SWE 599

Progress Report

Frequency Analysis of Turkish Music

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Frequency Analysis of Turkish Music

1. Introduction

This project briefly detects and identifies a Turkish maqam song and enables its users to analyze small parts of the music. Thus, in general intended users of the projects are mostly professional people who want to deeply analyze a Turkish music. Here are the project's goal by different people;

1) A researcher from Turkish music conservatory: Researchers might want to analyze a desired song. They might even want to analyze a specific interval of the music so, this program will provide them to analyze the part of the music with details. With this program, people can be able to gather really subtle details of the music that normally people cannot hear and detect.
2) A musician: Generally, the scheme of a maqam music is certain. However, although a musician plays maqam music in general, the musician does not possibly know the details of the music when playing the music. This program might help someone to reach the perfection when singing a song or playing a musical instrument. The musician can see detail corrections of the specific part of the music.
3) A professor from conservatory or assessor: Also, in order to assess a student from conservatory, the professor can be able to see wrongs and rights of the students in detail when playing music. Therefore, the professor can be able to give more accurate feedbacks to students. In the same way, a student can be able to correct their mistakes by using this program when playing or singing a song.

In order to obtain domain knowledge and get requirements, one external stakeholder from ITU Turkish Music Conservatory School is involved into the project. His main aim for this project is to analyze different type of Turkish maqam musics and he can be understand the generally how people plays a specific music.

2. Interview Results

In order to get requirements, some specific questions are asked to him and specified requirements of this project. Here are some general questions that helps us to acquire domain knowledge and detect the requirements.

1) What is maqam and what is çeşni?
2) What are differences between makam and çeşni?
3) Is there any other music type that is very similar to makam or çeşni in the world?

After getting some knowledge about the Turkish maqam music at the beginning some questions are asked to detect requirements.

1) Why you are going to use this program? What type of analysis are you going to do for analyzing music?

The stakeholder wants to analyze the music. He wants to upload a music file and he wants to see music signals and frequency of the signals of desired part of the uploaded music in selected time intervals.

2) What are the extensions of a music file that you want to upload?

The stakeholder wants to upload mp3 or wav.

3) What are the max length of the music that you want to upload?

There should not be a limit to upload a music type.

4) What are the outputs of the program after uploading music file?

He should listen to the music or he should select an interval of the music and listen only that part of the music. Then, the program should analyze the music if he wants to analyze it.

5) What are the outputs of the program after analyzing uploaded music file?

The stakeholder mainly wanted two specific charts for monitoring the analyzed music result. One is called Melogram that shows us signal and time. Another one is called histogram that shows us frequency of the signal and time.

6) What should be the output of Melogram?

Melogram should be a line graph and should show signal of the music in y axis and time on the x axis. The unit of the music signal should be Hertz however, should be able to convert Cent or Koma as well.

7) What should be the output of Histogram?

Histogram should be a line graph and should show frequency of signal in the y axis and time on the x axis.

8) How do you want to use the application?

He should install and run the program only in his computer. Thus, it should be a desktop application.

9) Do you want to save any data?

He wants to see already analyzed data in a folder. If he uploads a music file before, he doesn't want to wait to analyze them again and again. Therefore, analyze results will be saved in a folder.

10) Is there any time limitation when analyzing the program?

When uploaded song is 5 minutes, for example, the program should analyze the song in 5 minutes. Analyze time should be maximum same time with the length of the uploaded music file.

11) Do you want to export the analyzed results? If you want, in which formats do you want to export them?

He should export the results of selected part of the Melogram in an Excel file. Also, he should select intervals in the Melogram. Charts should be scalable (zoom in or zoom out).

3. Requirements

1) The user of the application shall be able to analyze Turkish Classical Music data.

1.1) The user should upload a music file.

1.1.1) The user shall be able to select part of the music from the application.

1.1.2) The user shall be able to listen to the music.

1.1.3) The user shall be able to listen selected part of the music explained in the 1.1.1 Section.

1.1.4) The user should choose music type from the draft.

2.2) The user should see frequency of the uploaded music data with respect to the time.

2.2.1) The user should see frequency of the music data in a plot diagram.

2.2.2) The user should see time on the x axis and frequency of the music data on the y axis.

2.2.3) The user shall be able to change the frequency of the music data.

2.2.4) The user shall be able to see draft data in the plot diagram with respect to the chosen music, explained in the 2.1.4.

2.2.5) The user shall be able to move the drafted data.

2.3) The user should see Melogram data of the uploaded music data with respect to the time.

2.3.1) The user should see music waves in a plot diagram.

2.3.2) The user should see time on the x axis and music waves on the y axis.

2.3.3) The user shall be able to select some point intervals in the plot diagram.

2.3.4) The user shall export the selected point intervals to an Excel file.

2.3.4.1) The user should see values of the music waves data of the selected points in 2 milliseconds intervals in the exported file.

3.1) Uploaded music file's extension should be wav.

3.2) Default unit of plot diagrams should be Hertz in y axis.

3.3) The unit of frequency of the music should be changeable with Koma and Cent.

3.4) All plot diagrams should be scalable (zoom in/out).

3.5) There should be no limit to size of the music file.

3.6) The system should keep already analyzed data in a folder and should not analyze already analyzed music file again.

4. Legacy System

4.1) Tomato and Dependencies

For building the project, it is decided to use some APIs. For building a Melogram, a project called Tomato is found to use.

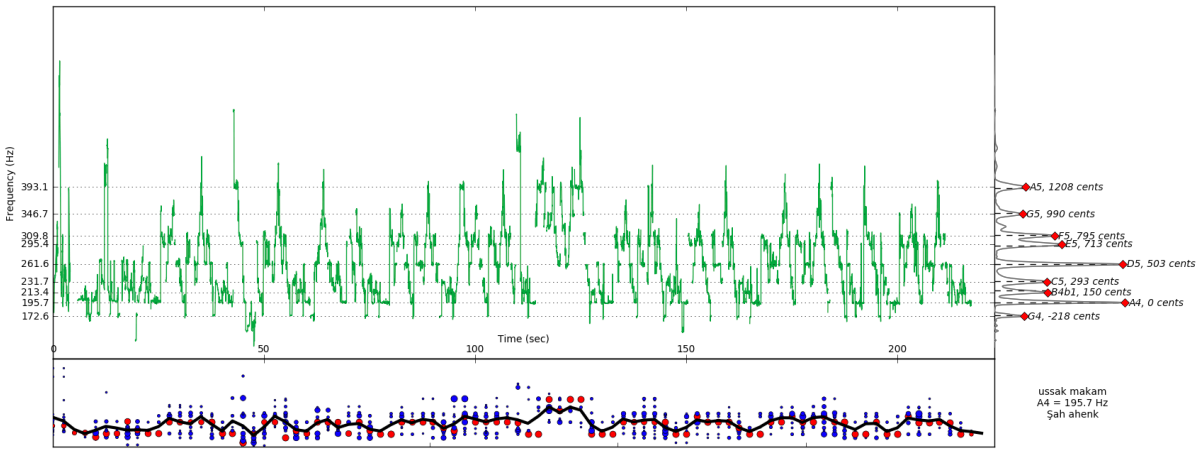

Fig 1: Tomato Melogram

Here it is one of the output of Tomato project currently available on Github (https://github.com/sertansenturk/tomato/blob/master/demos/audio_analysis_demo.ipynb) However, in order to run the Tomato project there are some dependencies.

Here it is the dependency diagram for Musiki project:

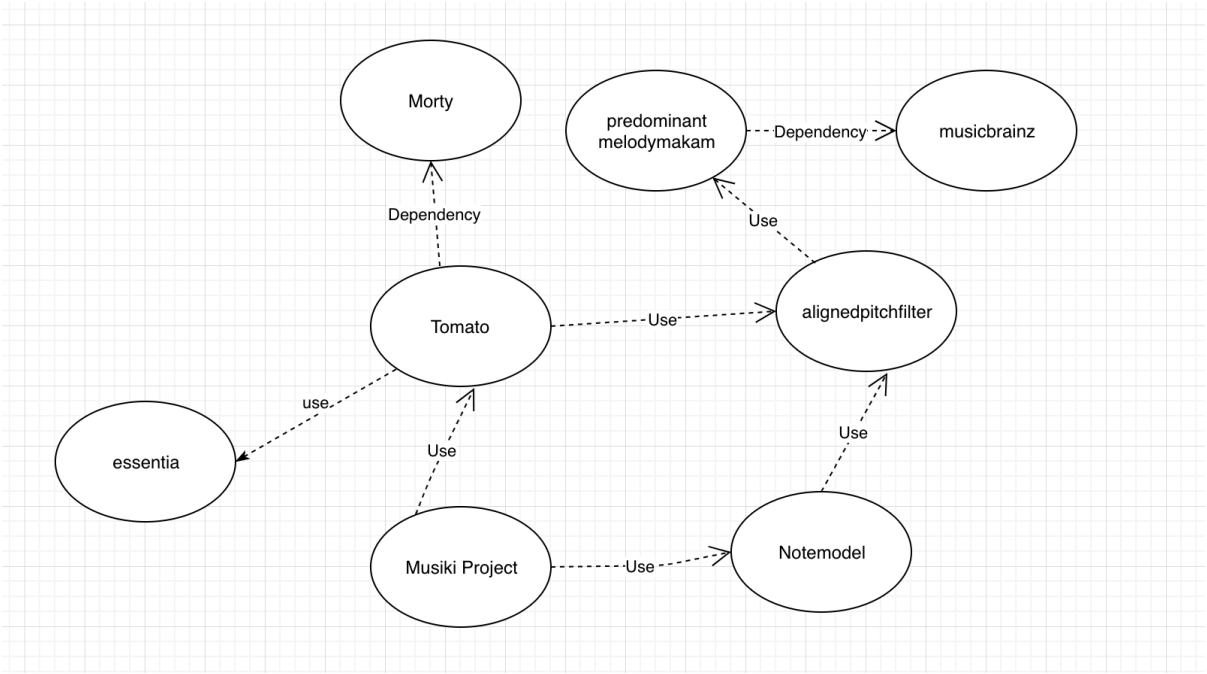

Fig 2: Musiki Project Dependency Diagram

Musiki project is going to use Tomato to create Melogram can be seen on the above. However, in order to run Tomato, it is needed to install another project called Morty which is also an open source application (https://github.com/altugkarakurt/morty). In addition to these, Tomato project uses an audio analysis library called Essentia (https://github.com/MTG/essentia). However, since it is not available for macOs, Ubuntu 14.04 is installed on Docker and installation process are made on the Docker Ubuntu 14.04. For more information about creating environment to run applications: https://github.com/mehmetkayaalp/swe599/wiki/Docker-Environment

4.2) AlignedPitchFilter and Dependencies

At some point, in order to analyze frequency data in Tomato, another project called it is realized that AlignedPitchFilter (https://github.com/sertansenturk/alignedpitchfilter) should be installed to analysis part. However it is also used PredominanyMelodyMakam project (https://github.com/sertansenturk/predominantmelodymakam). At the basement again, these projects are also used a project called MusicBrainz (https://github.com/alastair/python-musicbrainzngs). MusicBrainz and Essentia are currently developing projects, however when developing these projects, since other projects that used MusicBrainz and Essentia are not developed, some methods

are deprecated. Therefore, it is not possible to run Tomato application by installing requirements and other programs.

4.3) Makam Tool Box

Makam Tool Box is another application written on MatLab. It is currently working well on MatLab R2012a (7.17) Runtime. However, it is not working when upgrading MatLab and its runtime to higher versions. When analyzing application on the MatLab R2018b which is the latest version of the MatLab now, it can be seen 803 deprecated method is needed to be changed.

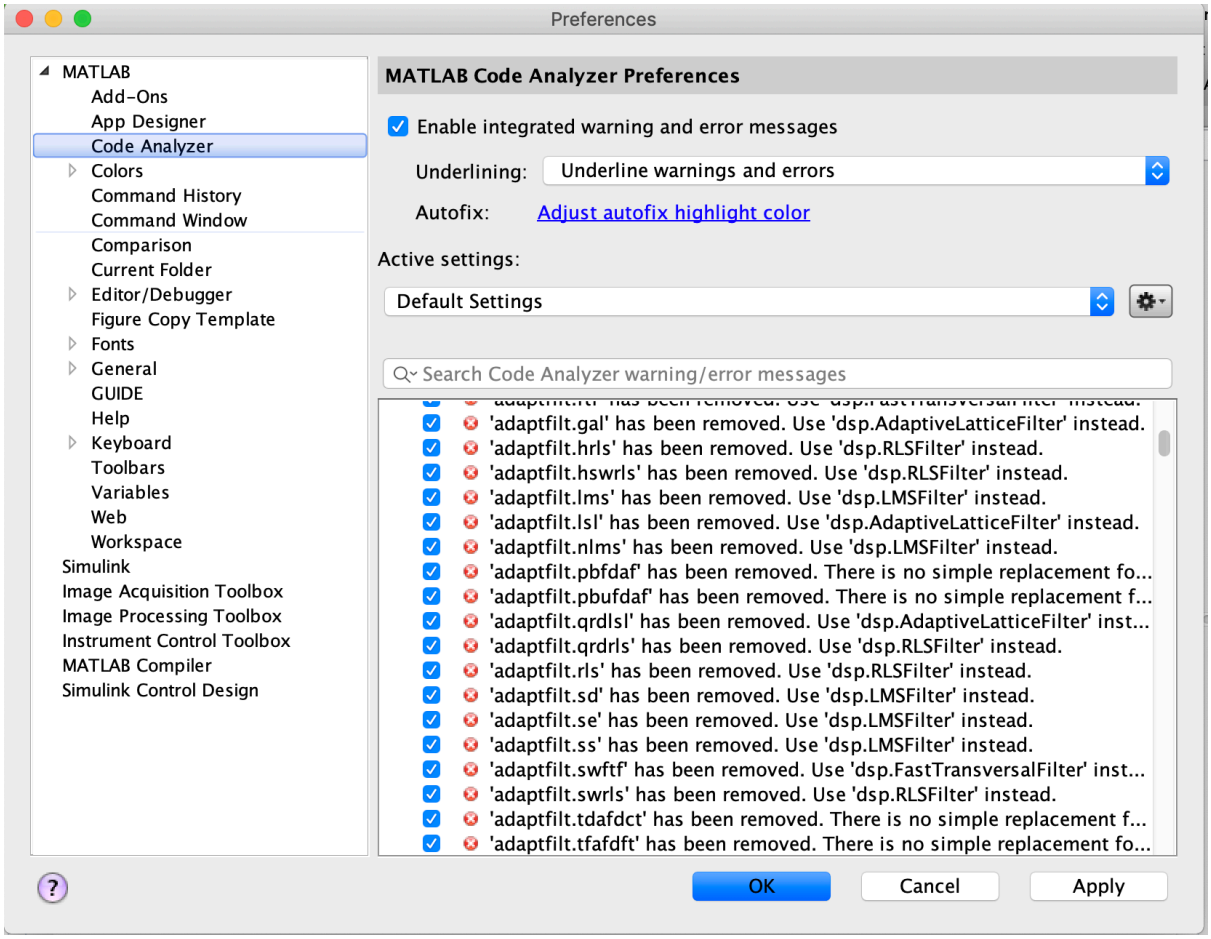

Fig 3: MatLab Code Analyzer Result

195 warnings and errors are solved until now. It is still in progress to clear the errors because of the deprecated methods and 608 errors are still waiting to be fixed.

5. System Design

5.1) Mockups

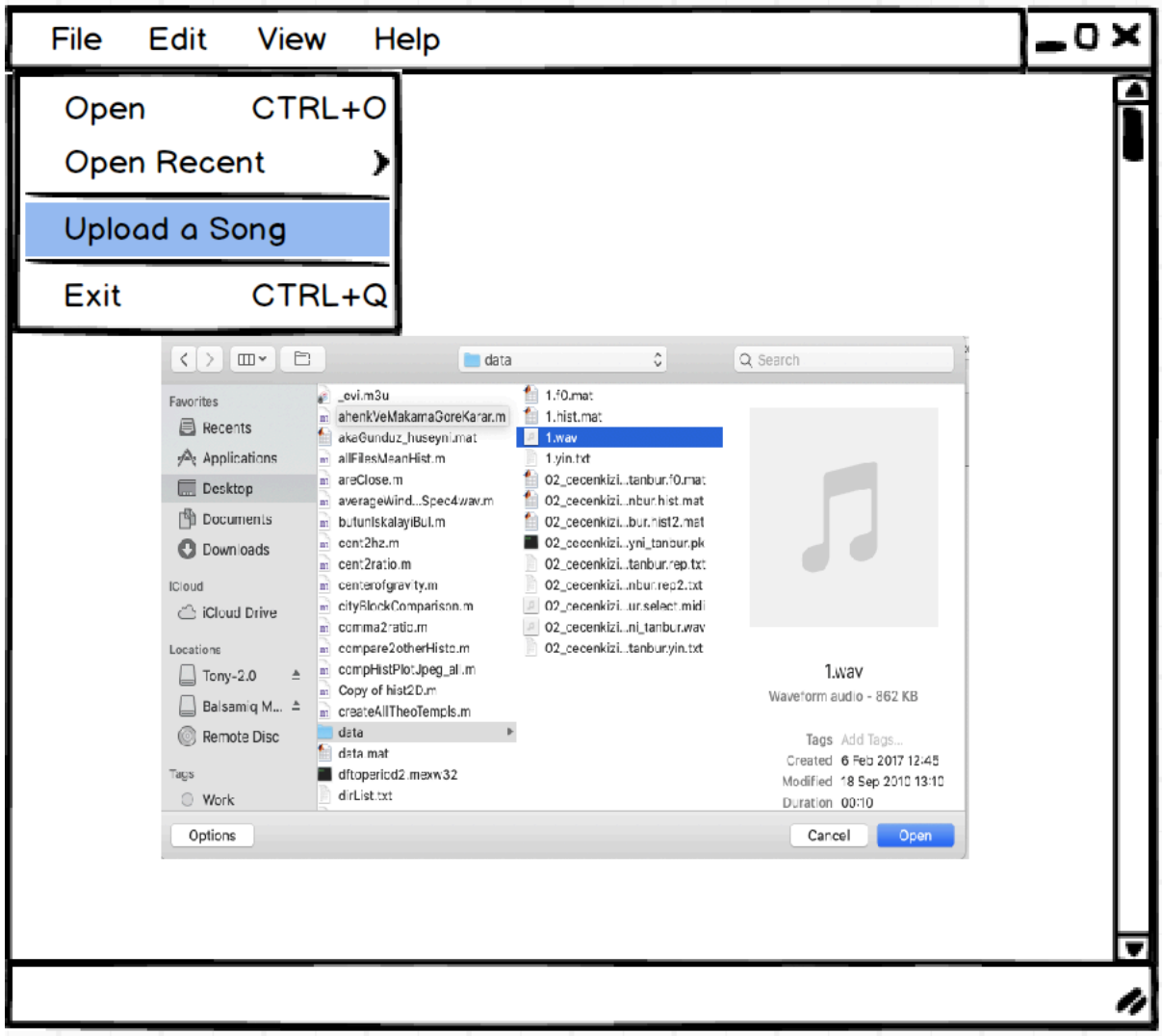

Fig 4: Upload Music File Screen

Music file will be uploaded when clicking file button at the menu bar.

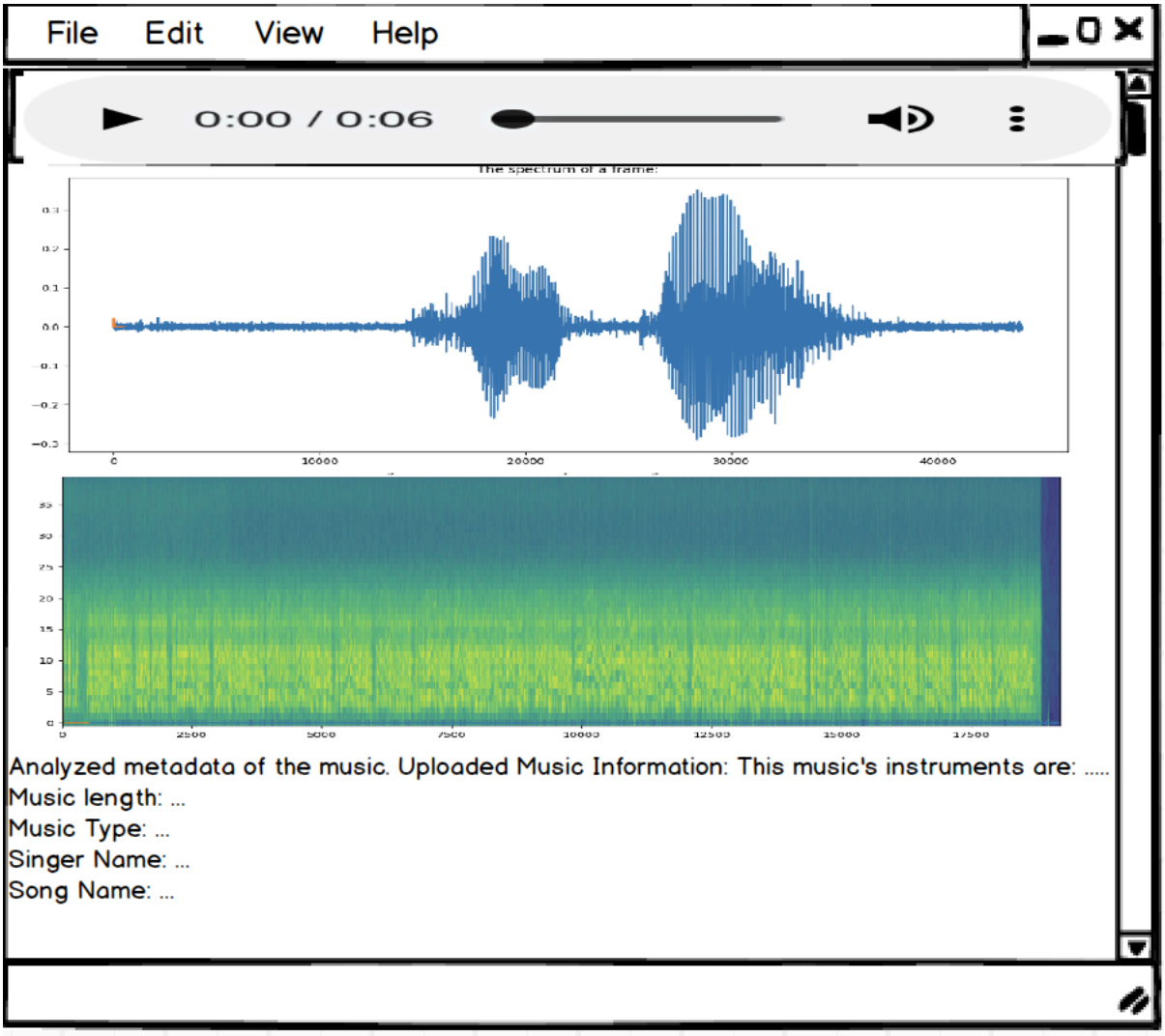

Fig 5: Uploaded Music Home Screen

At the first diagram called spectrum of frame, music waves can be seen. At the below of it, another diagram called spectral energies shows when the the singer touch the instrument also it is the another representation of Melogram.

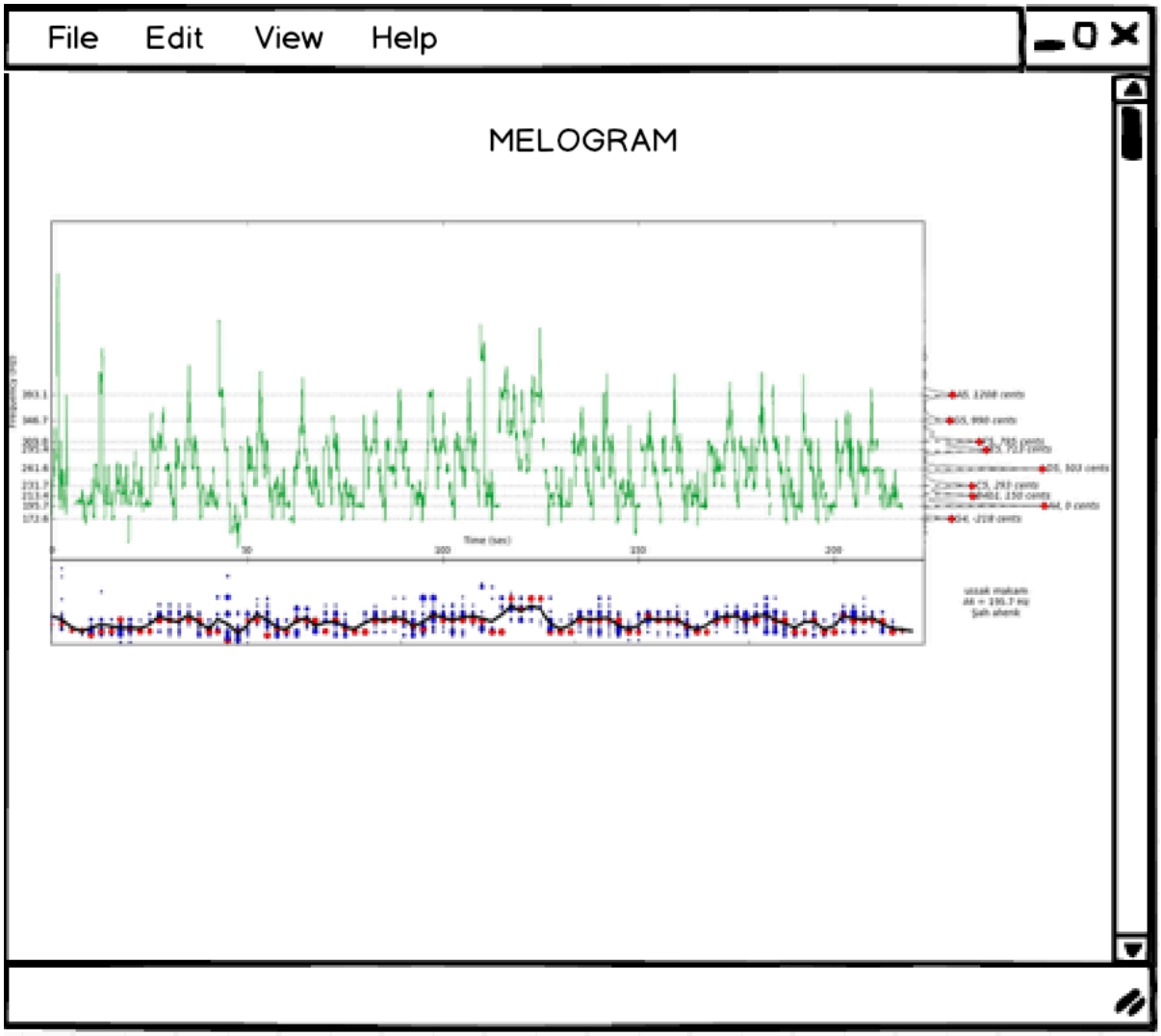

Fig 6: Melogram

When the user of the program clicks edit, there will be two options which are Melogram and Histogram. When clicking Melogram, the system will going to create Melogram diagram which is shown above.

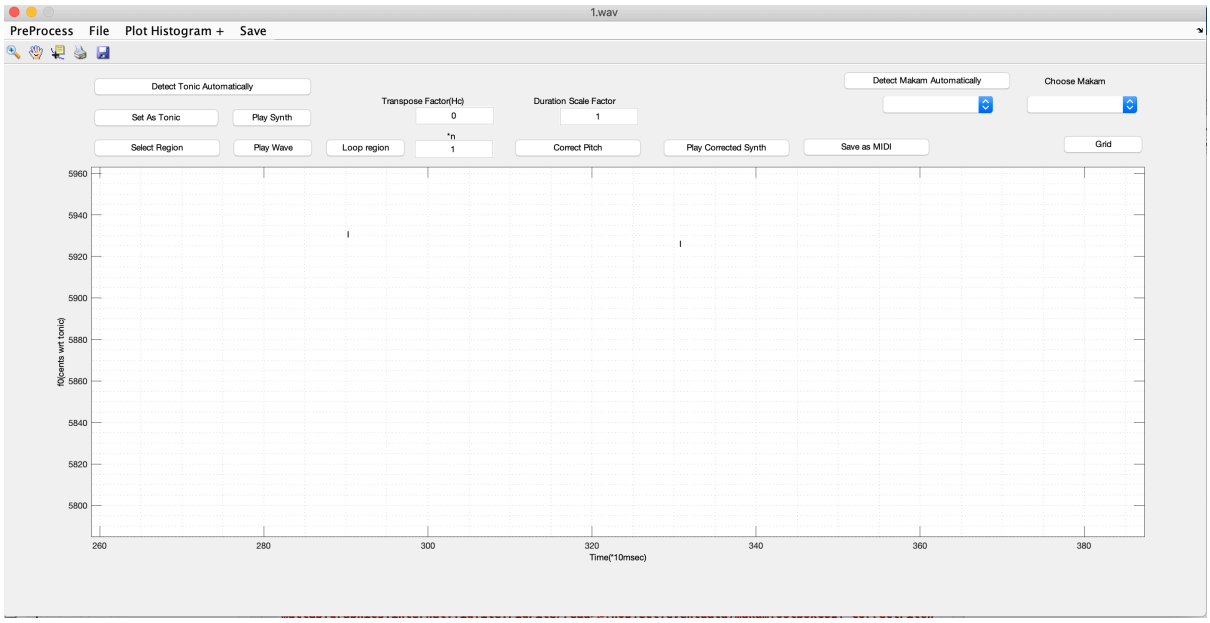

Fig 7: Makam Tool Box

After fixing some methods, makam tool box front end part came in view. Here it is how makam tool box is shown.

5.2) Activity Diagram