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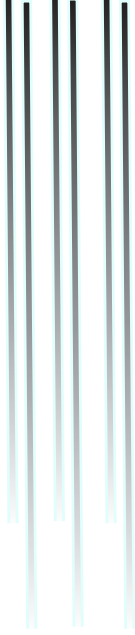
Musical instrument design :To design a product in the world of music

Project II

Project Guide
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THE JOURNEY

The thought
Objective and expected learning

Understanding concepts

Explorations

Various directions and evaluation
The concept and evolution
The instrument

Future scope
Conclusion



The topic

Music is the medium, through which one can express his thoughts and feelings. It is the sum total of the experiences and emotions which are not bound by time, community and rationality.

Force of music is strange where it expresses everything but nothing in particular. Music is intangible, but can be felt and experienced. This is where the musical instruments play its role by making music an experience where one gets a medium to express.

Thus a musical instrument is a device constructed or modified with the purpose of making music. In principle, anything that produces sound, and can somehow be controlled by a musician, can serve as a musical instrument.



The thought

I have chosen to consider the topic 'to design a product in the world of music' which is about relation of imaginative mind to different aspects of art of music. More I live the life of music the more I am convinced that it is freely imaginative mind that is at the core of all vital music making and music listening. Music is the medium through which one can express his thoughts.

Being a design student, and being genuinely interested in music, I desire to learn design process that involves systematic research, planning and its implementation towards the universal art form: music, and its variations. Being a musician, and even knowing music I observed, analyzed that I should work over areas with respect to musical instruments. Apart from redesigning and modification of such instruments, there could be new innovation possibilities.



Objective and expected learning:

The objective of this project is focused towards designing a product in the world of music, a new musical instrument that has definition sound and will introduce a unique experience and style of perceiving music.

The study is a systematic approach to do a research on acoustics, theory behind building of various string instruments, studying existing theories of music. These will help me understand and explore various aspects regarding musical instruments such as instrument building, tuning of an instrument, its evolution, the style, experience, sound and existence.

Also to develop an instrument which blends technology and music, it is imperative to understand various technical aspects, basics of sound engineering, science and contemporary musical products.



Understanding concepts:

Before actually stepping into the ideation its necessary to understand basic concepts, history, musical products those already exist and the way they evolved.

Here I desire tounderstand the following concepts:

- Music

- Sound and acoustics

- Musical Instruments: Definition and classification

- Musical string instruments

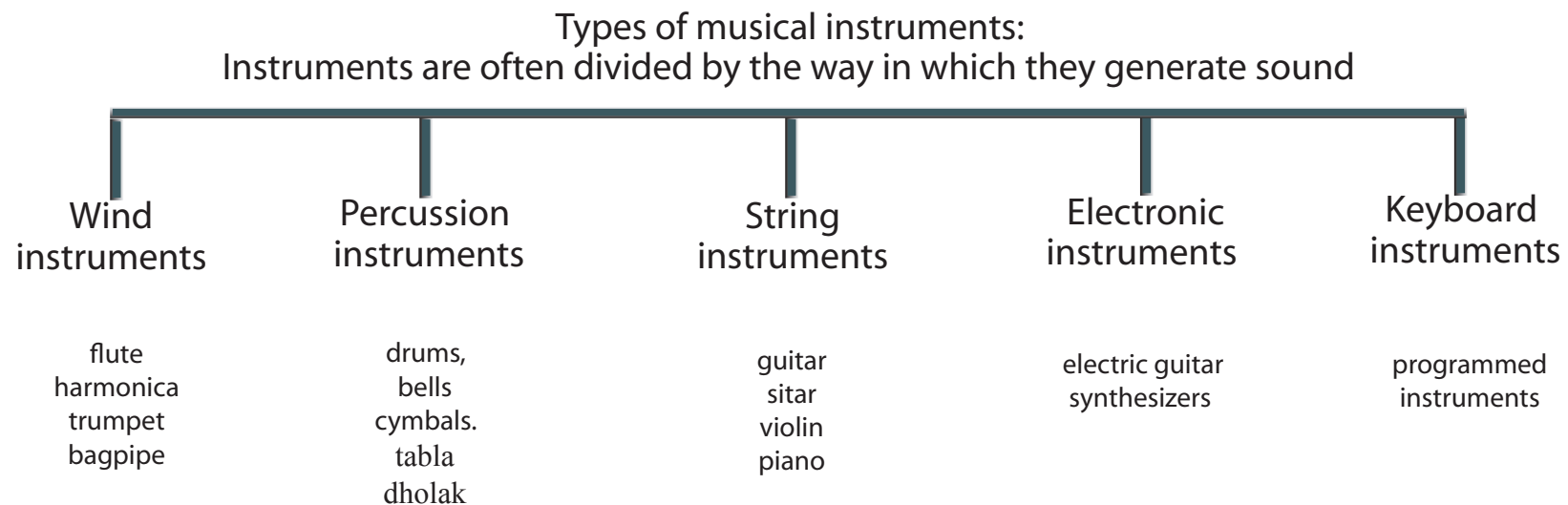
- About Indian string instruments

- About western string instruments

- Existing experimental, redesigned musical instruments

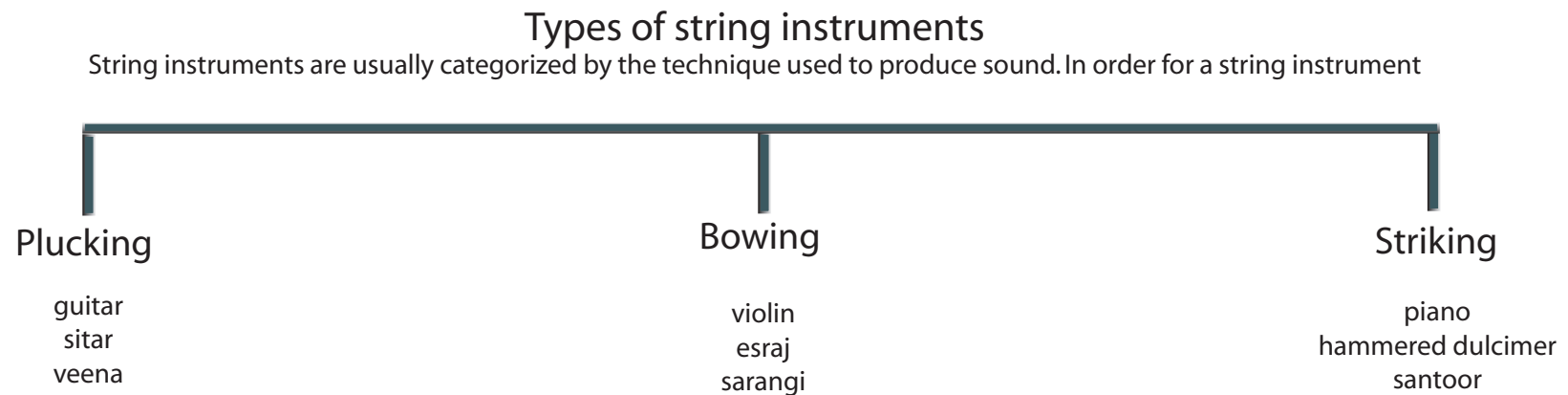
Musical instruments:

A musical instrument is a device constructed or modified with the purpose of making music. In principle, anything that produces sound, and can somehow be controlled by a musician, can serve as a musical instrument. The expression, however, is reserved generally to items that have a specific musical purpose. The academic study of musical instruments is called organology.



String instruments:

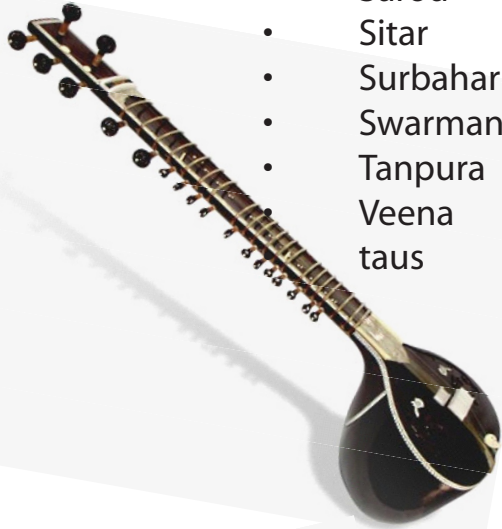
A string instrument (or stringed instrument) is a musical instrument that produces sound by means of vibrating strings. In the scheme of musical instrument classification, used in organology, they are called chordophones.



Introduction to Indian string instruments

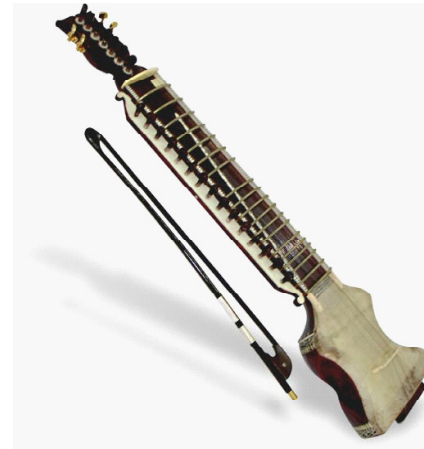
Plucked:

- Ektara
- Sarod
- Sitar
- Surbahar
- Swarmandel
- Tanpura
- Veena
- taus



Bowed:

- Esraj
- Sarangi
- Sarinda



Struck:

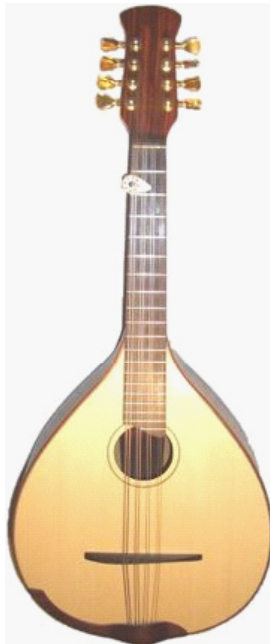
- Santoor



Introduction to western string instruments:

Plucked:

- Banjo
- guitar
- Theorbo
- Mandolin



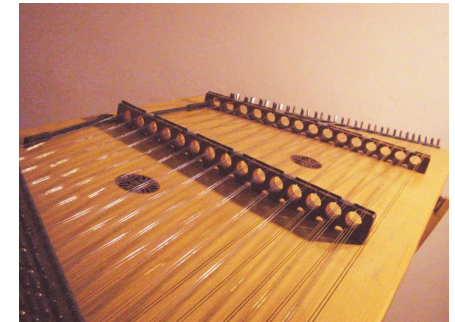
Bowed:

- violin
- Electric upright bass



stucked:

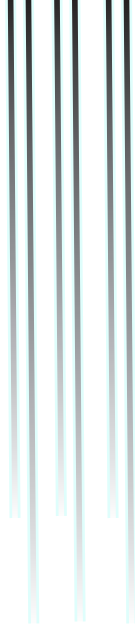
- piano
- hammered dulcimer



Experimental, redesigned string musical instruments:

1. The Amazing Pencilina
2. Bazantar
3. Bowafridgephone
4. The Dijbass
5. Electric violoncello
6. Former Guitars



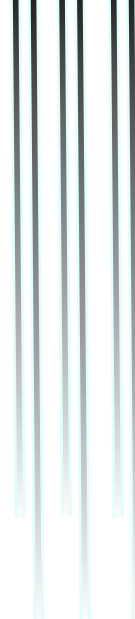
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Explorations:

Various directions and evaluation

The concept and evolution

The instrument



Ideas are grouped into three basic categories.

1. A product that introduces new experience and style:

This group represents ideas that extend or break the existing way of playing or experience with the instrument. This may have a blend of music and other art forms. This can be an attempt to extend the concept of music from audible art to audio-visual experience. Ideas may introduce a product that is meant for anybody who has inclination towards music.

2. A product that is complete in itself from music point of view:

Music is group activity when it comes to performing and can be practiced individually alone. Performing music demands 3-4 musicians play together to give it a complete sense. Ideas belonging to this cluster throw light on completeness of a musical product and its relation to individual.

3. A product that has unique sound:

It consists of some ideas and experiments that generate a new definition of sound that can't be readily related to existing instruments or sounds. With digital modulation and processing almost every kind of sound can be generated. But digital; processed sound has its own limitation in terms of feel and appreciation. Here attempt is to achieve a new earthy sound through acoustic experiments.

product that introduces
new experience and style:

Cluster 1

1. A .Musical canvas

1. B . Musical dance floor

1. C . Lets play

1. D . Larger than life
instrument

product that is complete
in itself:

Cluster 2

2. A . One man band

2. B .Composition friendly
instrument

2. C . Folk harp

2. D .stringed percussion

product that has
unique sound:

Cluster 3

3. A .fluid filled
instrument

3. B . String rhythm
instrument

3. C. Elastic string
instrument

3. D. Piston instrument

product that introduces
new experience and style:

Cluster 1

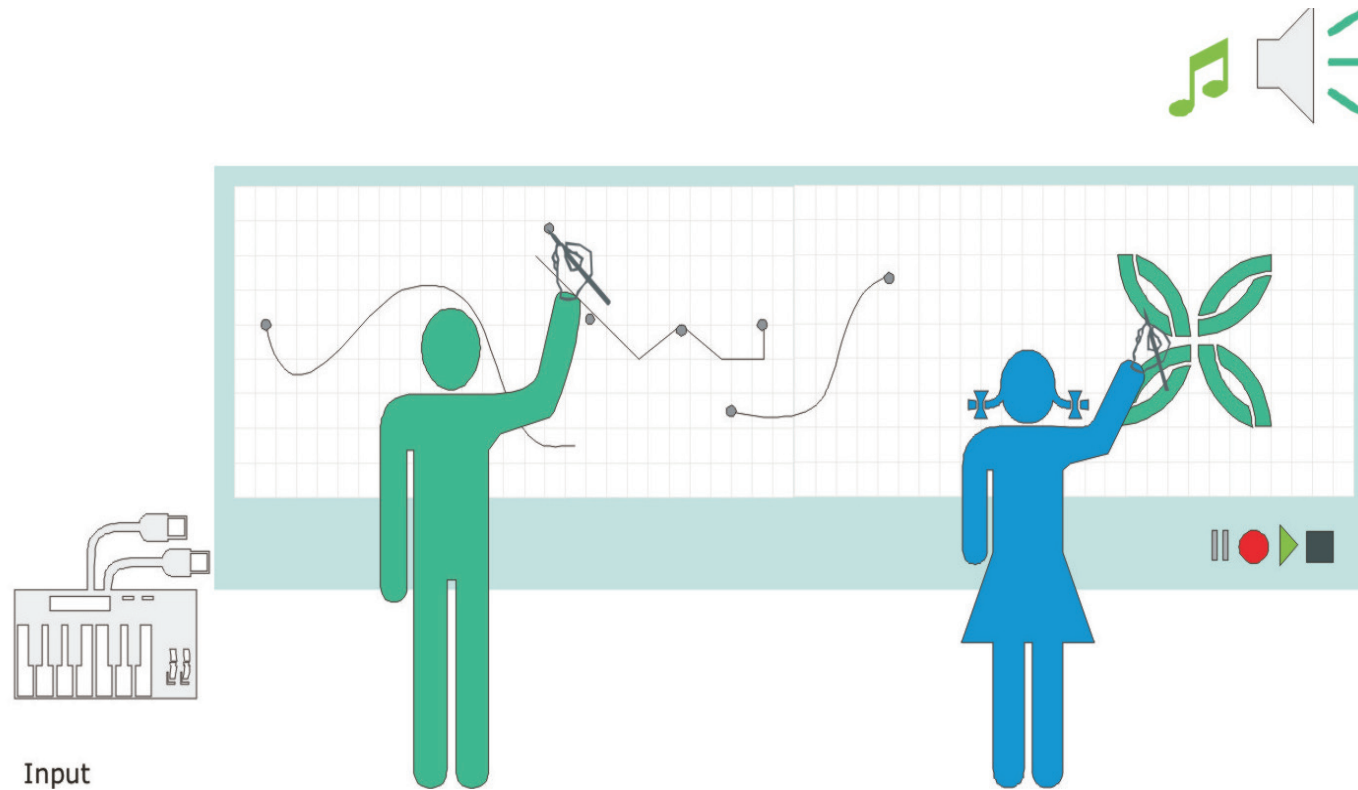
1. A .Musical canvas

1. B . Musical dance floor

1. C . Lets play

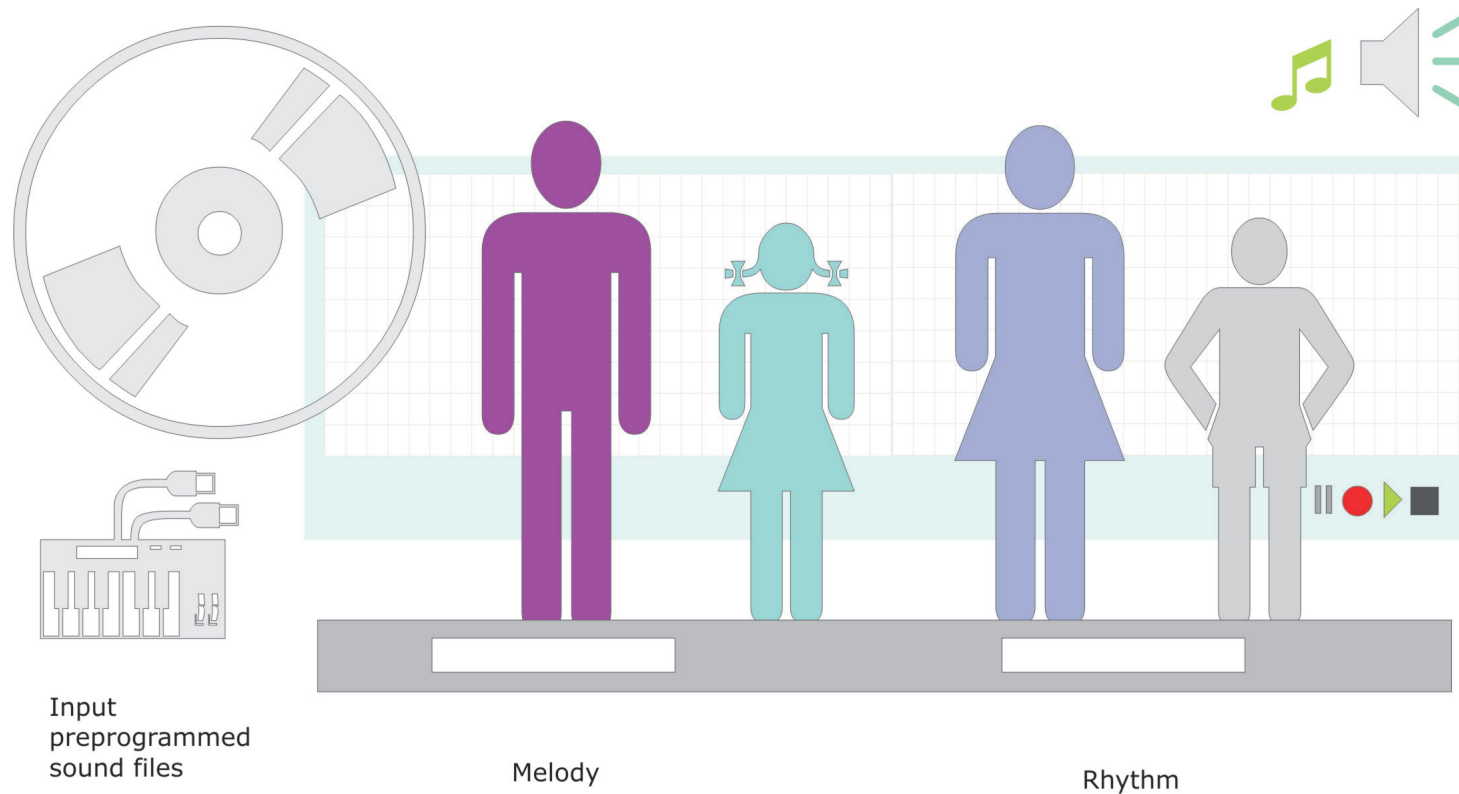
1. D . Larger than life
instrument

1. A .Musical canvas



Musical graffiti is an interactive musical installation or canvas that blends music with art of sketching or painting. And to be installed at art school walls or any education institute and even can represent art on theatre level.

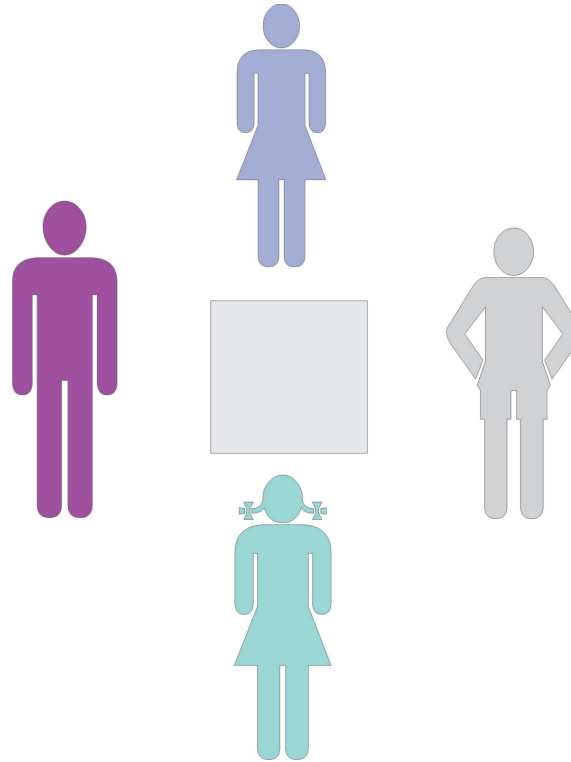
1. B . Musical dance floor



Musical dance floor is an installation that blends the art of dancing with the music creation. Tap dancing is a form where dance actually creates music but again tap dancing involves lot of practice and training. Musical dance floor is an easy entry platform where amateur dancer can also participate and enjoy.

Platform has various regions where dancing on them creates different sounds. So group of people dancing in synchronization will create meaningful musical experience.

1. C . Lets play



Playing music together helps establishing indirect communication between people. There can be a group musical instrument that has melody, harmony, rhythm together and people can play it together, when they all are jamming up nicely, they understand, that now they all are equally participating, involved. This will help them concentrating, and being focussed.

1. D . Larger than life
instrument



Instruments if extended and seen in magnified context can be used as day to day life installations.

Generally musical instrument is designed for one; it's a personal experience when it comes to playing. Can there be instrument that is meant for more than one guy who can play simultaneously??

E v a l u a t i o n

Cluster 1

A product that introduces new experience and style:

	Unique sound	Control & specification	Completeness	Experience/ style	Feasibility / illustration	Total
1. A . Musical canvas	3	5	7	8	2	25
1. B . Musical dance floor	2	4	6	9	3	24
1. C . Lets play	3	7	7	8	8	33
1. D . Larger than life instrument	2	4	4	5	5	20

product that is complete
in itself:

Cluster 2

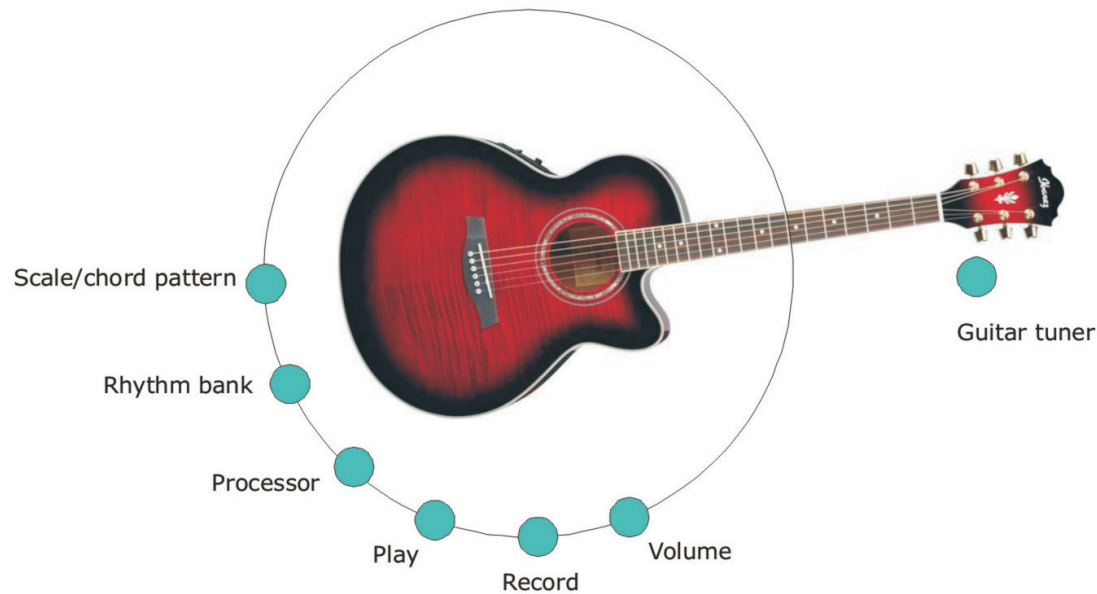
2. A . One man band

2. B .Composition friendly
instrument

2. C . Folk harp

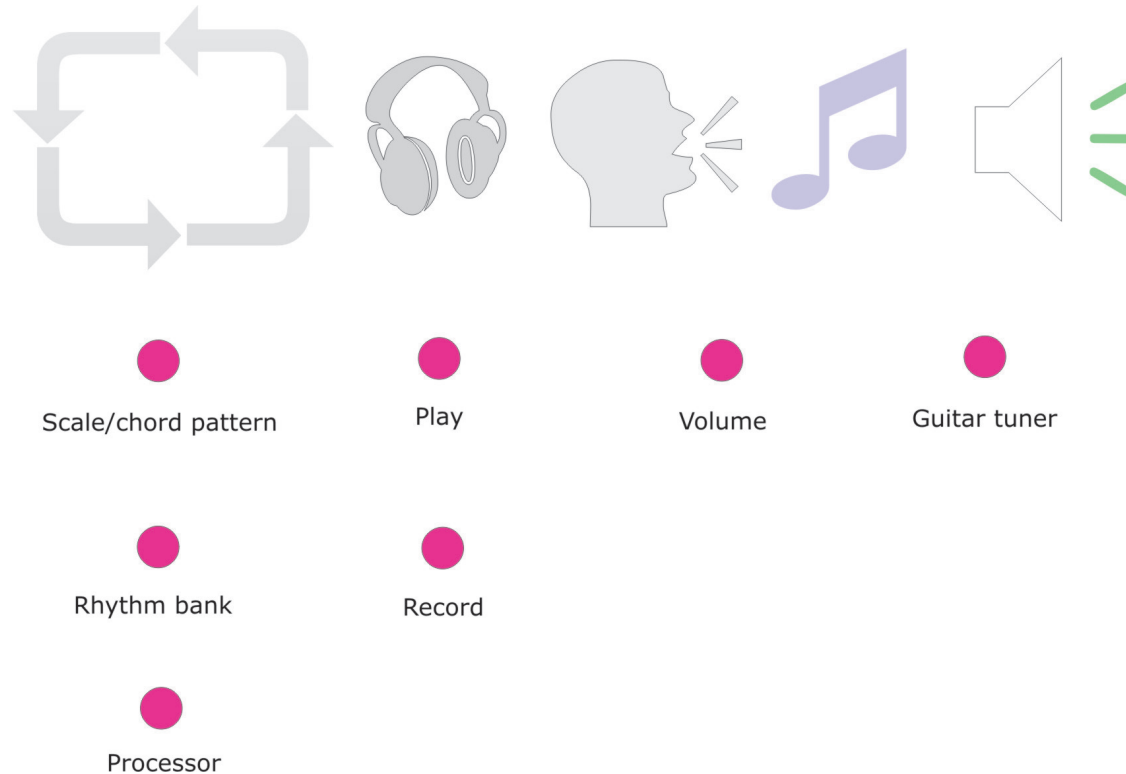
2. D .stringed percussion

2. A . One man band



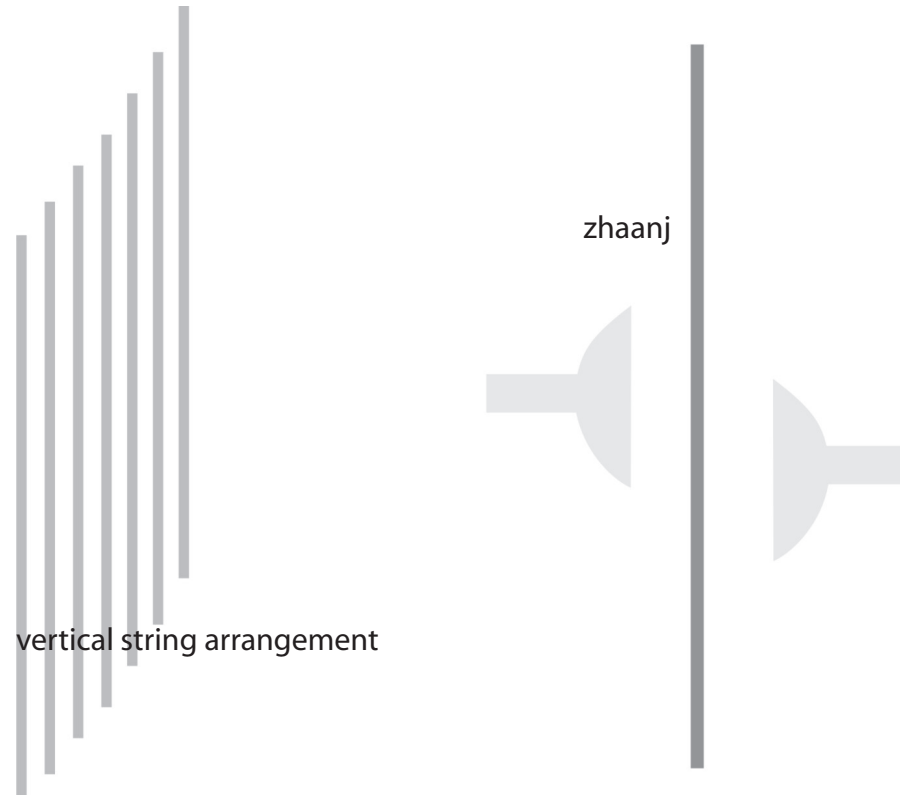
Rhythm, melody, vocals played simultaneously helps composing songs. Even it helps learning an instrument. You get all such things separately as of now like rhythm bank, processors to record and playback. So musician has to depend on such devices to compose or play music. So can there be a single guitar that takes care of above issues and helps creating new music??

2. B .Composition friendly instrument



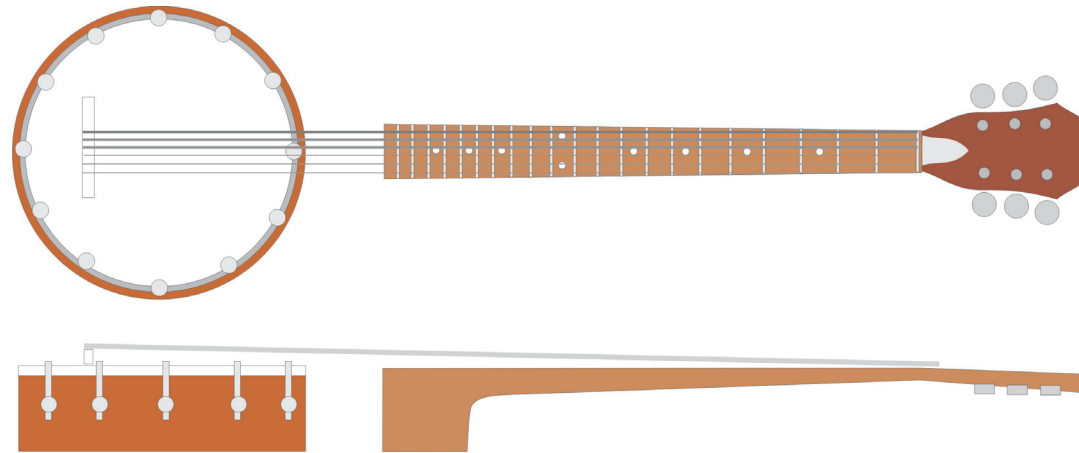
Composition friendly instrument is digital derivatives that helps u creating new music or explore new composition possibilities. It's a small portable electronic device that has Necessary inputs required for composition and accompaniment.

2. C . Folk harp



Harp is an instrument that creates waves of notes those act as a basic reference for the singer. It is very similar to Indian instrument swar-mandal. Folk harp will be a harp like string arrangement where player strums or strikes the instrument using zhaanz, clap discs.

2. D .stringed percussion



Stringed percussion is a combination of stringed instrument similar to guitar and percussion drum. Here strumming the guitar it self make strings to hit the membrane and that creates mixed effect. It's a complete instrument in itself as it gives complete a accompaniment and cal also used for solo performance.

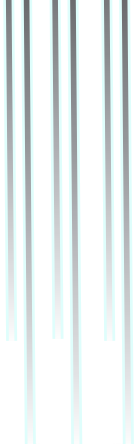
E v a l u a t i o n

Cluster 2

product that is complete
in itself:

	Unique sound	Control & specification	Completeness	Experience/ style	Feasibility / illustration	Total
2. A . One man band	3	5	7	7	4	26
2. B . Composition instrument	2	4	6	6	3	21
2. C . Folk harp	6	4	7	6	5	28
2. D .stringed percussion	8	7	7	7	8	37

product that has
unique sound:



Cluster 3

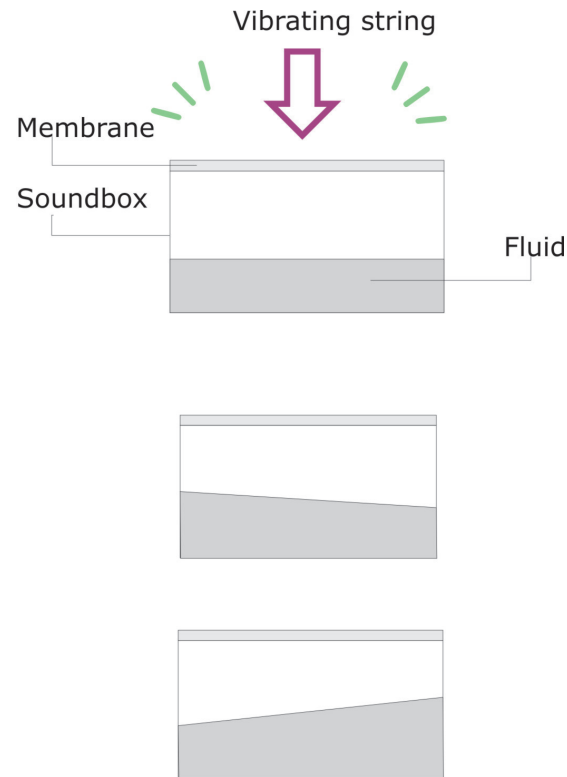
3. A .fluid filled
instrument

3. B . String rhythm
instrument

3. C. Elastic string
instrument

3. D. Piston instrument

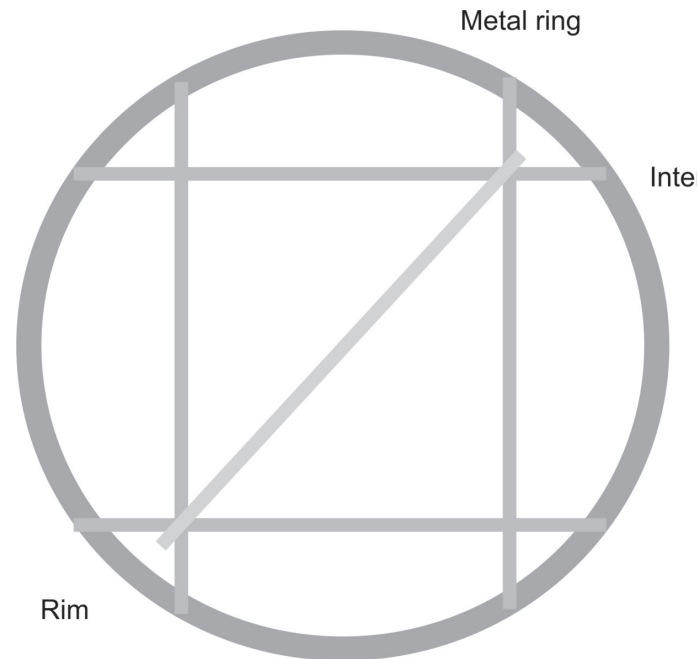
3. A fluid filled instrument



Every stringed instrument has strings under tension and a sound box. When strings are plucked they vibrate and sound box amplifies the sound.

So imagine a case where the sound box is partly filled with the fluid, and string is plucked. Now moving the sound box moves the fluid inside that further displaces the air in the sound box. This gives a changing sound, notes those are in-betweens and amorphous.

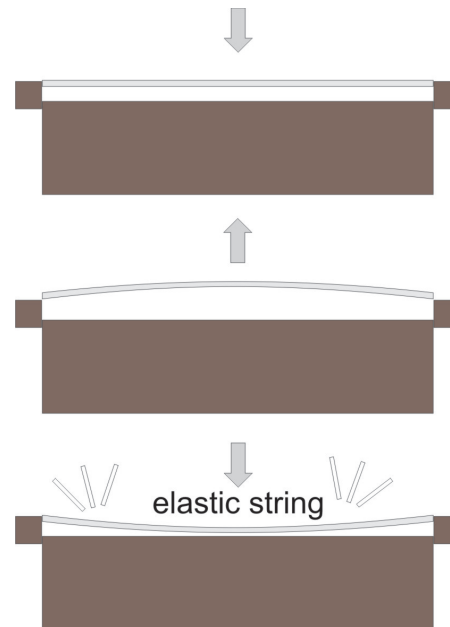
3. B . String rhythm instrument



Drum kit is a popular rhythm instrument for contemporary western music, rock, jazz, fusion. But drum kit has huge set up, size, and cost. Simulated drum pads are also available those give same feel as that of drums.

Stringed rhythm is an instrument that has base strings and rods or bars mounted on a rim. And one can play this using drum sticks. It's a low cost alternative for the drum kits and can be used where actual kit is not available. Here attempt is not to simulate drum sound but to have alternative option that fill in the rhythm.

3. C. Elastic string instrument



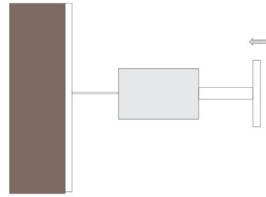
It's a kind of percussion instrument that has strings.

Stringed used will have elastic properties. Those string will be closely wound over a membrane. Imagine a rubber band over a tightly held membrane. Now pulling the string and leaving it will make a sound as string goes back to hit the membrane.

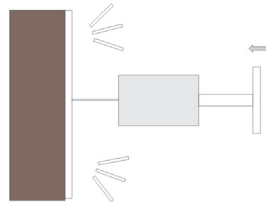
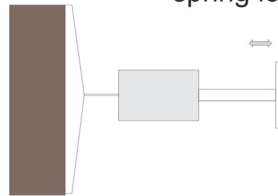
Due to elastic properties of the string, it makes unique sound when it hits and vibrates over the membrane.

3. D. Piston instrument

principle



spring loaded piston



Instrument is a derivative of ektara. In ektara after plucking the string pressing the wooden sticks changes the scale length and hence the sound.

E v a l u a t i o n

Cluster 3

product that has
unique sound:

3. A .fluid filled instrument

3. B . String rhythm instrument

3. C. Elastic string instrument

3. D. Piston instrument

Unique sound

Control & specification

Completeness

Experience/ style

Feasibility / illustration

Total

7

5

4

5

4

25

6

6

4

6

6

28

7

5

3

5

6

26

7

4

3

5

5

24

	Unique sound	Control & specification	Completeness	Experience/ style	Feasibility / illustration	Total
1. A . Musical canvas	3	5	7	8	2	25
1. B . Musical dance floor	2	4	6	9	3	24
1. C . Lets play	3	7	7	8	8	33
1. D . Larger than life instrument	2	4	4	5	5	20
2. A . One man band	3	5	7	7	4	26
2. B . Composition instrument	2	4	6	6	3	21
2. C . Folk harp	6	4	7	6	5	28
2. D .stringed percussion	8	7	7	7	8	37
3. A .fluid filled instrument	7	5	4	5	4	25
3. B . String rhythm instrument	6	6	4	6	6	28
3. C. Elastic string instrument	7	5	3	5	6	26
3. D. Piston instrument	7	4	3	5	5	24



2. D .stringed percussion

1. C . Lets play

2. B . Composition instrument

1. B . Musical dance floor

3. B . String rhythm instrument

3. C . Elastic string instrument

1. A . Musical canvas

1. D . Larger than life instrument

2. C . Folk harp

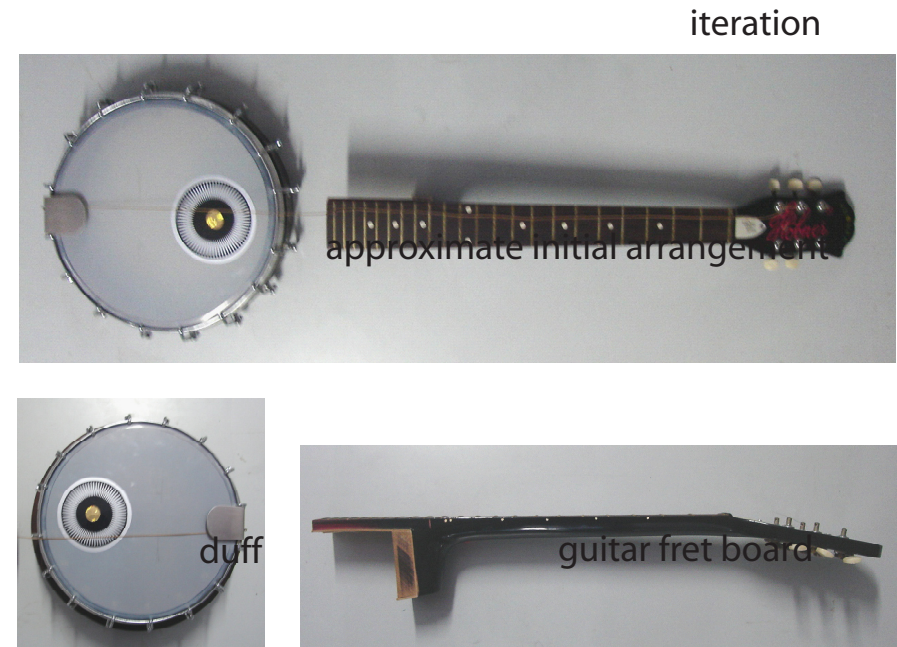
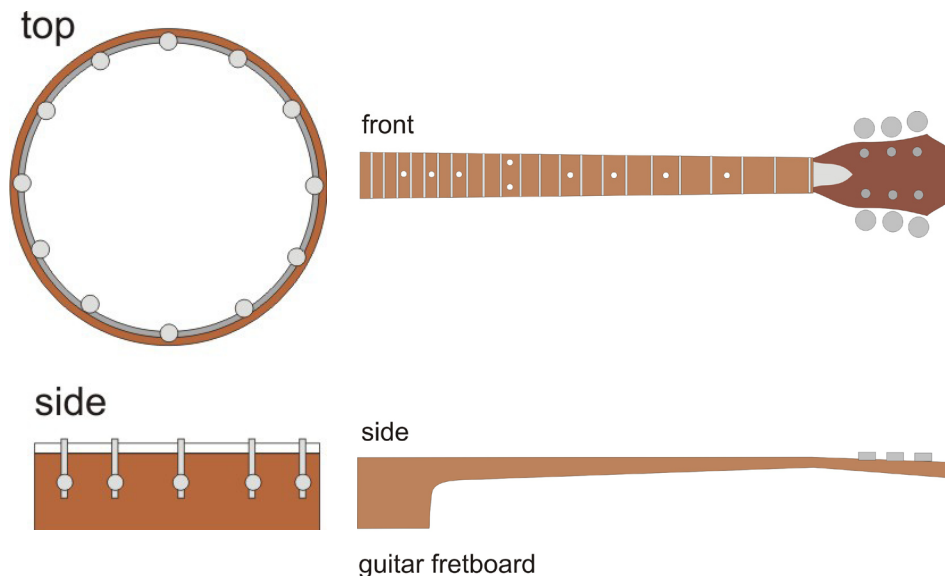
3. A .fluid filled instrument

2. A . One man band

Stringed percussion: The concept and evolution

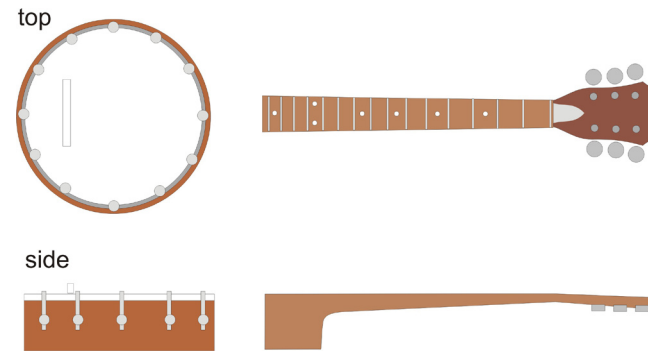
Stringed percussion- as name itself suggests, is a concept based on an idea where drum/ duff is played with string. Here vibration of the string also contributes in creating music, a tune.

Here I looked at two instruments, a simple duff and guitar. Duff is an instrument capable of creating rhythm and guitar play harmony, melody. Idea here is can there be an instrument that blends effect of these two instruments and creates a sound that is complete in itself. As melody, harmony and rhythm played together.



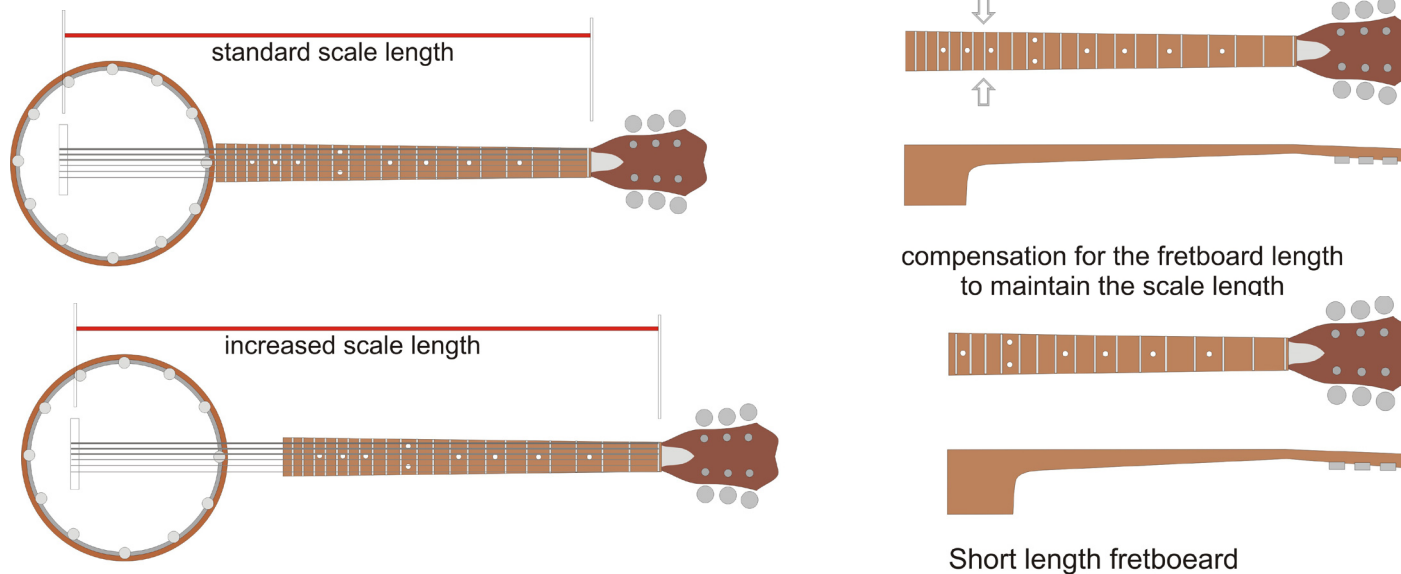
Duff is a rhythm instrument that is played by hand (fingers to tap and create rhythm). Other similar instruments like drum use sticks to play. Guitar is played with plectrum usually or by fingers. in guitar sound box amplifies the vibrations of the strings.

Unlike guitar, banjo here string has to make contact with the membrane of the duff so extra room must be provided. So fretboard has to be little away from the duff.



Iteration 1: arrangement

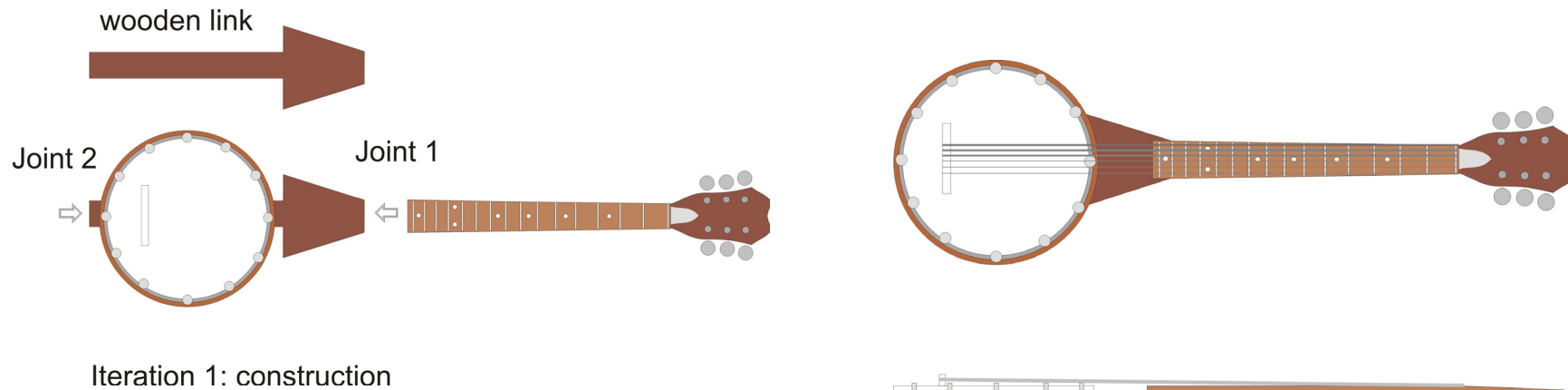
As scale length is increased now, guitar strings can't be comfortably used for the instrument as tension in the strings has to be increased to get the same standard tuning.



To avoid extra tension in the strings, to keep the scale length to standard comfortable length, fret board length adjustment is done. End frets of the fret board are chopped off as they only contribute in creating high pitch melody, so are used less as compared to upper frets.

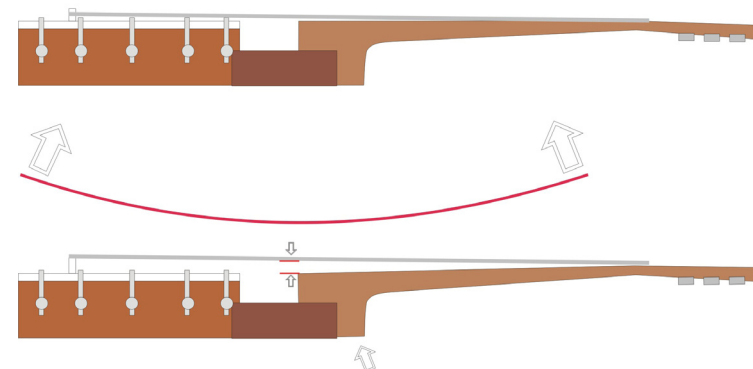
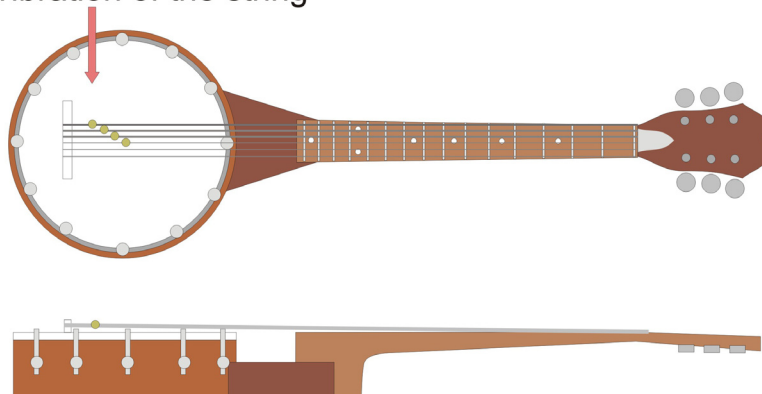
After this the next thing is to decide overall structure of the instrument.

A wooden link that held together the fretboard and duff rim is added, this will also take care of tension due to strings and prevent bend.

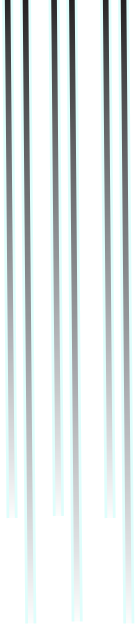


Creating rhythm simultaneously is the aim that makes instrument complete within itself. To achieve this clearance between strings and membrane of the duff has to be minimum and constant. But this creates difficulties in construction. To solve this problem beads are woven along the strings. Idea here is, when string will vibrate the beads will hit the membrane and create rhythm.

beads woven into strings those hit the membrane with vibration of the string



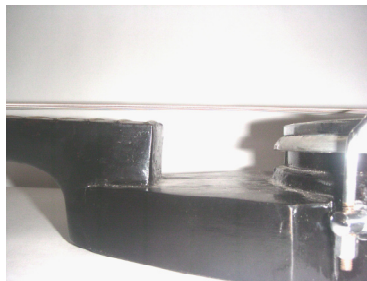
force on the structure due to tension in the strings



tail piece



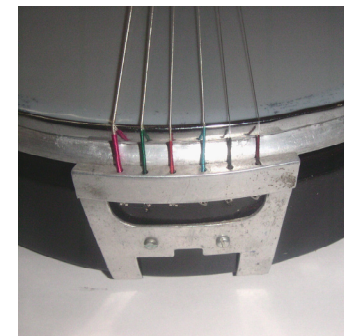
strings passing over
drum membrane



bridge variations

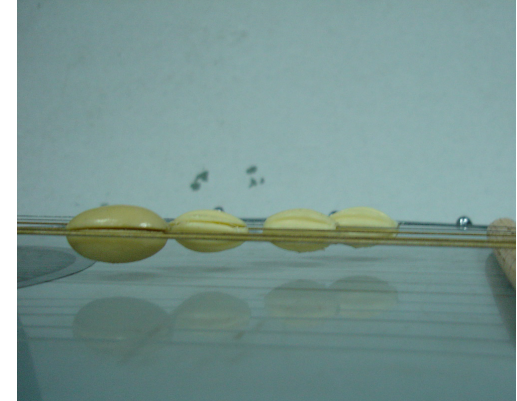
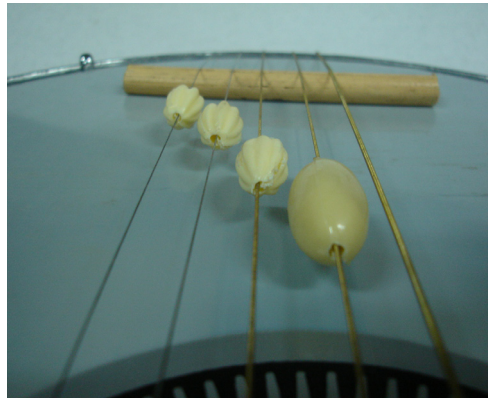
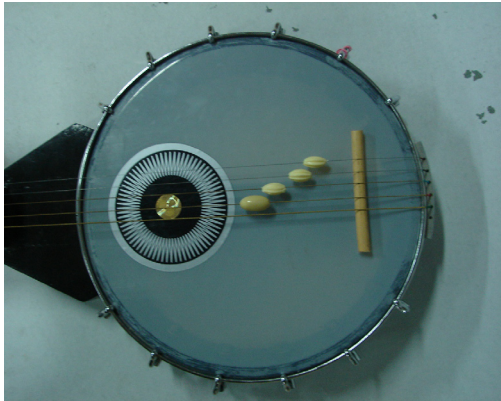


iteration 1

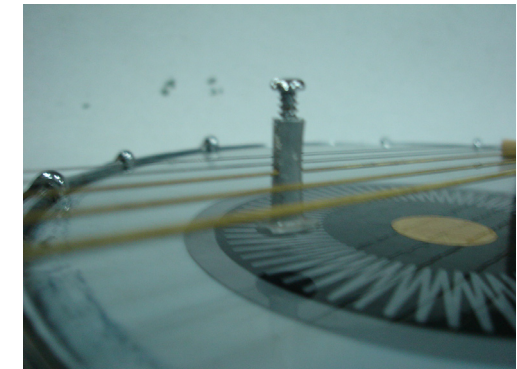
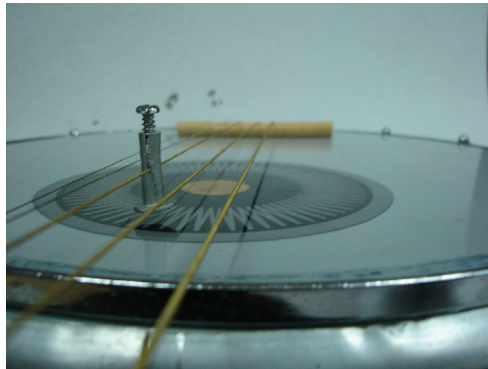


Explorations, experiments with iteration 1 setup

Beads were woven into the strings, and as string vibrates beads touch the membrane to create beat. The problem here was, one end of the string should be open to weave a bead and the point of contact was not a point contact to get right tone.

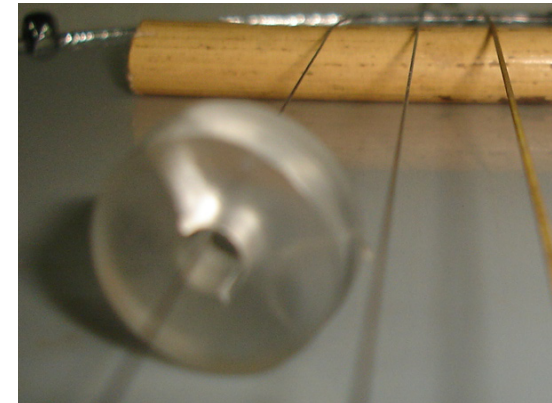
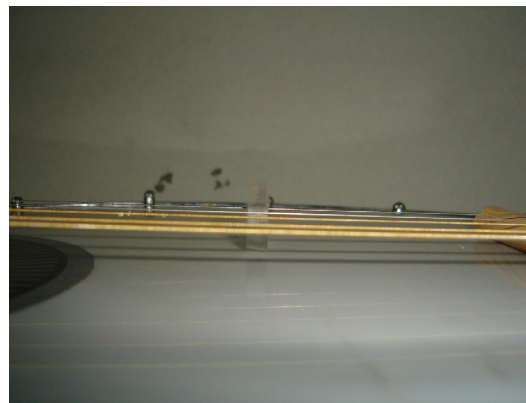
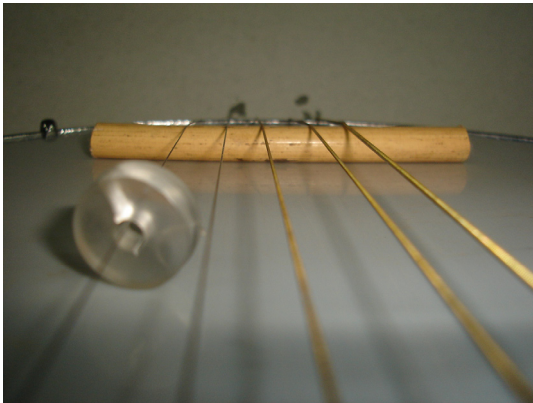


Here more mechanical arrangement was done where one can fix the contact element anywhere on the string and tighten it to be in that position. Height adjustment and nice tone can be achieved easily. Two variations were tried out, one with revette and screw and other with switch board nut. Both were successful but if membrane is goat skin the hitting contact element has to be of organic material like wood.

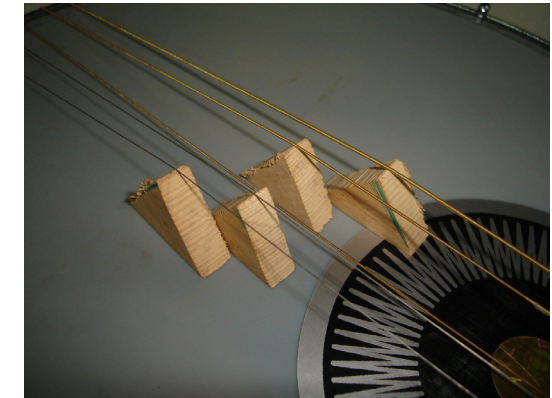
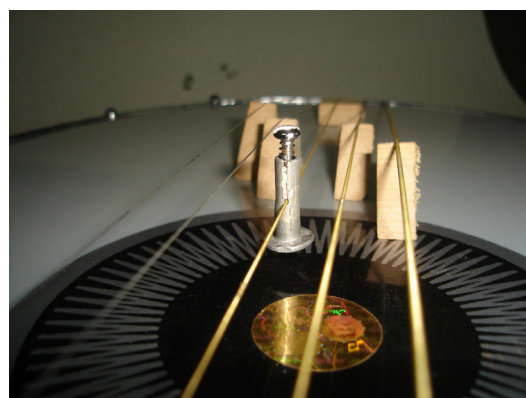


Explorations, experiments with iteration 1 setup

The washer was used as its more flexible material. It improved the overall tone of the sound but using available washers in the market was a constrain. If it is moulded specially for these strings then it will work fine.



Split bridge was used for individual string. The idea behind this was each string can transmit vibrations through individual bridge to create sound. Experiment was successful but the output was varying and tone was not definite.

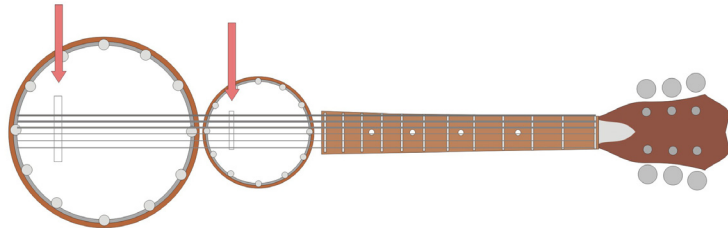


one option was to have double bridge instrument or triple bridge instrument. This helped creating multiple notes but tuning and increasing tension on the string were major constraints. Arrangement worked well for higher gauge strings, base strings.

Bridge1 Bridge2



Bridge1 Bridge2



Iteration2

Iteration one helped understanding issues related to mechanical arrangement of the design. Iteration 2 is just the extension of that to test if its really workable. A mini instrument is planned to demonstrate experiments to understand minute scope for further improvement.

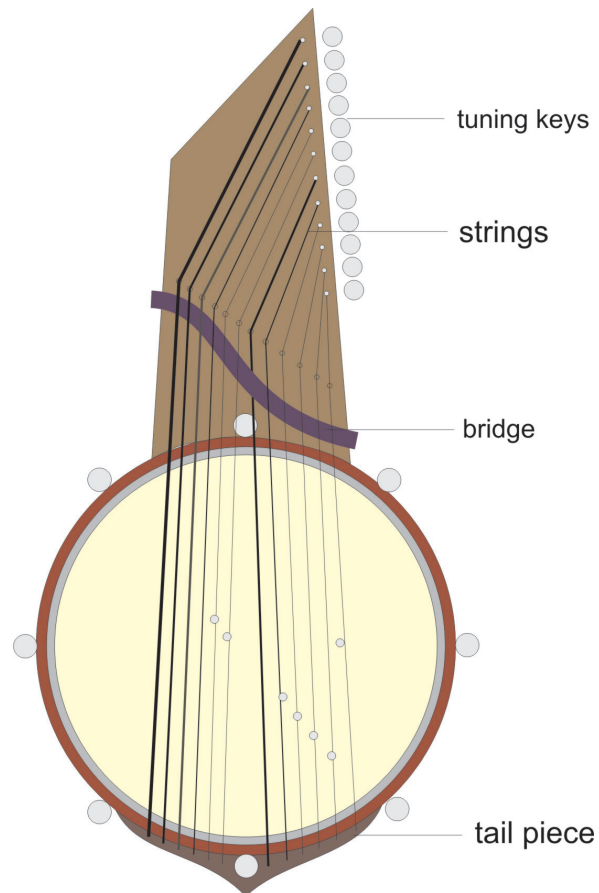


A small drum and a fret board is used to construct the instrument. Drum has got goat skin unlike iteration1 to test the difference in the tone of the instrument.

Iteration 3:

Though iteration 1 and experiments done worked well it is very important for an instrument to have good tone. Playing drum and simultaneously changing scale length by your left hand (as you do it while playing guitar) was affecting the tone of the instrument.

Hence iteration 3 has a major obvious change that it has shorter fret board with fixed scale lengths. however to achieve multiple notes number of strings are increased to twelve or more.

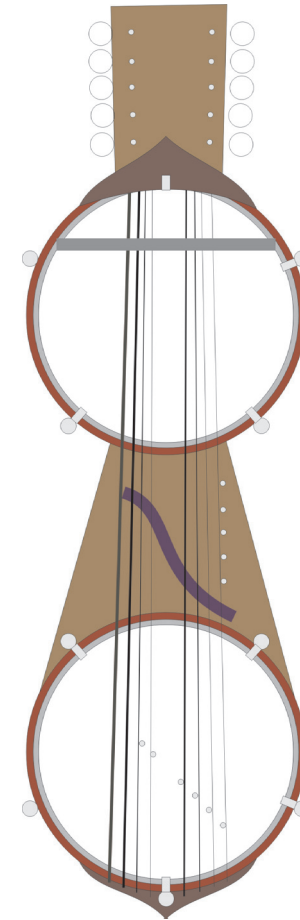
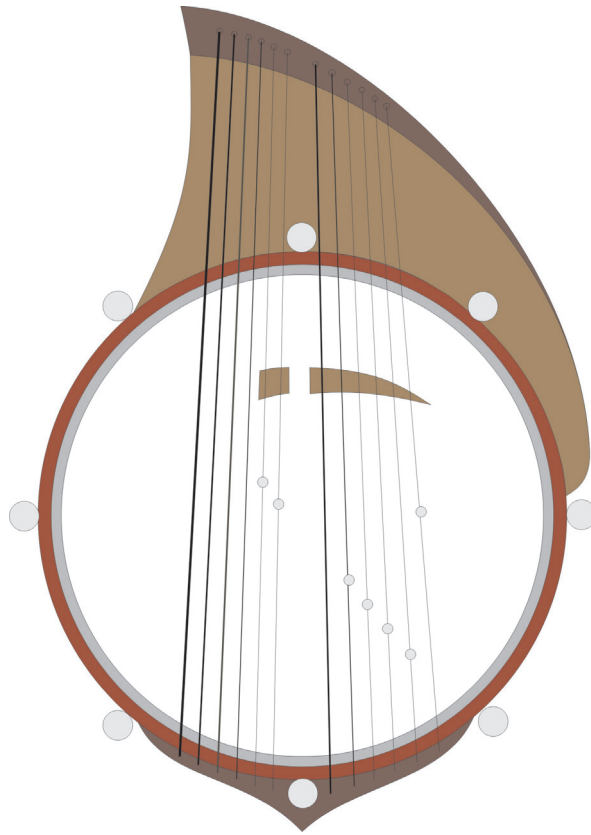


This approximate final instrument. Further work about detailing of the instrument is being done.

Detailing includes following:

1. About deciding appropriate form:

Possible
options:

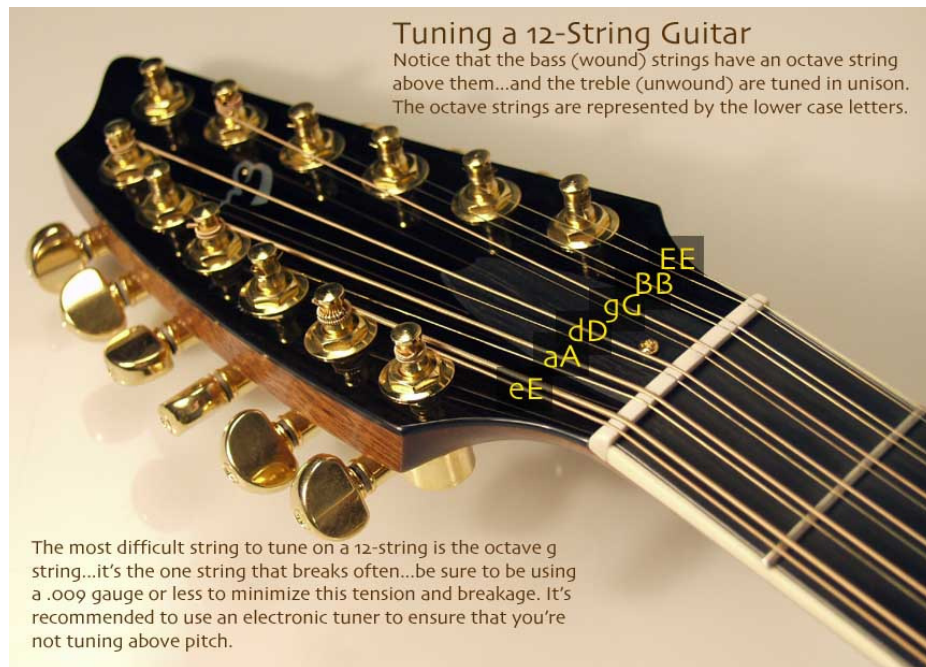


Number of strings:

for iteration 3 (so far final concept) i choose to have 12 strings. Constrain here is to use readily available strings. so i prffer using 12-string guitar strings.

String tuning:

Tuning is similar to 12-string guitar standard tuning



Bridge placement:

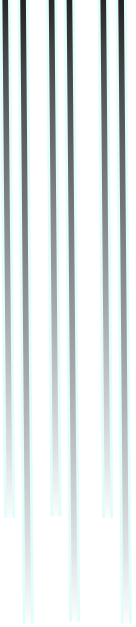
Position of the bridge is crucial factor for getting different tones and variations in the sound. On the membrane and off the membrane positions were tried. Composit arrangement looks good option as you get the affect of both the positions.

MODEL



MODEL



A decorative graphic on the left side of the slide consisting of several vertical lines of varying heights and colors (black, grey, and light blue).

Future scope:

The beauty of the musical instrument lies in its refined characteristics. Instrument has optimum essential components, it has good balance, visual appearance, character, identity.

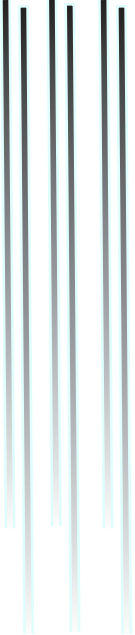
The instrument I am designing is like a new born where it has to grow in many directions. It is very incomplete and has scope to evolve. More experiments are required to be done to understand the mathematics of it.

Once the basic sound, tone manipulation is achieved it has to get the form and character. Actually the musical instruments must be evolving simultaneously, on all the parameters.

Yet the first step of completely defining instrument will be achieved when one can specify aspects that regulate the instrument. Scale length and gauges for strings, exact dimensions, wood and materials to be used, sound waveform patterns should be specified.

Manufacturing process, refinement techniques should also be decided.

I intend to work over the above areas and take its status towards a completely defined instrument with necessary specifications.



Conclusion

The musical instrument design is meaningful learning experience where after an attempt towards completing it I find myself someone who can understand whole spectrum about evolution and process behind musical instrument design.(and design that lives forever)

Musical instruments evolve through centuries, Sarod is considered to be youngest instrument who has evolution history of about 200 years. Each iteration on its way of evolution progresses minutely and silently towards refinement. Through this project I explored the root over which further research becomes more meaningful and can lead towards possibility of stand alone instrument thats complete in itself.

Musical instrument has its own stance and identity that blends design and art like a magic. Musical instrument becomes more than just a physical form or object, it speaks, interacts and takes seamless position in our life.

Being design student I am familiar with the design process that applies to most of the design problems., but musical instrument design project made me understand about process that is very indirect but profound. I felt like getting introduced to design at much bigger level and this unknowingly changed the way I looked at it.

Design is an activity that is more about coming up with the final refined product but through this project I feel even every step while moving towards better, is equally valuable. Some of the ideas those hit my mind are exciting enough to cheer up myself to keep the interest and faith towards project and design studies.

I can surely conclude stating, design for me is THE JOURNEY thats routed by undefined process and that sail us towards BETTER.

A series of vertical lines of varying heights and colors (black, grey, and light blue) that frame the central text.

THANK YOU