

iHearIT

World's most economic and Intelligent Hearing Aid

Healthcare Democratized

Intelligent and Precise Healthcare

Sensorineural Disorder is a state of a patient's hearing where hearing for selective frequencies gets impaired.

Out of 13 crore Indian patients suffering from partial hearing loss more than 95% suffer from sensorineural disorder.

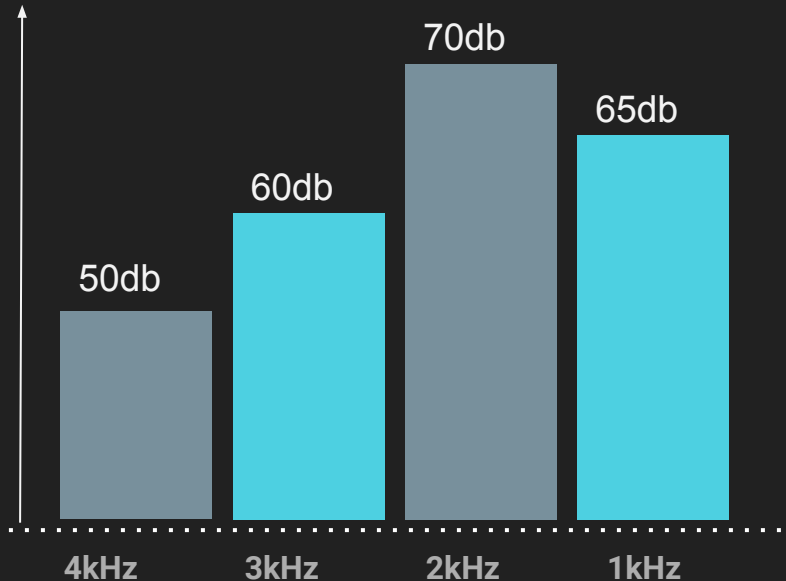
Out of these 12.35 crore Indians, more than 90% people generally don't get treated properly and their hearing conditions continues to worsen.

Our aim is to find a way of treatment for all 13 crore patients.

The Existing Paradigm of Treatment

Step 1: Audiometry

The patient goes to Clinic where he is subjected to the audio of various frequencies and intensities. On basis of feedback of patient of his/her ability to hear these sounds, a graph is made against frequencies and threshold intensities. This graph is called audiogram and this process is called audiometry.



Step 2:

Digital Hearing Aid and Tuning

On basis of the audiogram, the patient is provided with a wearable device which selectively amplifies the input sound. This device is called a Digital Hearing Aid and it is tuned on basis of the audiogram.

Step 3:

Audiometry is recommended to the patient as frequently as possible, generally carried out bimonthly. Hearing aids are fine tuned after each audiometry

Although not apparent, this paradigm has many loopholes because of which digital hearing aids are not being accepted by patients

Problem 1

Digital hearing aids are **Expensive**, unaffordable to the major part of the Indian population.



Proposed solution

Digital Hearing Aids work on processing of Digital Signals and processing of Digital Signals requires a computer which makes the device expensive.

Smartphones are being widely used throughout the world by almost all economic classes. These are rich in computational power and can be used to substitute the computers of Digital Hearing Aids.

Alternatively, available computers at home or mini-computers like Raspberry Pi zero.

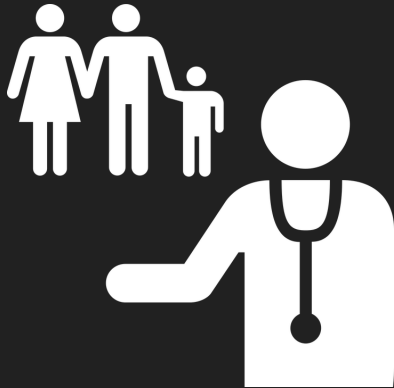
This simple transition reduces the cost by 70% and opens doors to more advanced and adaptive processing of audio which will enable us to solve other problems associated with the current paradigm.

Problem 2

The hearing condition of the patients changes more frequently than every week/month which means audiometry and of hearing aid needs to be done more frequently.

Since **Doctors to Patients ratio is very low**,

it's not feasible for the doctors or patients conduct these audiometry sessions



Proposed solution

We believe that 'those who can't do, automate'.

Taking the benefit of availability of Smartphones, we incorporated the entire process of audiometry into a smartphone app - iHearit. Just like in the conventional process, audio of different Intensities and frequencies will be played to the user and their response to those will be recorded by Can-hear/Can't-hear technology.

The process will be as simple as just touching the screen of mobile device or just few click if mobile device not available which is suitable for all age groups to use.

The process of automation is explained in next slide

The Procedure for Patient

1. Login with the credentials
2. Click on Begin Test
3. For different beeps played, tap on Can hear or Can't Hear

This process can be completed by either of these methods:

- a. Performed by patient themselves
- b. Guided by Chatbot
- c. Booking a specialis (Chargeable)



This process generates an audiogram which is uploaded on the cloud

(Frequency in Hz)

From Audiogram to Tuning Function

This process will generate an audiogram which will be uploaded to our cloud. Each audiogram will be regressed extensively using

1. Machine Learning algorithms based on Information Entropy, Polynomial Regression with Regularization Consideration and Logistic Regression.
2. Deep Neural Networks processing the audiogram to a 100 point boolean data space, providing more data for processing.
3. Reinforcement Learning Algorithms, considering the Boolean Audiogram and providing an associated tuning function.

These algorithms return a computationally economic audio tuning functions. Live audio will be sent to the smartphone from the patient's headset. This audio will be processed by the tuning function and will be sent back to the patient's headset in real time. This process won't require Internet Access.

HEARING LEVEL IN dBHL (ANSI 2004)

Problem 3

Signal to noise ratio is low which makes it unacceptable for the patient to use. In crowded situations, patients can't tolerate the noise coming through and can't focus on their conversations.

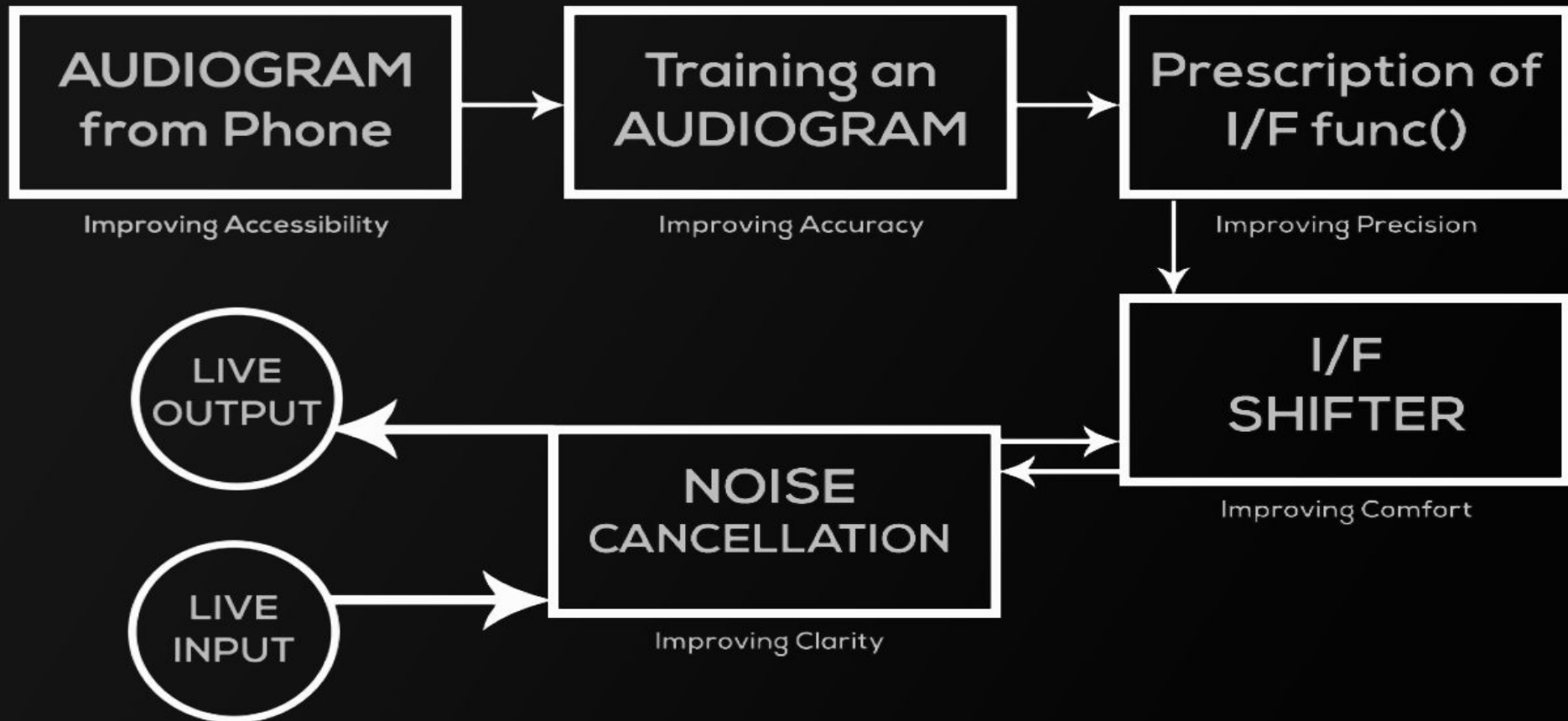


Proposed solution

Taking advantage of the extensive computational resources available on the mobile phone, the spectral components of audio which the patient wants to focus on can be recognized by further analysis of the Fourier Transform of real-time audio.

Recognition of these desirable components gives us the details of the other undesirable components which can be suppressed, hence increasing the comfort of the patient.

Overall Process



Past Attempts

There are many publications done concerning the application of Genetic Algorithms in Audiogram Regression.

On Google Play Store, some apps have tried to implement the audiometry process but fail considerably due to the uncalibrated I/O devices and inefficient algorithms being used.

So far, there has been no acceptable solution to this problem as the previous attempts fail to address the problems clearly.

Tentative Timeline

April 2019 to June 2019

Clinical Trials, Cross
Validation and Iterations



Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sept

Oct

Nov

Dec

April 2019

Development of first
successful prototype

Mid August 2019

Submission of a market
ready product

Existing System VS Proposed System

1. Cost of Device: Rs 25,000
2. Reliable time: 2 years
3. Audiometry: Rs 500 per visit
4. Takes 30 minutes for test
5. Low Signal to Noise Ratio

1. Cost of Device: Rs 5,000 max
2. Reliable time: 5 years
3. Audiometry : Free
4. Takes 5 minutes for test
5. High Signal to Noise Ratio



Purchase Options for Customers

Sr. No.	Variant	Cost Price (INR)
1	Smartphone App + 3rd Party Headphone	2000
2	Smartphone App + Custom made ergonomic Headset	3000
3	Mini Computer + 3rd Party Headphone	3000
4	Mini Computer + Custom made ergonomic Headset	4000
5	Mini Computer + Smartphone App + Custom Made Headset	4000
6	Mini Computer + Smartphone App + 3rd Party Headphone	5000

The Market

- More than 10% of Indians are patients suffering from Sensorineural Disorder. Out of, only 10% of patients i.e 1% of the total Indians can afford to buy Digital Hearing Aids. Even these 1% of Indians, face the problems apart from affordability. This gives our product more than 13 Crore potential Customers all over India.
- Tie ups with Headset manufacturers are also desirable considering mutual benefit of sales
- Considering the average minimum cost of making one product as ₹1000 and marketing and publicity cost to be ₹500 per product for reaching till end user we can assume minimum profit of ₹500 per product for initial phase.
- So what's the big number ?

A 3D bar chart with seven bars of increasing height from left to right. A large 3D arrow points upwards and to the right, passing behind the text.

₹1.3 crores

Considering a minimal average profit of Rs 500 per customer,
even if reach out to only 2% of Indian patients of Sensorineural Hearing Disorder
in one year

Recognition

GE Healthcare Precision
Health Challenge 2018:

Among top 5 at National
Level

Testimonial

A perfect attempt to
Democratize Healthcare in
today's world, hope to see
your product in market soon

- Dileep Mangsuli,
CTO at GE HealthCare

Our Motivation?

HealthCare DemoCratized

Our families have many people in the age range of 55-80, most of them suffering from a sensorineural hearing disorder. Considering them as case studies, we have observed the existence of above-mentioned problems. Being in the middle class, our elders can afford to buy Digital Hearing aids, but a vast majority of the world suffer from the sensorineural hearing disorder and can't afford to buy Digital Hearing Aids.

This is an attempt to make the world a better place, make Healthcare more accessible to the general public.