SYNOPSIS

In the initial learning days of Sitar researcher was very excited to buy a new Sitar. Having the Sitar he realised that the first step to play the Sitar was to know the tuning. Every time he had to go to the teacher to get the Sitar tuned. So he felt a need of a device which can help him in tuning till his ears are trained to guide hands to do it.

In the same days he was enjoying a sweet melody of his teacher on Sitar during learning sessions in the class. But when he listened the same teacher playing the same melody on the same Sitar during his public recital it was not sounding with the same sweetness. Timbre was totally different than the original one. The reason was, in public recital a help of amplification was taken and amplification was not proper. At that time researcher noted the need of proper amplification.

On completion of graduation, researcher got a chance to play Sitar with other instruments in a temple. Even though amplification was on the adequate level Sitar sound level was not proper in accordance with the other instruments, even after playing the harder strokes. Sitar sound was getting supressed in the presence of some other instruments. At that time he felt that something should be connected there with the

Sitar instead of a regular mic so that in orchestra, sound of Sitar can be made a prominent one. At this time to tune the Sitar in the presence of other sound of ongoing program of orchestra was difficult. Again a need of tuning device raised even though researcher was trained for tuning this time.

One day a son of the researcher wanted to carry his Sitar to his school for a Sitar recital, for this he requested his school van driver to allow him to carry his Sitar in the van. The driver refused to carry Sitar in his van saying that it is too bulky. Sharing this experience with many Sitarist researcher concluded the same problem of bulkiness of Sitar while carrying it in travelling by road or in air flight.

While playing the Sitar in the quiet environment researcher put the 'Dand' (डांड) of Sitar on his ears, and listened the amazing sound which he had not experienced before. He noticed that the sound dome which is generated in the resonator of the Sitar is not audible even by a player, and thought that it will be a great task if this sound is brought to the ears of the audience.

Observing the performance of other Indian and western instruments, researcher found that recently, in the field of sound production, propagation and reception a lot of development has taken place in the field of electronics related to all musical instruments but it has not happened up to the mark for Sitar.

Very small particles we cannot see by the naked eyes but same can be seen if we use the microscope. Same way minute lower frequency sound can not be heard by the naked ears but can be definitely heard if a proper amplification is done.

The researcher was fortunate to have knowledge of music and electronic engineering by having graduation in both of them, which is a state of an art in itself. Having good experience in both the field, researcher started learning the problems faced by Sitarist

during his playing. To know about these problems researcher had a number of sessions of discussion with Prof. (Dr.) A.S.Pathan who himself is a well-known classical as well as an orchestra player. On discussion a lot of points pop up in front of us.

Having the list of problems researcher started finding the solutions and naming it as 'Feature' for each of them so that these problems can be resolved.

Depending on the working function of the feature, researcher classified the features in to three categories i.e. Electronic features, Physical features, and Aesthetical features.

Researcher had focused in fulfillment of electronic features in an analytical way, and in a practical way to some extent.

By using some techniques and devices available in the market researcher could make a remedy for the electronic features. A unit is suggested using a right combination of a signal processor, tuner, pickup, power supply, housing and some other parts.

With the help of the suggested unit Sitar sound can be amplified in a right manner, producing amplified sound in the original tonal quality.

Every Sitar lover must have experienced that during 'Zalavadan' (झालावादन) whistling effect arises many a times which can be avoided using this unit.

Low frequency signal, does not get amplified in the manner of middle or higher frequencies. Proper use of pick up, and signal processor avoids this and thus maintain the tonal quality. Signal processor suggested has facility of opening and closing low pass, mid pass and high pass filter, allowing Sitarist to adjust the sustention time of the musical notes. And can also retain the original tonal quality or can vary it, if desired.

When mic is used to convert audio signal into electrical one, sound has to pass through the air before entering in to it, getting some distortion and loss in the amplitude too.

Usage of appropriate type of pick up allows amplification of low frequency from 20 Hz to high frequency up to 20 KHz avoiding distortion happening in the air and loss of amplitude.

In recent days some of the people have started using the flat tumba to make Sitar a compact one. But by doing so its tonal quality gets changed, as this resonator is unable to produce a rich dome of the sound. But in suggested unit as sound is picked up and amplified directly from the vibration produced on the body of the Sitar, and processed accordingly, original tonal quality is maintained even in the flat tumba Sitar.

Tuner display provided in the main unit gives Sitarist an ease of tuning not only for main seven strings, but also for all sympathetic strings with a great precision, even in the noisy environment.

Feature of volume control and tonal quality adjustment removes the dependency of Sitarist on the sound operator in the live concerts. Handy mixing console offers Sitarist a dominating position in the orchestra.

Feedback device, feedback control switch also keeps Sitarist aware of the sound reaching the audience and guides him to do necessary changes in control panel if needed.

Additional feature of recording and retrieval of sound makes it technically rich.

Thus traditional Sitar matches its step with the technology making it more competent for its utility in live concerts along with other Indian and western instruments.

Need For the Research on This Topic

Sitar Timbre gets irrelevant, during live concerts while playing along with other musical instruments; it becomes difficult to tune during its operation in live concerts, have to keep dependency on sound operator for expected tonal quality.

Hence some of the features are desired to be implemented in the Sitar.

Hypothesis

The original tonal quality will be retained after fulfillment of desired features in Sitar. The features developed in such a manner that it will be more suitable to synchronize with other musical instruments during live concerts.

Objectives

In recent years a lot of development has taken place in the field of electronics related to all musical instruments, but it has not happened up to the mark for Sitar.

To make Sitar more competent in accordance with contemporary Indian as well as Western musical Instruments.

Data Collection Methodology

- The researcher is learner of Sitar since 30 years. He has observed and analysed the playing of Sitar closely. From that he noted down certain point related to the thesis subject and discussed with his guide in depth. Fortunately his guide being a proven artist of orchestra and classical music, shared a lot of things with him. From that researcher made a list of shortcomings of Sitar while using in live concerts of contemporary music.

- Researcher met the scholars, who have the depth of knowledge about the thesis subject and took their opinion for the same.
- Researcher met famous artists of Sitar and asked the question “Which features would you like to add in the Sitar to make it competent in accordance with contemporary Indian as well as Western musical Instrument”? And noted down their answers.
- Researcher also studied the limitations derived by other instrument artists.
- Then researcher took opinion of some amateur Sitar artists, and students of the Sitar and knew their views regarding the subject.
- Researcher made the study of literature regarding some seminars on instrument makers and analysed the facts.
- Researcher made a summary of all inputs which he received from himself, his guide, artists, and students. He summarised the data, and made a list of desired features of Sitar in utility of live concerts of contemporary music. Also categorised them in: Electronic features, Physical features and Aesthetical features.

  The researcher focused on the ways of fulfillment of the electronic features.
- For that, he referred the latest available data of invention in this subject on the internet.
- He also learned the thesis already published in related subject.
- He also met various electronic musical instrument suppliers and makers and knew the different apparatus available in the market to fulfill the subject requirement. He bought and tried some of them and experienced their usage.
- The library is the biggest source of literacy, musical and scientific reference books. The researcher has visited libraries and studied many manuals of different gadgets.

He had also captured some pictures from various museum to learn the history and evolution process of Sitar. All these pictures are included in this thesis.

- He went to the industry and verified the facts and correctness of his suggested solutions.
- He put up an analytical study of fulfillment of desired features of Sitar in utility of live concerts of contemporary music.

Review of Literature

The collected data, statistics and facts about the presented subject are reviewed. Only accurate and feasible solutions are written rest is omitted.

The other research books are referred to collect required data.

Research Methodology and Planning

The presented analytical study in this thesis is done by analytical method. The scientific approach is also followed in data collection. New found facts are presented in an adventurous manner.

Technical information in the thesis is put in a simplified manner, which a nontechnical person can also understand.

The research is done in qualitative and quantitative method.

The collected information is presented in a chapter wise index.

Chapter 1: History of Sitar and its Evolution

The historical knowledge of musical instruments is essential and important for its future development. To understand the evolution process of Sitar researcher has divided the study into four parts.

- **Origin of Sitar**

  In first part researcher will study some Etymology and history regarding origin of the Sitar.

  A human body is considered as God created Veena. Inspiring from that man created a musical instrument 'Veena' using the wood, so it is called as 'Darvi Veena'. In ancient time, different types of the Veenas were in existence. Many instruments of today are believed to be derived from them. Short description of some important Veenas is given in this section.

- **Evolution in 13th to 16th Century**

  This period is important in process of evolution, as Sitar came into existence during this time. Regarding the name of inventor of the Sitar there are different opinions. Researcher will study various opinion.

- **Evolution in 16th to 19th Century**

  With the time different technical up gradation came in the construction and playing style of the Sitar. These are described in this section. Some pictures are also given as a reference to support the theory.

- **Current Versions of Sitar**

  After 19th century whatever changes came in to the construction and playing style of the Sitar, till today are described in this section.

Chapter 2: Classification of Musical Instruments, Working Principle of String Instruments, Sizes and Constructional Detail of Sitar

After studying the History and evolution of the Sitar, here researcher will see the classification of the various musical instruments and match Sitar in the string instrument category. Researcher will also see the other string instruments which are similar to Sitar and can also adopt the same technical amendments like Sitar. Researcher will also see the definition of 'Sampurna Vadya' (संपूर्ण वाद्य) and the parameter required for an instrument to be considered as a sampurna Vadya. Here researcher will see how Sitar matches the requirement of becoming Sampurna Vadya. After learning this researcher will study the contemporary sizes of the Sitar and differentiate them in basic three sizes i e. Chhota (छोटा), Madhyam (मध्यम), and Bada (बड़ा) Sitar.

To know how size of Sitar, string, wood, bridge, and other things used in construction affects the performance, and Timbre of the Sitar researcher will study the constructional components of the Sitar in detail. This study will help building a basic platform to do the amendments in traditional Sitar.

So the chapter is subtitled as follows:

- Classification of musical instruments
- Working principles of string instruments

- Sampurna Vadya
- Sizes of the Sitar
- Constructional components

Chapter 3: Characteristics of Nature of Sound for Sitar

In the third chapter acoustics and characteristics of the sound of Sitar is studied. First the differentiation of the musical sound and noise is studied. Then the characteristics of the sound of Sitar is studied in a scientific manner.

Characteristics of the musical sound are:

- **Pitch Or Frequency**

Under this topic researcher will understand the meaning of pitch and its relevancy with frequency. A chart of range of pitch of various musical instrument is also attached. Meaning of 'Standard of musical pitch' is also explained with its history. Tuning of all strings of Sitar is also shown to play Sitar on 'D' as a drone.

- **Loudness**

  In this topic loudness and the intensity of the sound is explained. A table of sound level of different working environment is also attached. The parameters which can affect the loudness of the sound of Sitar are also shown.

- **Quality**

  The property of the sound because of which we distinguish the musical notes produced by different musical instruments, or voices even though their pitch and loudness is same, is the 'Quality' of the sound.

Help of graphical presentation of the waveform of tuning fork, clarinet, and cornet is taken, to understand the term quality. Another graph of Spectra of instruments referred

in previous waveforms is also shown and explanation of the fundamental, Overtones, Harmonics, and Inharmonic is given. Helmholtz's law "Difference in musical quality of tone depends solely on the presence and strength of partial tones and in no respect on the differences in phase under which these partial tones enter into composition", also explained in a brief.

Then the factors responsible for tonal quality of the Sitar are mentioned. At last the term 'Vibrato' is also explained with respect to all above terms. After studying this chapter researcher is ready to enlist the desired feature of the Sitar related to the sound tonal quality.

Chapter 4: Desired Features of Sitar to make it Competent in Its Utility of Live Concerts of Contemporary Music

In beginning of this chapter researcher has described the purpose of the research.

As per Darwin's theory it is not the matter how powerful the thing is but it depends on its adaptability to survive with the time. Same rule is applicable to musical instruments also. Musical instrument will become obsoleted (Lupt) if it is not modified technically with the time.

Different versions of ancient Veena are still in existence in the different forms. To play these instruments specifically Sitar in contemporary music has some limitations. After a long research, study and getting the opinion of the learned Sitarist and musicologist, researcher has pointed the shortcoming and difficulties of Sitar while playing in contemporary music, and also listed the features which can be added to the traditional Sitar to make it competent in accordance with contemporary Indian as well as Western musical instruments.

This is the time to match our pace with the technology and researcher has to show to the world that this is the place where Technology Meets the Tradition.

Then listing of the features, which can be attained by doing the changes, internally or added externally to the main instrument is done.

These features are discussed in three categories.

- **Electronic Features**
- **Physical Features**
- **Aesthetical Features**

Chapter 5: Fulfillment of Desired Features of Sitar in Utility of Contemporary Music

In this part of the thesis the path is shown to fulfill the desired features describe in chapter 4. Researcher has discussed and shown the fulfillment of electronic features which are essential for its competitiveness in utility with the other instruments in contemporary music. For this a device is derived. And its function is explained with the help of the block diagram.

The device is comprising of:

- **A Power Supply**

  It is the unit generating a stable D.C. supply from 220V a. c. Supplies voltage to all other blocks of the unit.

- **Transducer**

  It is the first and the most important apparatus converting audio signal in to the electrical signal. The tonal quality of the output firstly depends on the make and

type of this. In case of string instrument suitability and importance of the pickup is explained in detail. Classification of pickup is done depending on the principle on which it works. Technical detail of some popular pickups are also given.

- **Signal Processor**

  It is the main unit which offers the various facility for a Sitarist to make Sitar more playful and competent.

- **Tuner Module**

  It is an external unit giving an ease of tuning to the player in different conditions.

- **Recording Unit**

  This is another external unit which provides a value added feature of Recording and Retrieval of the sound.

- **Head Phone**

  It is a small head set helping a player to have the feedback from outgoing sound of the amplifier, enabling him to take corrective action if any for improvement of the Tonal Quality.

- **Wooden Housing**

  It is a portable passive component of the unit housing all blocks of the diagram.

Conclusion

Though the instrument is enriched by value added features Timbre will not be affected in any manner /can be varied as per requirement of an artist.

As a resultant the instrument is enriched in such a manner that it gets synch and equivalency in accordance with other Indian or Western musical instruments in live indoor concerts. So the objective of this thesis is concluded according to my perception.

Limitation of the Research:

- Researcher has listed some of the desired features of Sitar in to three categories. But will do fulfillment of Electronic Features only.
- Electronics being the dynamic field of an engineering gets changes and up gradation very fast, so the solutions and suggestions given for electronic features are in accordance with the title / situation and it may vary accordingly.
- To maintain Timbre to enrich the instrument in Indoor live concerts only.
- The modification and aesthetical appearance may change as per the resources and fund available.
- Ownership of resultant of product and patent will remain with researcher, and can be utilized through prior permission in a respectable manner.
- Result may vary depending on the resources demanded / allocated in terms of skilled manpower, funds, and facilities.