ReDesigning The Stethoscope

Team Motiv8

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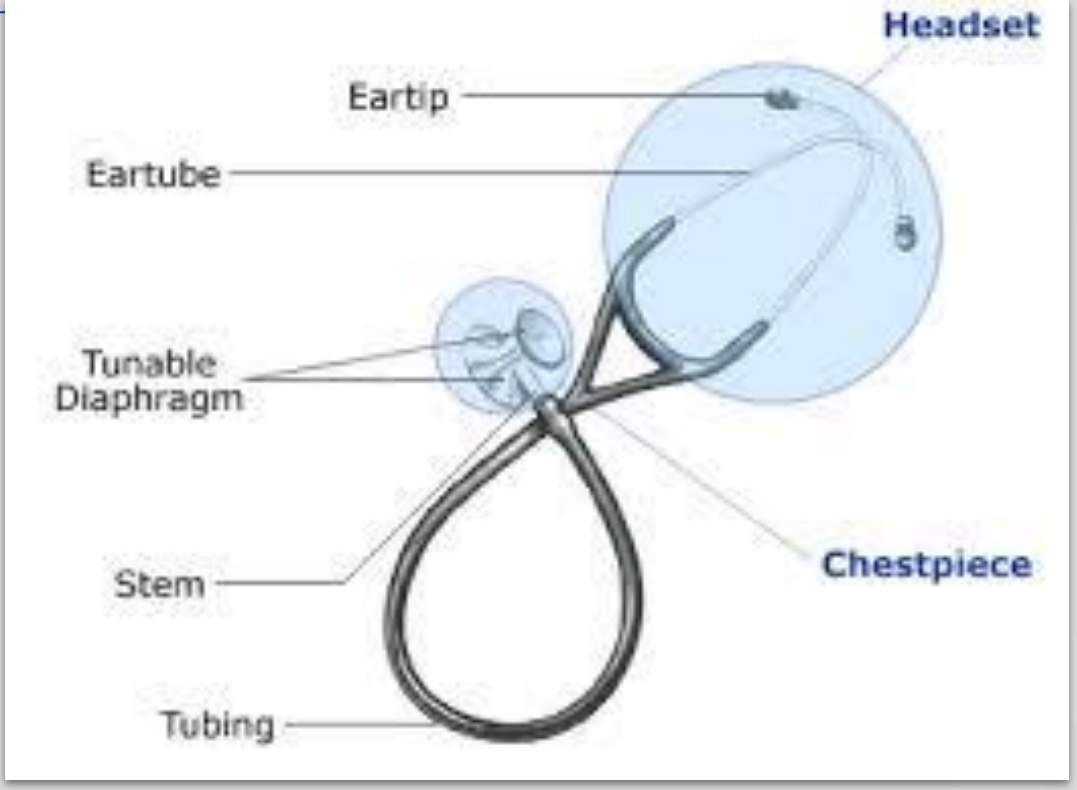
The Need for a new design:

- The design of a stethoscope has existed since 1816, when Rene Laynk built a wooden stethoscope with a significantly large chest-piece
- Medically, the stethoscope has had a stagnant design since that period, with the only redesigns being in the hearing part
- Internally however, the design has changed very less, and of late the inclusion of Electronic parts , has had little to no effect on the adaptability of the stethoscope.

Internal Structure - Reliable, Yes Renewed,No

- Auscultation opens up opportunities to understand bodily changes through one of the oldest methods in Healthcare: listening
- The Stethoscope works by passing and amplifying the resonations at the chest piece .
- The steth proves to be one of the most basic screening tests in any medical procedure.



ReDeSteth : A renewed Stethoscope

Stage 1 : The Hardware Redesign

Stage 2: The Software Integration

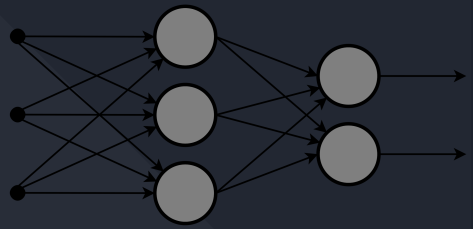
Stage 3: Hitting the market

Stage 1: Hardware Redesign

Key points to be noted here are:

- The original Chest piece design is to be maintained, so whatever components we build, goes inside the Steth Head as it is.
- A MCU that supports bluetooth transfer or any such wireless transfer is recommended, with cap on battery usage and support for flash storage. (Analysis of the Nordic **nRF52 Series as a feasible solution for the MCU usage)**
- Usage of KiCAD as a free OS software is recommended for mass marketing

Stage 2: Software Integration and UI/UX : (Current focus)



- Heart has particular types of beating patterns, closely associated with any malfunction going on the inside.

- A healthy heartbeat has a clear “lub dub lub dub” pattern. Anything which deviates from it can be labelled as:
  - *Murmur*
  - *Extrasystole*
  - *Artifact*
  - *Extrahls*

- *A model has been developed, employing LSTM networks , to beat this classification problem .*

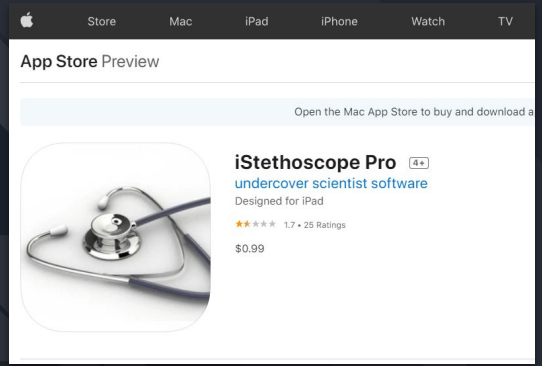
- Rather than ~~quantifying~~ the health of the Human heart by the Blood Pressure or Beats Per Minute (BPM)

- This approach aims at the classification of the type of the heartbeat which will help the medical practitioners to enhance the quality of their diagnosis

- Due to the unavailability of Actual sensor data, we started with the analysis of a Kaggle Dataset, made of data Collected from the iStethoscope Pro iPhone app.

- As a classic ML quote once read, “When in doubt of a signal processing problem, use MFCC”, the **Mel-frequency cepstral coefficient** is used as a factor for this learning problem.

- The model was built for classifying into 3 labels and run for 100 epochs, during which it got an accuracy of 73% for the given data.

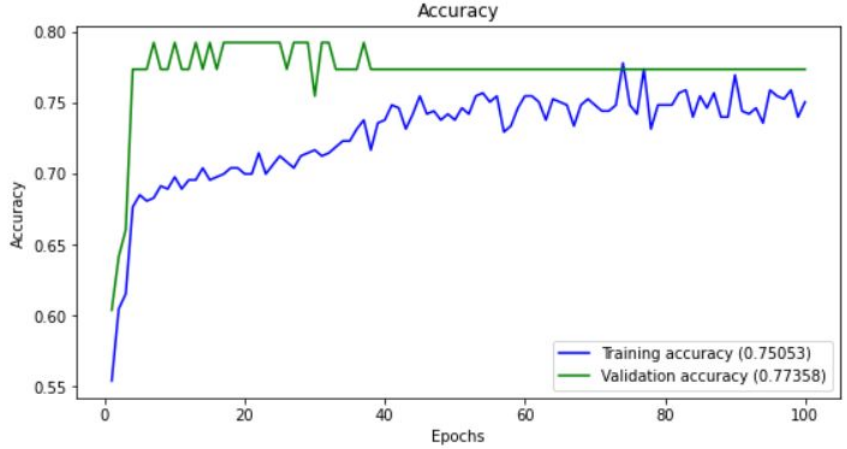


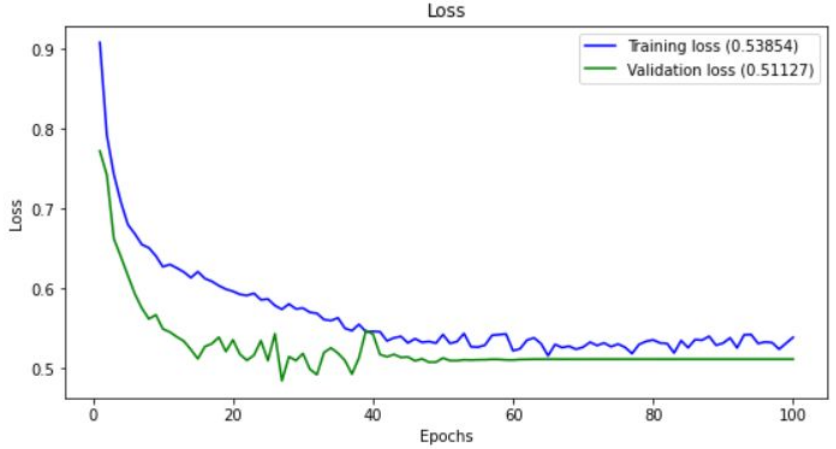
Health Data and Privacy

- Privacy is a part of a healthy life. Hence, we also introduced the usage of an encryption algorithm, like the **SHA Algorithm**, which scrambles the data at the transmitting end and unscrambles the data at the receiving end.

- Encryption provides valid security to health tracking

Metrics and Tuning: A rough overview



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CPU times: user 493 ms, sys: 36.7 ms, total: 529 ms
Wall time: 492 ms
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Loss and Accuracy comparison

Answering the key questions: **To Whom? How? Who else?**

Stage 3: Market analysis

1. The main target market is the Medical fraternity , ranging from MBBS students to Expert Respiratory Physicians.

2. The Key to the How question would be sequential. Regulations (IN) mandate that medical devices are to be treated like drugs, thus obtaining of a valid license post all testings of the product is a good first step

3. Due to the minimal to no presence of similar products in the market, we are sure that the product will get a good footfall when it is released. The comparative reduction in cost provides a good incentive for people hesitating

Key Competitors

Thank you!