

**Mood Streamer**

**Final Year Project Report**

DT228

BSc in Computer Science

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**Abstract**

Music has the power evoke strong emotions in the listener.

This project aims to provide a system for the music listener to categorize and play his or her favourite music based on the emotions that music induces in the listener.

The result of the project was the development of a mobile application and server-side back end which allows the user to select a mood they are experiencing and be played music from their personal collection which matches that mood

**Declaration**

I hereby declare that the work described in this dissertation is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

Signed:

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26/03/2015

**Acknowledgments**

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# Introduction

## Project Aim

The aim of this project is to develop a software system that will allow the user to select a mood or degrees of multiple moods that they are currently experiencing by inputting this choice in a mobile application. The user will then be played music that the system has deemed to be matching this mood. The system will consist of three components:

## Challenges Faced

## Structure of this Document

This document is structured into 7 sections (including this introduction), they are as follows:

### Section 2 – Research

This section explores the research undertaken before and during development of the system. It first details existing solutions and systems in similar areas to this project as well as outlines pros and cons of these systems relative to this project.

This chapter then outlines the technologies researched before development began, as well as the justification for the choices made in this area.

### Section 3 – Design

This section outlines the design methodologies employed in this project. It also looksat

### Section 4 – Architecture and Development

This section outlines the overall technical architecture of the system and documents the development of the system that has taken place over the course of this project.

### Section 5 – System Validation

Validating the completed system was a major part of this project; section 5 attempts to outline this validation. Validation consisted of comparisons with existing system as well as user testing, automated and unit testing.

### Section 6 – Project Plan

This section documents the planning stage of the project and evaluates how well the final system stuck to that plan as well as areas in which it differed.

### Section 7 - Conclusion

This final section reflects on the learning that has taken place over the course of the project. Suggestions are also presented as to possible additions and improvements that could be made to the final system should development continue into the future.

# Research

## Alternative Existing Solutions

When evaluating similar existing solutions in the area of mood recognition music players, several criteria were used to assess the feasibility of developing a system in this field.

Some existing systems perform mood analysis only on the tracks found on the user’s device, using similar techniques to ones which are to be employed on this project: tempo and beat detection, key recognition and pitch analysis. This localized approach has the downside of limiting the tracks a user may listen to those on the device, this in turn is limited by the relatively low storage capacity found on many devices today. A further limitation of using only those tracks which reside on the device is the inability to learn from other music tracks. A sophisticated system in this area is one which can learn from other music and build ratings models from large amounts of music. As such, a system which learns from such a limited number of tracks might not be as accurate as one which can learn from a user’s entire music library, as well as the libraries of other users.

Other applications do not perform any analysis on the actual file to be played, but instead consult an existing online database of rankings for tracks. This method has the drawback of potentially trying to ascertain the mood of a track in a user’s library which has not been ranked by the system.

Other applications do not allow the user to use their own music collection at all; instead choosing music from an existing streaming service. This practice comes with some downsides, one of which is cost. Should the user be streaming music that has not been bought by them, it will usually need to be paid for. Other applications have circumvented this barrier by streaming from popular free music streaming sites such as SoundCloud and BandCamp, where the music artist allows their music to be listened to for free. These services suffer from a greatly reduced music selection as most record labels and musicians do not offer their work for free.

### SensMe

SensMe is an application developed by SONY, which has been included on a selection of their MP3 players, smartphones, and games consoles since 2009. This application allows the user to transfer their music collection to the device. Once music has been added to the device, the software analyses a subset of the music according to such factors as beats per minute (BPM) and key. Once analysis has been performed on the tracks, the software visualises them as small white dots and scatters them on a four axis graph. These axes are labelled ‘Happy’, ‘Sad’, ‘Fast’ and ‘Slow’. Once the user touches a point on this graph, a playlist of tracks which have been deemed to match the labels of the axis/axes closest to the contact point.

A downside to the SensMe system that shall be addressed with this system is the storage limitations present on the devices on which it runs. As no music is stored on the client, but rather on the server ready to be streamed to a client device, much more storage space can utilised. Another advantage of this system over one which analyses local files only is that other users’ files can be analysed alongside one another, enabling the system to learn.

### Moodagent

Another existing application, Moodagent, which can be downloaded from the Google Play store for Android devices and from the Apple App Store for IOS devices addresses the task in a slightly different manner. Instead of performing the analysis locally, the application consults a pre-existing online database of mood ratings for a track. This has the advantage of not being limited to learning from the relatively small set of music added by the user. The user is presented with a series of sliders labelled ‘Sensual’, ‘Tender’, ‘Happy’, ‘Angry’ and ‘Tempo’, and sliding these up or down adjusts the mood of the playlist of tracks to be played to the user accordingly.

Moodagent limits the track selection that can be played to those which are on the device, greatly limiting selection, it does however allow the user to hear new music similar to the current mood-based playlist and gives them the ability to buy it on services such as Amazon.com. It also limits the rating of a user’s music to those tracks which have already been rated and stored in the Moodagent database.

### StereoMood

StereoMood is an Android and iOS application as well as web-based music streaming service which, according to the company’s website “plays music tailored to your mood and daily activities” [4]. The music recommended by this service is aggregated from music blog postings and streamed using the popular SoundCloud music hosting platform.

### Feature Matrix

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature** | **SensMe** | **Moodagent** | **StereoMood** |
| Streaming from the Web | No | No | Yes |
| Analyse local files before they’re played | Yes | No | N/A |
| Use user’s own music collection | Yes | Yes | No |

## Technologies Chosen

Many decisions had to be made as to the technologies to employ for this project as it consists of three distinct software components that all need to communicate together effectively.

### Mobile Development Platform(s)

When it came to deciding on the mobile platform to develop the application, certain factors needed to be taken into account. These factors included:

* Platforms which run on devices currently accessible
* Cost of licences for those platforms
* Additional hardware required to develop for a platform (Mac OS is required to develop applications for iOS, for example)

It was decided that initial development will be done for the android platform as there is no cost to develop for it. Development took place using the Xamarin [5] toolkit for mobile application development. It was decided to use this technology as it allows for the development of an application for other platforms, namely Windows Phone and iOS further into the project. A decision had to be made whether to develop native applications for one or more platforms using the Java language for Android, Objective C or Swift for iOS and C# for Windows phone, or to use Xamarin to write for any of these platforms using the C# language and the mono runtime. It was decided to use Xamarin for a number of reasons. One such reason is that a shared code base can be used across all platforms for functionality which does not relate to the user interface; UI features are largely specific to the mobile platform, but all are wrapped in C# for uniformity.

An influencing factor in the decision to use the Xamarin platform was an existing familiarity with the C# language and the .NET framework, which the Mono framework attempts to emulate. This familiarity with these technologies will lead to increased productivity during the development of the mobile application, as well as cleaner, more idiomatic code.

While Xamarin affords the developer the opportunity to write mobile applications in the C# language, it is still necessary to become familiar with the APIs specific to each platform; Xamarin doesn’t re-implement these, it merely affords idiomatic C# access to them. As Android is the primary development platform at this stage of the project, some time was spent reading the android tutorials found on the developer.android.com website. These tutorials and supporting documentation primarily use the Java language, however given the similarity between the two programming languages, they proved and continue to prove highly useful in the development of the Android application for this project.

### Database

# Design

# Architecture and Development

The system is developed using a multi-tier architecture consisting of:

* Web Service
* Client Application
* Desktop Upload Utility

# System Validation

## Testing

### Usability Testing

Testing the quality of the mood analysis of the application comprised a large part of testing process for this project.

### Comparison with Existing Systems

Many existing systems attempt to recommend similar music to a user based on music they listen to using the system. Such systems include Spotify and iTunes Genius. It was also decided to compare the analysis with existing music mood rating systems such as Mood Agent.

A starting point was chosen as a song that was subjectively sad to the ear of the tester as well as one which scored a low rating in the positivity and energy analysis by the system. This song was then played in Spotify and the ‘start radio’ feature was used to obtain a list of tracks that Spotify considers similar to this starting track. These recommended tracks were then put through the system to be analysed and it was expected that the ratings for these tracks were to be similar. A subset of tracks analysed using this process is shown in the table.

|  |  |  |  |
| --- | --- | --- | --- |
| **Artist** | **Track** | **Positivity Rating** | **Excitement Rating** |
| Low | Lullaby |  |  |
| Low | Down |  |  |
| Red House Painters | Dragonflies |  |  |
|  |  |  |  |

It was noted that these seemingly similar tracks provided varying results when passed through the mood analysis; this provided a basis on which to tweak the weightings assigned to the various parameters used in the formation of the rankings.

### User Testing

# Project Plan

# Conclusion / Future Work

## Future Work

### Web Frontend

As web technologies have progressed, more software services are being made available as a web application rather than, or in addition to the native applications offered for platforms such as iOS, Windows Phone and Android. Popular music streaming services such as Spotify, Google Play Music and Rdio all offer a web application in addition to their native applications. This can prove useful to the user when they are away from their primary machines and wish to listen to music using the service.

### Securing the Service

At the moment the web service providing the analysis and streaming of the users’ music files is not encrypted using SSL or TLS standards. This could prove problematic as user credentials and copyrighted content associated with the user could easily be intercepted by an attacker.

### Improving the Audio Analysis

The mood analysis performed on the tracks the user uploads to the service can be improved upon greatly with a combination of user feedback and investigation into other methods of extracting relevant features from music.

### Python 3 Support

Python 3 was released in December 2008 and brought with it many improvements and new features, such as Unicode strings by default and a difference in division results. A result of this major overhaul of the language is the backwards incompatibility with Python 2 code that was necessary to introduce.

This application was written using Python version 2 as library support at the time of development, primarily for the essential library used for music feature detection.

While it is not presently possible to port the application to python 3 due to the outlined concerns, steps such as using python 2’s future module to ease the transition may be employed in the near future.

### Better Support for Classical Music

**There are no sources in the current document.**