ECE1778

Creative Applications for Mobile Devices

# Motion-o-Meter

## Final Report

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04.06.2012

Word count: 1394

Record – Measure – Compare

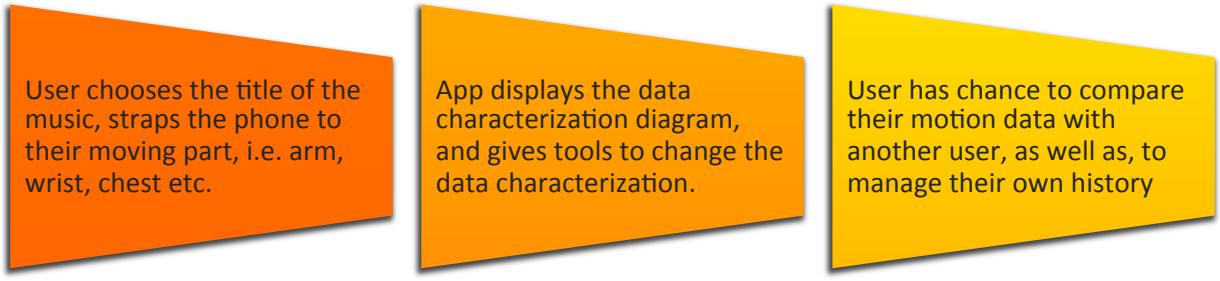
# Motion-o-Meter



## Introduction

Motion-o-Meter is a research instrument that can be used by musicians to study the motion characteristics of people who play instruments. This tool is developed as an Android mobile application.

The application measures and records the *motion* and *the music* of a musician, while they are playing an instrument. Then provides simple data characterization by displaying chart. To enhance the usability the app provides a general chart, i.e. total force over time; Fourier transform chart, i.e. energy over frequency; and finally users have chance to apply custom function to the chart, i.e. abs(), cos(), sin(), log(), pow(), addition, deduction, multiplication, and division. Other helper tools are comparison of motions between different users, and history management.




So the overall idea is to measure this data; the ultimate goal, which would need a lot of research by someone in the field, would be to find characteristics that are good, and then provide feedback to a musician who is learning or trying to improve.

## Overall Design (Arsen)

Figure 1 is the block diagram of the application.

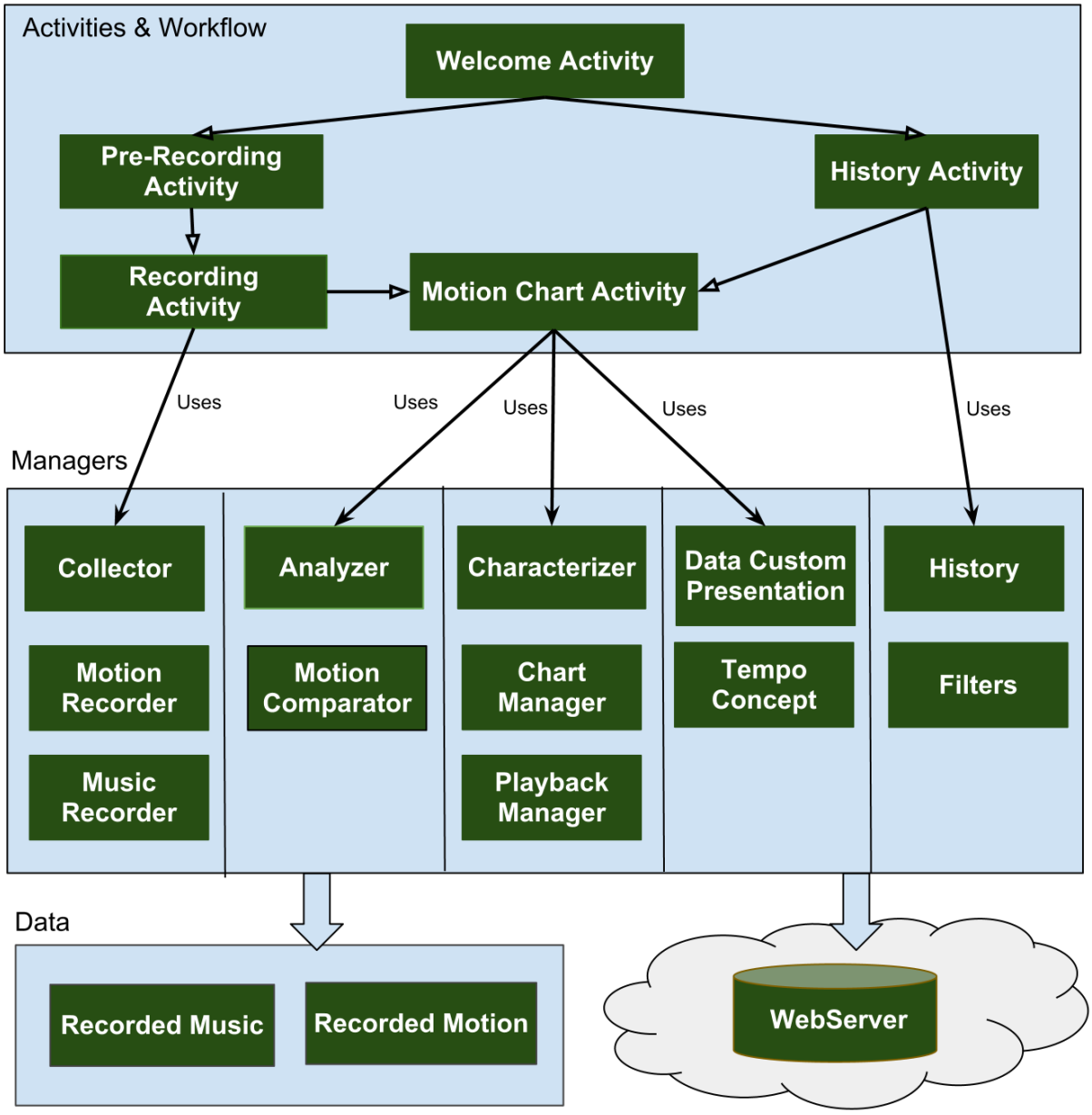



**Figure 1**

As the diagram suggests, our architecture consists of three layers - presentation layer, business logic layer, and data access layer.

Data access layer encapsulates the logic behind reading and writing data into internal and remote server databases. This layer handles network connection logic and provides facade to the remote database. It provides Recording Bean class which encapsulates the information of a given recording, including motion and music data, as well as the name of the musical piece, the date and the auther.

Business logic layer acts as a helper for the Presentation layer, providing functionality for the following features of the application:

- Mathematical operations and transformations, including Fourier transform and basic math equations parser component integration,
- Data collection from sensors and microphone, including motion noise removing.
- History management, including filtering logic over recordings listing,
- Data comparison,
- Export motion data

For mathematical equations and transformation the application uses 3rd party libraries and the integration component is located in business layer as well. It acts as an adapter to the 3rd party library.

Presentation layer is responsible for event handling, view rendering, and basic logical operations handling. This layer acts as a controller of the application flow and uses business layer classes to handle the input and the output information.

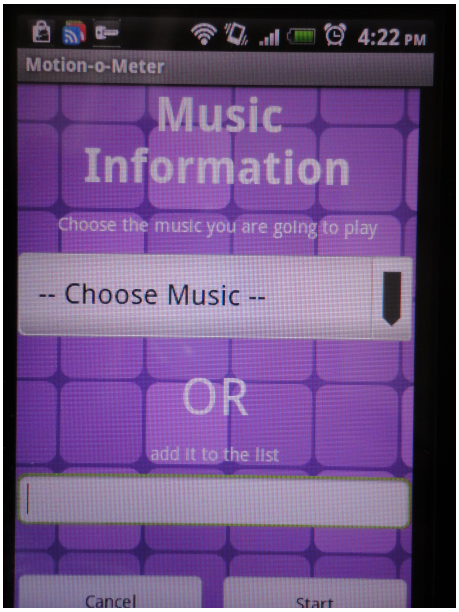
## Statement of Functionality & Screenshots from App


The application has the following parts :

- Data recording,
- Data comparision,
- History and filters,
- Exporting,
- Data representaion on a chart and music playback.

At the first screen user can choose to between recording new motion, comparing previous motions with each other or browsing the local history.

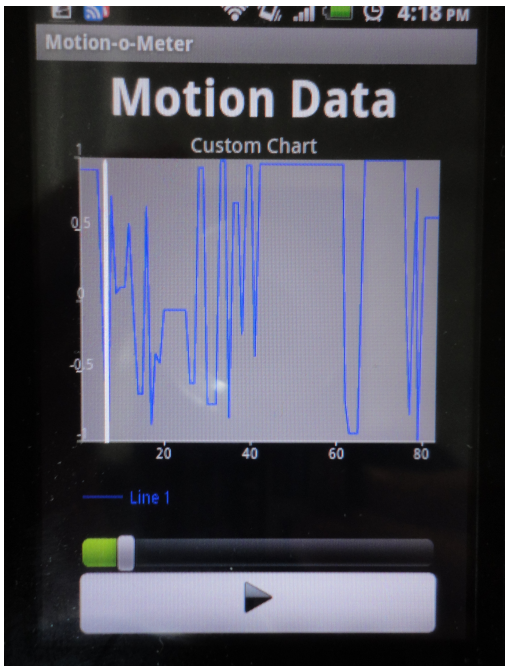
### *1. Recording*

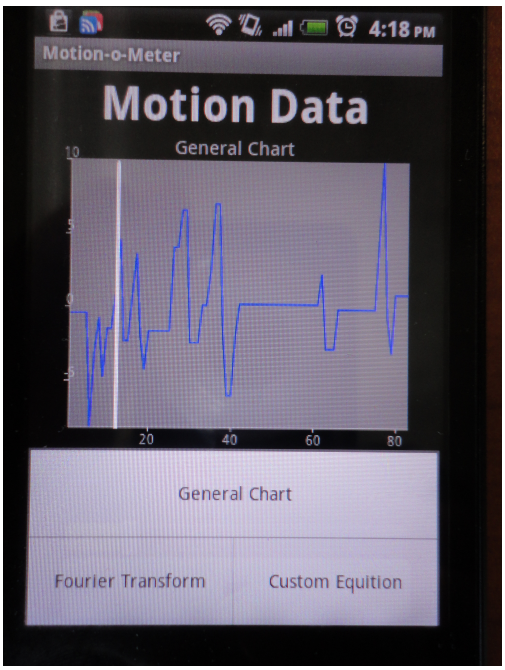



Recording screen has 2 subscreens – pre-recording and recording. In prerecording screen musicians can select a music that has been played before to update it's motion with a new performance or they can type a new name for a new performance. Once, the music has been selected the user will be taken to the recording view. They click « start » button and the applications starts recording both the motion and the music. When the musicians are done with the performance they click stop are switch to data representation screen.

### *2. Data Representation*

In this screen user can see the chart of the recorded data and the music playback, synchronized with the chart. They can also apply different math equitions and transforms to the data and see the new data on the screen.

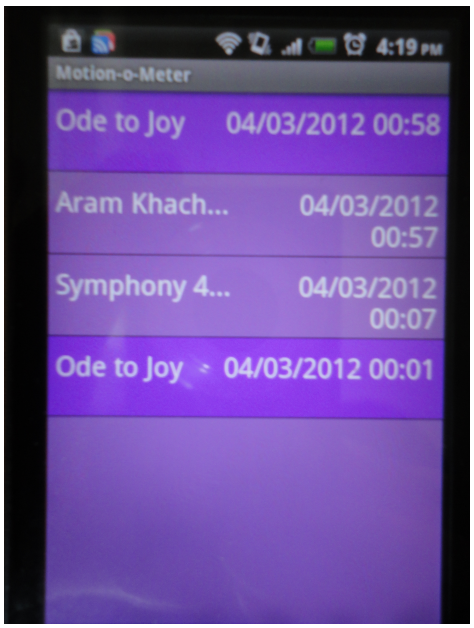



### *3. Data Comparizion*

In data comparision mode users can choose to compare their recording with other user or with some other version of the same music recording played by them in the past. The comparision screen shows two charts, each for the comparable data and we can apply math equitions in this screen as well.

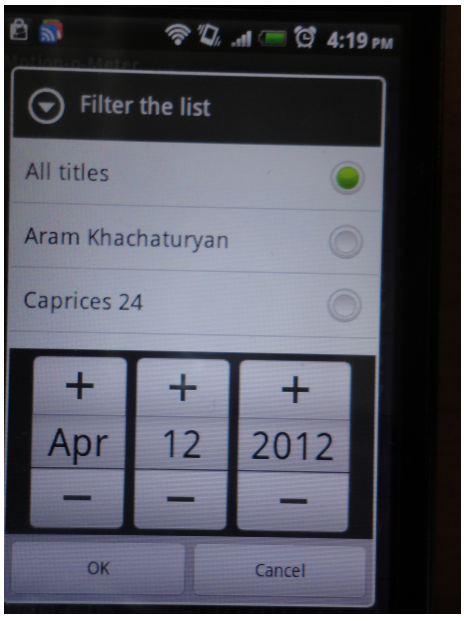
In case when user selects to compare their data with other user's data, the comparable data is being loaded from remote server otherwise it's being compared with the data stored locally on the device.

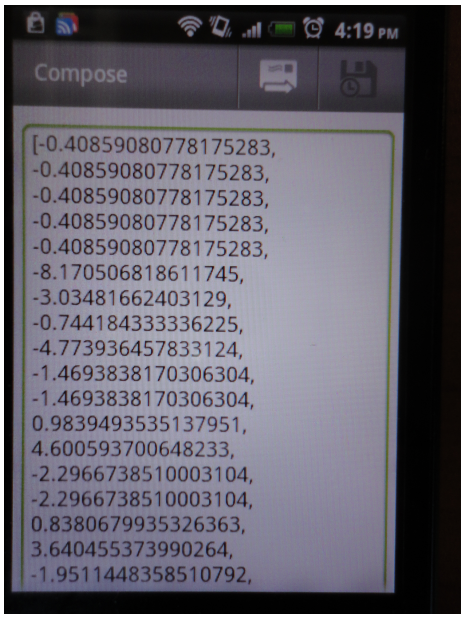




### *4. History and Filters*

In this mode users can browse the history of their previous recordings and see their chart. They can also filter the history list by date and title and also export the data and send it by email or skype.



## What did you learn - what would you do differently?

During the process of development of the application, we learned almost all features and sensors of the Android platform. The list includes:

- Accelerometer,
- Microphone,
- Speaker,
- Networking,
- Working with local storage.

Besides, technical side, we learned spiral development and product development with iterations. This process forced us to make time estimation on tasks in a way that will bring to a stable version of the application with specific features. The most important things here was choose tasks and features that will make the application ready for demo and meantime will be possible to develop then in a short period.

We also learned doing presentations, focusing on most important features in a limited time and explaining the application in a way that will be understandable for not only technical people.

That last but not least, that we learned during the class is the ability to think about the application from user perspective and try to prioritize features from user perspective. This approach helps in building user centric UI interface and application functionality.

If we started working on the application from scratch, we will spend more time on initial scope definition and planning. We started working on a learning platform creation at the beginning and realized that the application will have more value if it is a research tool for a professional in the field.

We would also try to find a researcher who is supposed to use the application to consult the previous experiments that’s been done in the field.

## Contribution by Group Members (Ani)

My started working together on planning the architecture of the application and splitting the process into tasks. We also did task estimation and initial mockuping together. Once we had plan, tasks and mockups we divided tasks between two of us and were continuously merging and consulting to each other about the progress.

Ani, has been working on music recording, comparison, history and filters functionality as well as on remote server integration. She has also been working on UI design application and layout creation.
Arsen has been working on motion recording, data access layer local storage part, chart integration, playback control and synchronization with the chart as well as on exporting data in CSV format.

We both have been participating in presentations and reports creation and demos on the spiral delivery dates.

We have been using Git repository control for merging files and Eclipse IDE as a development platform.

## Future Work (Arsen)

As a next step for the application we see the testing of it for a musician and discussion with a researcher in the field. This will give as a broader view on the next steps to focus on. The current state of the application allows collecting data and representing it in basic transformations and we see need for adding many other types of data representation. However, this step should be done after user evaluation to save time on development of useless representations.

From point of view of development and adding functionality we emphasis the following features for the next steps:

- Adding notes on a specific section of a chart or data. This will help the research to give feedback to the musician in more specific way, emphasizing exact part of a performance and motion.
- Adding different user types. This feature will help the researcher and the musician have different accounts. The researcher will be able to comment, measure, compare motion and the musician can record, see the feedback and browse the history of recordings.

## Would you be interested in having a Business School class on marketing/entrepreneurship take it up?

We would definitely be interested in finding ways and applications for the motion measurement concept. As we believe it can be extended to dance “measurement”, painting or any other art area that has active movement in it. So, if someone in a business field can see a broader view in commercializing the application we are ready to continue it’s development and extending it to a commercial product.