



# Investigation and Development of an Electronic Tuner for Santoor

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## Introduction

Musical instruments from different type of family made in various models and shapes produce different frequencies and harmonics which identify as tone. They need to be accurately *TUNED* in order to produce optimal sound. *TUNING* is a process of adjusting the pitches of tones to establish the intervals between them by considering a reference pitch such as (A=440Hz). An instrument with pitches that is either too high (sharp) or too low (flat) in relation to a given reference pitch, called “Out of Tune”. These instrument, therefore, need a *TUNERS* to adjust them to correct pitch or intonation[1].

An *Electronic Tuners* benefit of wide range of frequency detection which make them able to tune different types of musical instruments including Santoor[2].

## What is a Persian Santoor?

Santoor (also known as santur, santūr, santour) is a stringed instrument of Persian/Iranic origins which was recorded for the first time by “Mohammad Sadeqh Khan” from before the Qājār period in 669 B.S[3].

The santoor has 72 strings. Strings are made of two different materials and two different colours. The yellow strings are made of brass and the white strings are made of steel.

The strings, grouped in units of 4 and seat on top of small, movable, wooden bridge.

Wooden bridges arranged in two rows that divides the santoor into three positions.

Stretched metal strings horizontally across over bridges and snapped to the left side by metal hooks and right side by tuning pegs (adjustable part for tuning) of instrument. The santoor is played by two hammer shape plectrums called “Mezrab” which are held between the thumb, index and middle fingers[4].



## Aims and Objectives

The aim of this project is to investigate electronic musical tuning technologies and in turn implement and develop a prototype which can electronically tune a Santoor.

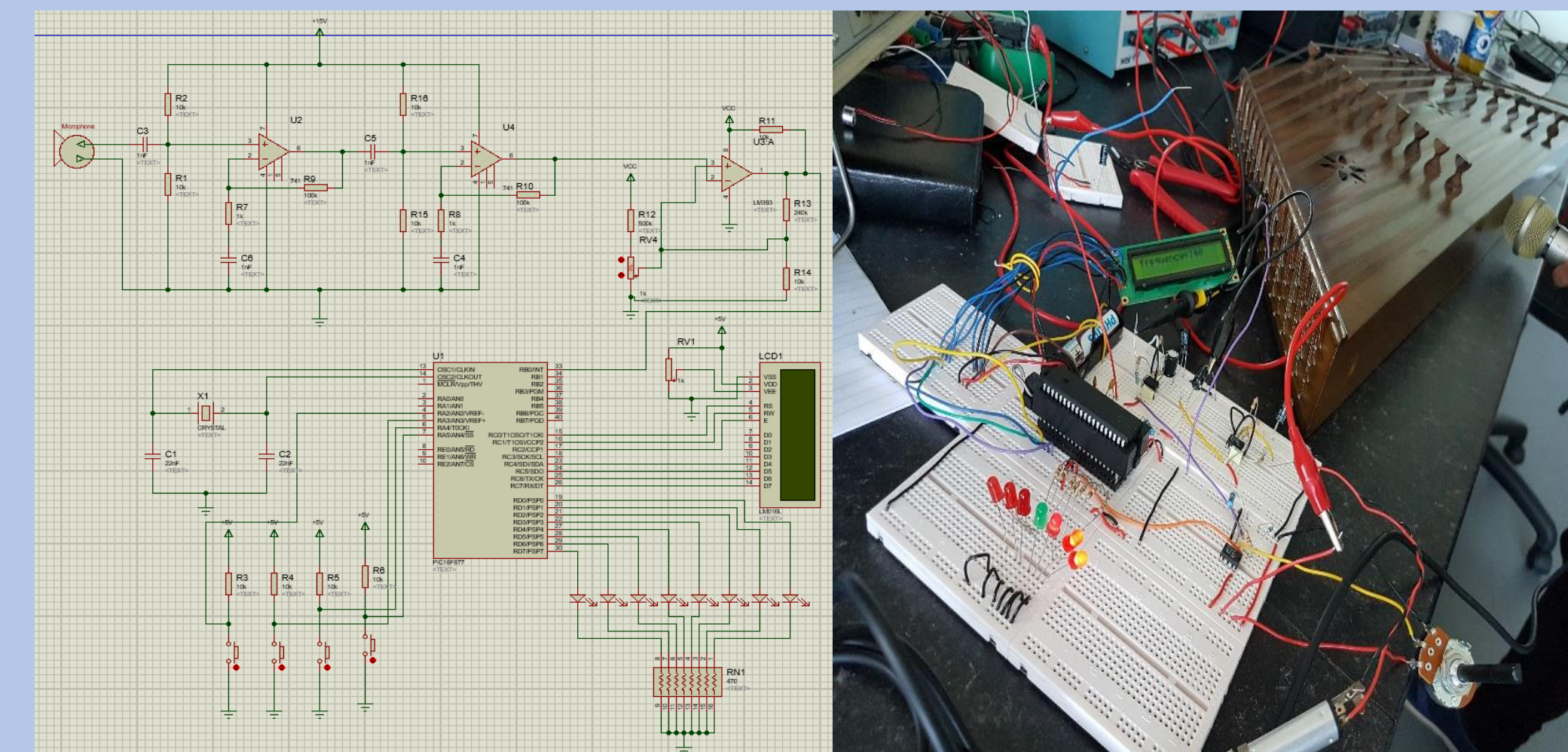
1. Research technologies on musical tuning devices.
2. Test various components which have been identified through research.
3. Analysis of various methods for tuning musical instruments.
4. Opting one method based on the analysis performed and other design considerations.
5. Design and implementation of a tuner with selected components.
6. Prototype various design methods and build final device based on preferred prototype.
7. Testing of the solution.
8. Evaluate finished device against the initial design.

## Electronic Tuners

- Wide range of frequency detection.
- Using internal microphone (or input jack) to pick up frequencies.
- Utilizing Microcontrollers for frequency calculation and tuning process.
- An LCD displays the information for tuning.
- A needle-shaped marker plus green and red LEDs indicate “in tune” or “out of tune” (sharpness or flatness of notes) instrument.
- The “Sound Out” ability distributes a reference sound for selected note and it improves ear training.
- “Back Up Memory” records the tuning history, even when the device is turned off.
- Some can clip directly to the instruments and sense the vibration
- High accuracy in term of circuitry by ignoring background noises[5].



## Design and Implementation



- Receiving frequency by microphone
- Amplifying signal using power amplifier
- Feeding amplified signal to voltage comparator using LM393
- Compared voltage connected to input pin of PIC16f877 Microcontroller
- A timer module is used to measure frequency
- An LCD is utilized to display measured frequency
- LEDs indicate whether notes are in tune or out of tune

## Conclusion

The frequency numbers which were produced by biting Santoor string were inconsistent on the LCD display. This is due to frequency generated from Santoor is instantaneous and diminishes quickly. Although this means the frequency is not displayed effectively to the user the project overall is still regarded a success. The frequency is displayed consistently on the LCD with a continuous frequency and is stable. For future work improvements are to be made to rectify this problem.

## References

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- [5] “CA-50 - CHROMATIC TUNER | KORG (U.K.).” [Online]. Available: [http://www.korg.com/uk/products/tuners/ca\\_50/](http://www.korg.com/uk/products/tuners/ca_50/).