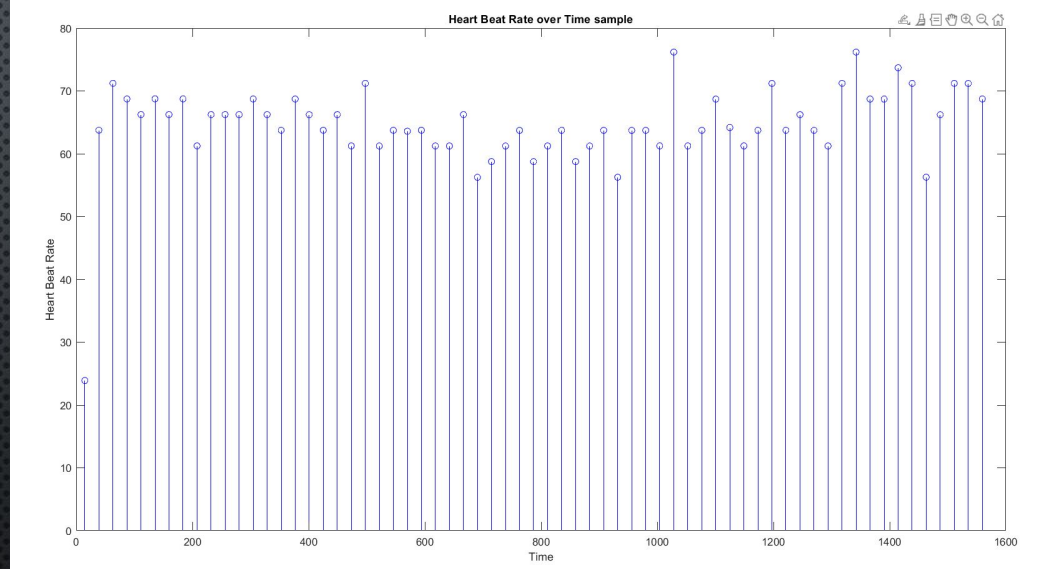
Experimental Data: Subject 3



Normal

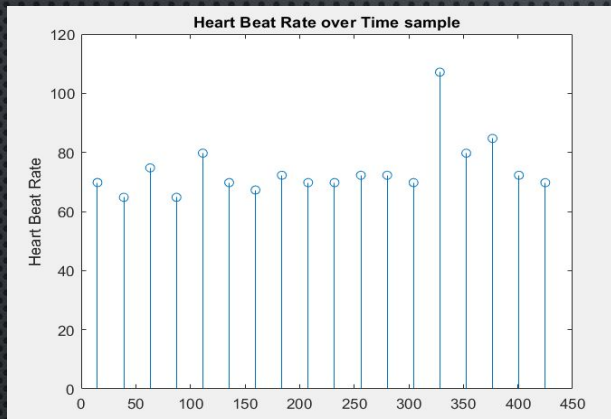


With transition

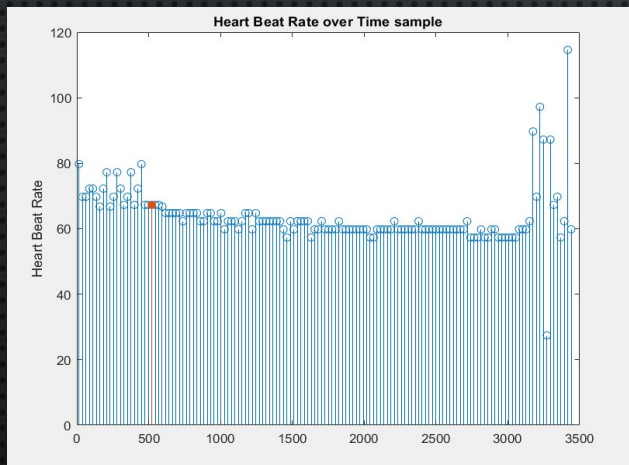


With transition (sleeping)

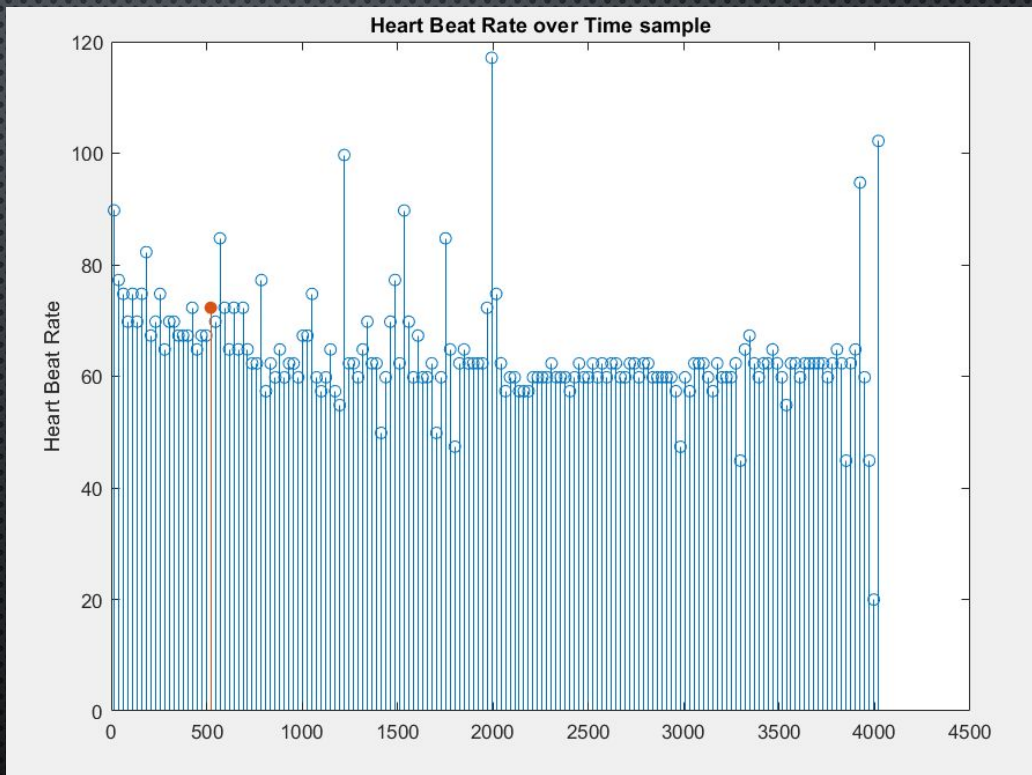
Experimental Data: Subject 4



normal

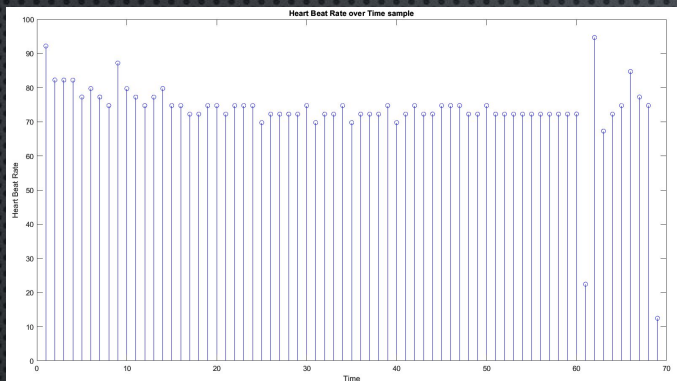


With transition

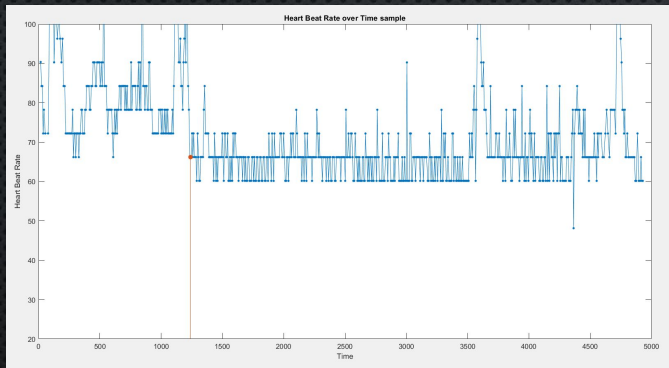


With transition (sleeping)

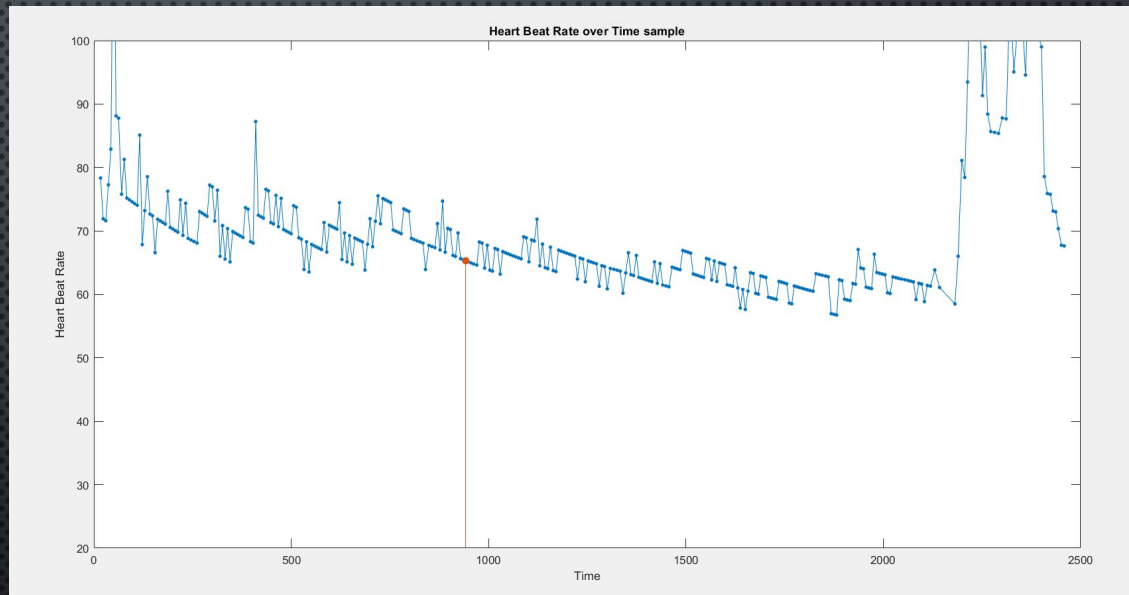
Experimental Data: Subject 5



normal

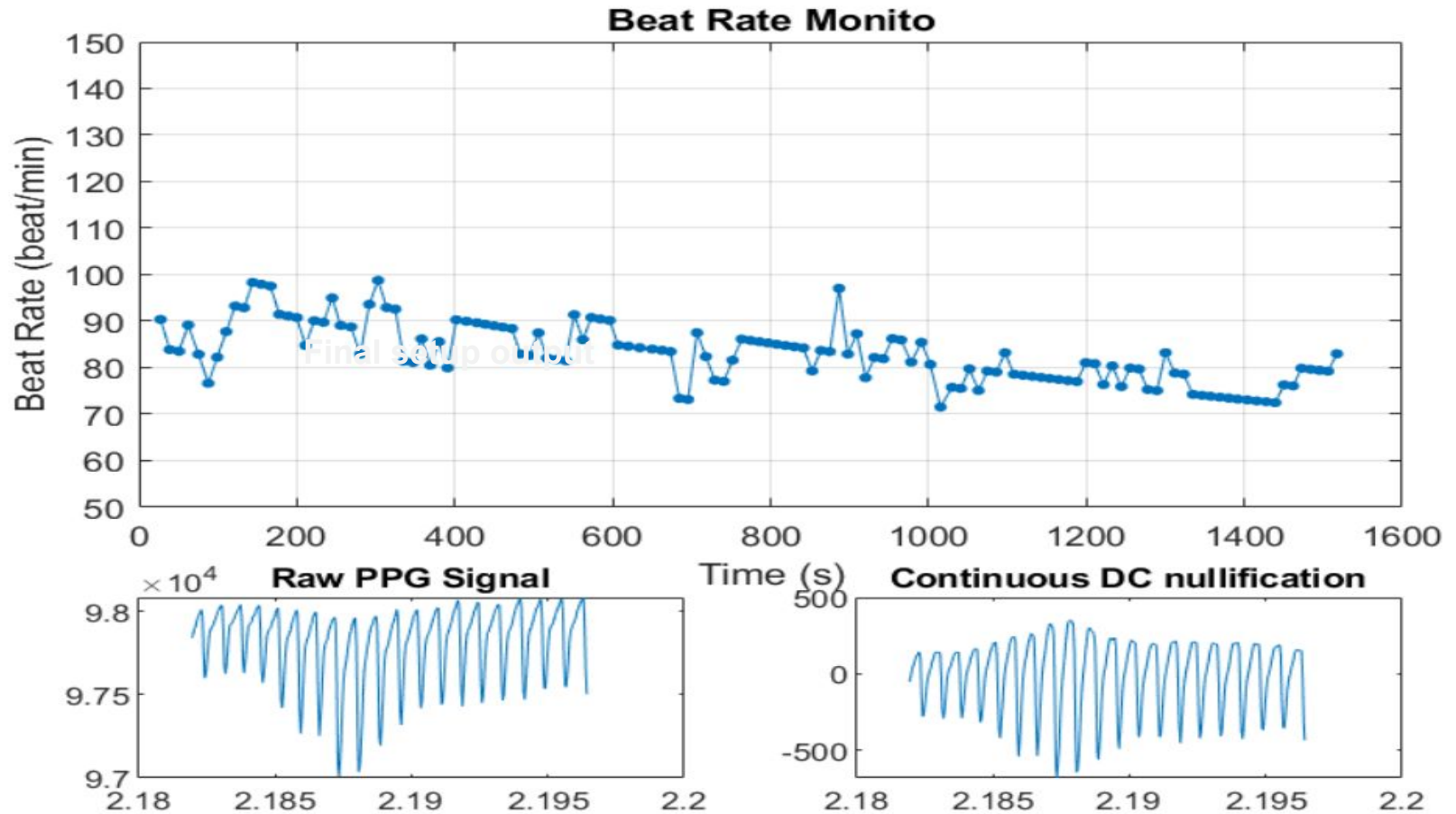


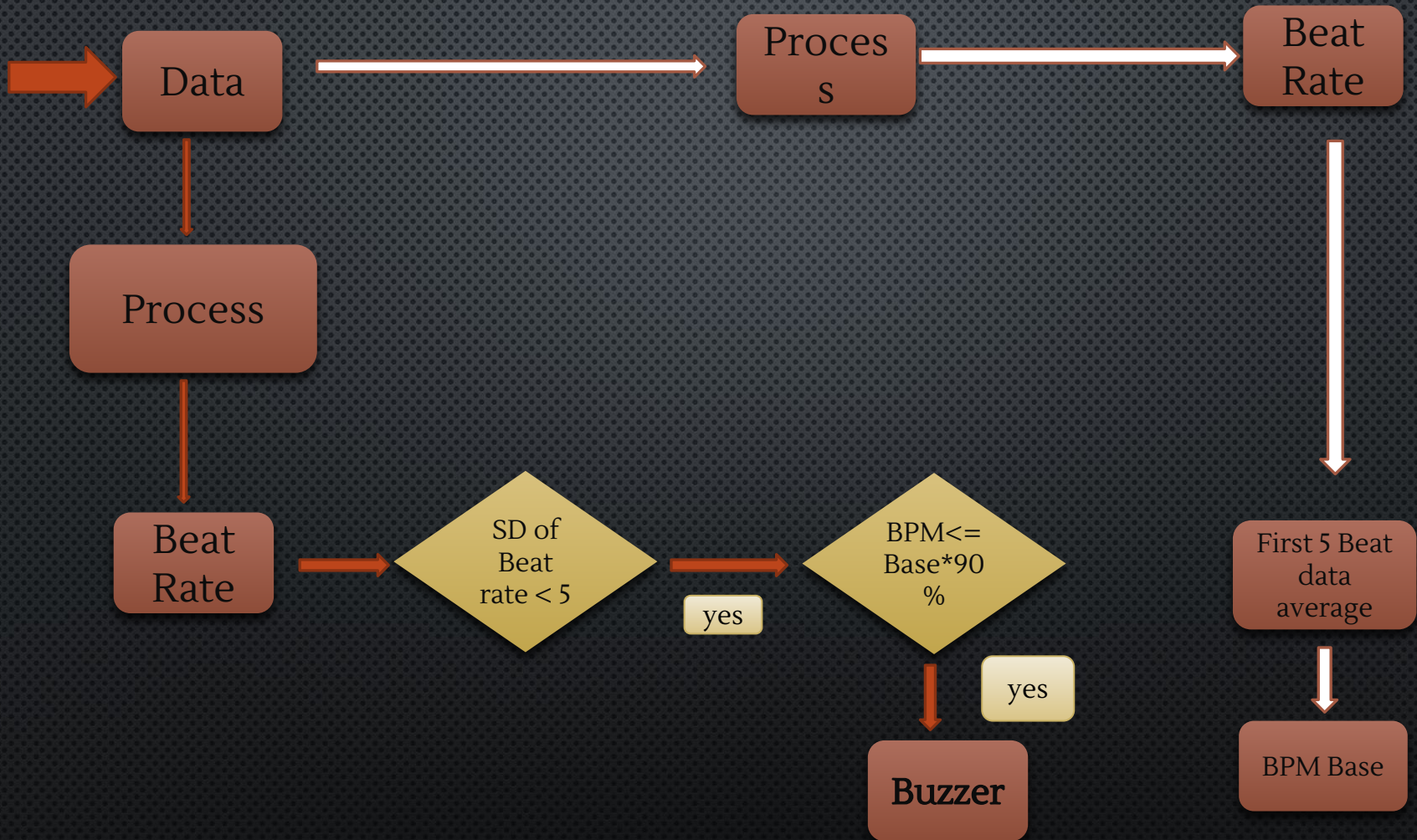
With transition



With transition (sleeping)

Final setup output





Decision

- From the experimental data we have seen that the heart rate of a person decreases when he starts to feel drowsy
- When the person feels sleepy, it is seen that heart rate decreases to 80% (approximately)
- We have set the threshold for transition between awake state and drowsy state to 80%

Social Impact & Future Aspect.

- This system can be installed in the car to detect driver's drowsiness. Now a days most of the accident happens because of driver's drowsiness during driving. Our proposed method could help to in this aspect which will reduce accient.
- Our device will also help in night guard where our device can make our guard awake if he feels drawsy.

Drawback

- MAX 30103 (PPG sensor) reads incorrectly when the device goes under motion
- While taking data, sometime false peaks arrive due to noise and bpm goes slightly higher

CONTENT OF THIS TEMPLATE

Component Name	Quantity	Price
Arduino Micro	1	600
Arduino Nano	1	500
PPG Sensor	2	1000
Smart Watch	1	13000
Pulse Oximeter	1	1400
Total		16500

Thank You!

