

CS4347 Sound and Music Computing  
AY2016/17 Semester 2  
Project Specification

## From Motion to Music

This Sound and Music Computing project is meant to test your knowledge of signal processing, sound and music computing, and to encourage your creativity. It will involve android development, and research and reading about digital signal processing (DSP) and motion detection. You will have to work together in a team to test, prototype and develop your project. This project is open ended and allows your group a lot of freedom to explore and be imaginative!

In groups of four, you are expected to produce a **software musical instrument** running on an android smartphone to perform a musical composition. The software musical instrument must use the motion of the smartphone as the trigger to modulate and modify the sound it produces.

This document is split into two sections:

1. Project Specification
2. Evaluation

## Project Specification

This system will consist of a smartphone application (the software musical instrument) which can analyse movements (gestures) by using signals from the accelerometers and gyroscopes of the smartphone. This motion should be analysed to modulate and modify sound. A simple example of this idea is producing a drum beat when a smartphone is shaken.

A *gesture* is a motion of the arm or hand whilst holding the smartphone, some examples include shaking, or waving. Gestures have properties such as speed or direction. These gestures are to be mapped to sounds of a musical instrument through the smartphone application.

The sound produced can be MIDI, pre-recorded audio, or synthesised. Regardless, the audio must be modulated or modified based on the presence and properties of a gesture. Specifically, the gestures should control at least one property of the sound being produced, for example, with an increase in speed of hand waving, the application may increase the pitch of the sound being produced. Some examples of properties of sound that could be changed include volume, duration, timbre, and pitch.

Whilst you have total design freedom in your application there are some basic requirements.

## Requirements:

### 1. Movement Detection (gestures):

The application must detect smartphone movements, and extract some properties of the movements, such as speed, and direction (or any others you can think of). We expect a minimum of three gestures detected.

### 2. Sound Synthesis:

The application must be able to produce sounds so that you can play a composition. The sounds can be MIDI, pre-recorded audio, or synthesised.

### 3. Gesture Mapping:

The properties of the sounds should be triggered and modulated based on gestures and movement. This mapping should be intuitive and accurate. It **can not** be a simple mapping, i.e. playing a sequence of predefined notes one by one as a gesture is detected.

You will need to use your knowledge of signal processing, sound synthesis, software development, and music computing. But, don't be afraid of reading outside of the module for other ideas and algorithms.

## Total Design Freedom (sort of):

How exactly you do movement detection, sound synthesis or gesture mapping is up to you. There are many options including simple thresholds, more complex filtering methods, or even modelling or machine learning!

You are also free to use the other sensors and modalities of the smartphone given to you (such as the touchscreen or microphone) if you wish. Combining these modalities may give even more options for your mapping.

Each group will be provided with an android smartphone for development and demonstration. You are expected to use your signal processing and sound synthesis knowledge gained from the course.

**One quick point to note:** android gestures are != the gestures as described in this project. Android gestures are touchscreen movements (like swipe).

Your individual contributions to the project must be clearly stated in the report. **To make sure you and your peers efforts are recognised, you will be required to do an evaluation of the contributions of your group members at the end of the project.**

## Evaluation

There are two evaluation points for this project. They will involve both a live demonstration as well as a written report.

You will be assessed on the latency and accuracy of the gesture detection as well as the complexity and novelty of the sound modulation. You and your group will also be expected to perform a short melody of your choosing using your instrument. It can even be an ensemble of musical instruments including pitched and percussion instruments, synchronized by your group of four so as to produce a music composition.

Date	Evaluation
3rd March	Project progress checkpoint demo and preliminary report (10%) <ul style="list-style-type: none"><li>- The android program should detect a gesture on the smartphone</li><li>- The android program should generate a sound on the smartphone</li><li>- It should be able to link the gesture to the sound</li></ul> Report: Elaborate on your progress so far and your plan ahead
15th April (Saturday)	Final project demo, Final report (20%) <ul style="list-style-type: none"><li>- Motion properties should change the properties of the sound being produced</li><li>- Perform a short melody of your choice</li><li>- Bonus points for additional/advanced features</li></ul> You are expected to submit both your final report and the source code of your project.