An Automated Music Selector Derived from Weather Condition and its Impact on Human Psychology

N Mohammad, M M Islam, Md. Nafees Mahbub and Debajyoti karmaker

American International University- Bangladesh (AIUB)

Abstract—

Keywords—

I. Introduction

"Verbis defectis musica incipit" that's Latin for, "Music takes us where word cannot." Music is an important part of our life. There is a strong relationship between music and human mind. In most researchers' opinion, people value music primarily because of the emotions it evokes. As Juslin says "People use music to change emotions, to release emotions, to match their current emotion, to enjoy or comforts themselves and to relieve stress". He also represents a novel theoretical framework featuring six additional mechanisms through which music listening may induce emotions: brain stem reflexes, evaluative conditioning, emotional contagion, visual imagery, episodic memory, and musical expectancy [4].

As listening of music varies with emotions, a better music classification is recommended to create a well-defined automated music playlist. Music usually classified according to genre and for limitation to cover these huge number of music collection sub-genre are introduced. If we go little deep while we are listening music, an artist or genre is not the primary key for music selection to satisfy our emotional state. There is two main roles go with our emotion, one is musical instrument and another one is tone. Sometimes lyrics reflect on our emotion. For example, a listeners with happy mood may want to listen 'Don`t Worry, Be Happy' or 'Hotat Roud', they will not care about the artist, they just need that specific speech to satisfy them.

Weather is another factor for a music listening which we cannot realize most of the time. As we listen music to satisfy our emotion and mood states changes with weather. Different categories of weather are responsible for changing in emotions, which indicates a character either positive or negative for the organism, but these changes, varies from one to another [6]. For example, in rainy weather a listener may want to listen a sad music to evoke his/her emotion; on other hand another one wants to a happy music. In other word we can say, weather helps us to feel our emotion more deeply.

In our work, we propose a different list of music based on mood and weather. It is recommended that listening of music depends on our mood. The interesting part is that, from this model we can define the relation between human mind and weather.

II. Background Study

With the development of modern science people are more and more reliable on newly invented technologies. From professional needs at work place or personal activities like listening to music they rely on modern tools and techniques. Today's music listener faces various obstacles in finding music for a specific context. With the extension of digital music library day by day it is getting more complicated to classify or categorize music according to user's emotional specifications. As a result the need for music classification tools is becoming more and more apparent. Listeners now a day's need tools that could classify their large music library into mood based category so that they could enjoy music in a new and exciting way. Music has various attributes that influence basic human emotions as like as human emotions changes with the changing of weather state. The work presented here is to find a relation amongst music, weather and human emotion and why they influence each other. Also updating our classification through user feedback and machine learning.

With the development of digital music technology, it is essential to develop the music recommendation system which recommends music for users. Some work has been done on the personalized music recommendation to recommend based on the users' preference. There exist two major approaches for the personalized music recommendation. One is the content-based filtering approach which analyzes the content of music that users liked in the past and recommends the music with relevant content. The other is the collaborative filtering approach which recommends music that peer group of similar preference liked.

Both recommendation approaches are based on the users 'preferences observed from the listening behavior [7]. Many of the current music recommendation systems follow the rule of social tagging rather than feature extraction of song. Now days there are many online social tagging sites which provide tagging system for classifying songs last.fm3 is one of them. Although these social tagging sites are useful but, they cannot keep it up to the mark when it comes to actual user preferences .Which is important in classifying mood based music.

As mentioned previously recommending personalized music based on the users' preference one of the two approaches is collaborative filtering approach.

Ringo is a pioneering music recommendation system based on the collaborative filtering approach, where the preference of a user is acquired by the user's rating of music. Similar users are identified by comparing the preferences. Ringo predicts the preference of new music for a user by computing a weighted average of all ratings given by peer group of similar preference [1].

1 http://www.stereomood.fm
2 http://www.musiccat.com
3 http://www.moodlogic.com
4 http://www.last.fm
5 http://www.qloud.com
6 http://www.mystrands.com

Stereomood1 is a music streaming service that plays music tailored to your mood and daily activities. It's a tool to create playlists for every occasion, with the ability to tag and share music with everyone you know [2].

MusicCat2 is a music recommendation agent based on user modeling, where the user model is defined by the user. It contains information about user's habit, preference or user defined features, etc. MusicCat can automatically choose music from user's music collection according to user's model. MRS is a system which provides music recommendation based on music grouping and user interests.

MoodLogic3 allows the user to generate "mood" based playlist based on the mood of the user. It uses a central database to allow users to collaboratively profile music by mood. The software was also capable of organizing a music collection based on a "fingerprint" of the song. MoodLogic would generate this fingerprint of the song, based on some social tagging websites like last.fm4, Qloud5, MyStrands6, upload it to the server and wait for a response from the user. Once the feedback tag is received from the user MoodLogic updates the tag for that track and use it for future recommendations for the users. This meant a user could have a collection of incorrectly tagged mp3's and the software would be able to correctly identify, tag, and even organize the songs into categories [3].

Human mind is changing consequently and weather plays an important role when it comes to music selection. Above mentioned models and application focuses on the mood of the user. Our goal is to develop a model that can analyze users preferred mood and weather to come up with a more comprehensive outcome for our end-users.

A. *Psychology of Music and Human Mind*

Here we will discuss about those musical emotions which are mostly related with music and also about those musical acoustic features will be introduced, which has a great role to influence on human mind.

1) Musical Emotion/Mood : The relationship between emotion and music is important when mapping various musical parameters to an emotion space. Emotion is a complex set of interactions among subjective and objective factors, lead by neural/hormonal systems, which can give rise to affective experiences such as feelings of arousal, pleasure/displeasure [14]. There are vast array of emotional states that human are capable of experiencing. It relates to our everyday life as a result it is comprised of various terms and definitions. Research indicates that people value music primarily because of the emotions it evokes. Affect, mood, emotion and arousal are often used interchangeably though each is unique and differentiable from each other. Mood affective state, which is the broadest of emotional states, may have some degree of positive or negative valence, which is the measure of the state's emotional charge [15]. An emotional state is largely influenced by the underlying mood and affective state of the individual. A highly aroused emotional state will be very apparent in the individual.
With the flow of time various approaches were implied to represent human mood in some sort of categorical form. Such approaches include James Russell's two-dimensional bipolar space (valence-arousal) [16], Robert Thayer's energy-stress model [18, 19] (see Figure 1), where contentment is defined as low energy/low stress, depression as low energy/ high stress, exuberance as high energy/low stress, and anxious/frantic as high energy, high stress [17].

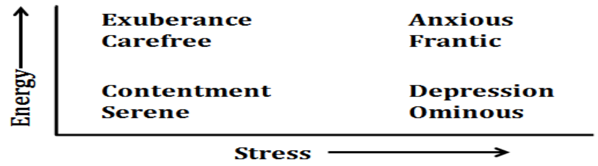

Figure 1: Thayer's two-dimensional energy-stress model [18]

The basic two-dimensional models have also been expanded to circular models, such as Russell's circumplex model [24] and Kate Hevner's adjective circle [20]. Russell's has expressed the basic mood of human kind in a circular format in his circumplex model (see Figure 2), which contains a quadrant graph format in which some general mood types like happy, sad, angry, serene are expressed in each of the four quadrants with some of its similar listed moods.

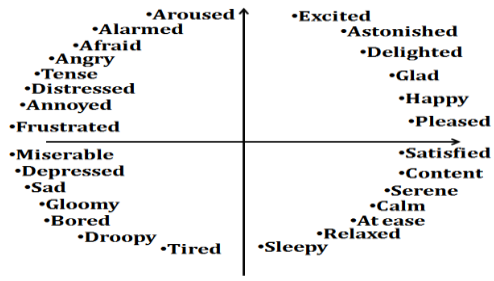

Figure 2 : Russell's multi-dimensional circumplex model [24]

Researchers from time to time have researched through the complex mode of human emotions and psychology in order to find some sort of pattern that may lay between human moods on music selection. Some of the famous citations are stated in the Table 1 and Table 2.

TABLE I. LIST OF EMOTIONS AND THE THEIR CITATIONS IN LITERATURE ON MUSIC AND EMOTION [13]

Emotions / **Literature**	*Scherer 1977*	*Juslin 1997*	*Hevner 1936*	*Lindstrom 1997*	*Krumhansl 1997*	*Watson 1942*	*Gundlach 1935*	*Maher 1982*	*Balkwill 1999*	*Thompson 1992*	*Imberty 1979*
Excitement	●		●			●		●		●	

Serenity		●	●	●		●	●		●	●	
Happiness	●		●			●	●	●	●	●	
Sadness	●	●	●		●	●	●	●	●	●	●
Anger		●		●						●	●
Fear	●	●			●						
Disgust	●										
Boredom	●									●	
Agitation			●								
Surprise	●										
Tender	●	●		●							
Dignified			●			●	●				
Gloom			●								
Triumphant						●	●				
Uneasy							●				
Sentimental							●				

TABLE II. LIST OF EMOTIONS AND THE THEIR CITATIONS IN LITERATURE ON MUSIC AND EMOTION [13]

Emotions / **Literature**	*Poffenberger 1924*	*Kopacz 2003*	*Cullari 2000*	*Kandinsky 1912*	*Terwogt 1995*	*Rusinek 2004*	*Kaya 2004*	*Valdez 1994*	*Wright 1962*	*Kouwer 1949*	*Wexner 1954*
Excitement		●	●	●			●	●	●	●	●
Serenity		●	●	●			●	●	●	●	●
Happiness	●	●		●	●	●	●	●		●	●
Sadness	●	●	●	●	●	●	●	●		●	●
Anger	●	●			●	●	●			●	●
Fear		●		●	●	●	●	●		●	●
Disgust					●		●				
Boredom		●					●	●		●	
Agitation	●										
Quiet	●						●				
Lazy	●										
Secure		●						●		●	●
Serious	●										
Radiant		●									
Romantic			●								
Comfort		●	●				●	●			●

2) Music & Emotion : In the mid 20th century, scholars and researchers began to think how various audio features can play a role in transforming human mood. Researchers like Hevner, Russell, Rigg, Thayer and Watson began to make progress in relating specific musical features, such as mode, harmony, tempo, rhythm, and dynamics (loudness), to emotions and moods. Such models have classified emotions along some axes, such as valence (pleasure), arousal (activity).

Hevner's studies [23, 20, 21, 22] focus on the affective value of six musical features and how they relate to emotion. The results of these studies are summarized in Table 3. The six musical elements explored in these studies include mode, tempo, pitch (register), rhythm, harmony, and melody. These features are mapped to a circular model of affect encompassing eight different emotional categories. Major modes are often associated with happiness, gracefulness and solemnity while minor modes are related to the emotions of sadness, dreaminess, disgust, and anger. Simple harmonies, or consonant chords, such as major chords, are often pleasant, happy, and relaxed. Complex harmonies contain dissonant notes that create instability in a piece of music and activate emotions of excitement, tension, anger, and sadness. In Rigg's experiment; 'joy' is described as having iambic rhythm (staccato notes), fast tempo, high register, major mode, simple harmony, and loud dynamics (forte).

TABLE III. HEVNER'S WEIGHTING OF MUSICAL CHARACTERISTICS IN 8 AFFECTIVE STATES [22]

Musical Element	**Dignified/ Solemn**	**Sad/ Heavy**	**Dreamy/ Sentimental**	**Serene/ Gentle**
Mode	major 4	minor 20	minor 12	major 3
Tempo	slow 14	slow 12	slow 16	slow 20
Pitch	low 10	low 19	high 6	high 8
Rhythm	firm 18	firm 3	flowing 9	flowing 2
Harmony	simple 3	complex 7	simple 4	simple 10
Melody	ascend 4	–	–	ascend 3
Musical Element	**Graceful/ Sparkling**	**Happy/ Bright**	**Exciting/ Elated**	**Vigorous/ Majestic**
Mode	major 21	major 24	–	–
Tempo	fast 6	fast 20	fast 21	fast 6
Pitch	high 16	high 6	low 9	low 13
Rhythm	flowing 8	flowing 10	firm 2	firm 10
Harmony	simple 12	simple 16	complex 14	complex 8
Melody	descend 3	–	descend 7	descend 8

Watson's studies differ from those of Hevner and Rigg because he uses fifteen adjective groups in conjunction with the musical attributes pitch (low-high), volume (soft-loud), tempo (slow-fast), sound (pretty-ugly), dynamics (constant-varying), and rhythm (regular-irregular). Watson's research reveals many important relationships between these musical attributes and the perceived emotion of the musical excerpt.

Mayers states that, loudness aligns itself roughly along the y-axis of arousal. High arousal and excitement are generally the result of loud music and peaceful and delicate emotions which are triggered by soft music [5]. The weightings for each feature and emotion are shown in Table 4. Positive values translate to major mode, simple harmony, fast tempo, regular rhythm, and high loudness, while negative values translate to minor mode, complex harmony, slow tempo, irregular rhythm, and low loudness.

TABLE IV. MAPPING OF MUSICAL FEATURES TO RUSSELL'S CIRCUMPLEX MODEL OF EMOTION [5]

Mood	**Mode**	**Harmony**	**Tempo**	**Rhythm**	**Loudness**
Pleasure	12	11	-7	-5	0
Excitement	24	16	20	-10	10
Arousal	0	-14	21	2	20
Distress	0	-14	21	2	10
Displeasure	-16	-2	-14	-3	0
Depression	-8	-4	-7	10	-10
Sleepiness	-12	4	-16	-9	-20
Relaxation	3	10	-20	-2	-10

During the last decade, many researchers (Feng, Zhuang & Pan, 2003; Juslin & Sloboda, 2001; Lu, Liu & Zhang, 2006) have investigated the influence of music factors such as loudness and tonality on the perceived emotional expression. They analyzed those data using diverse techniques, some of which are involved in measuring psychological and physiological correlation between the state of a particular musical factor and emotion evocation. Researchers to researchers the musical factor and emotional model varies, but they not say so far from each other. Table 5 describes the emotional models of Russell, Schubert, and Hevner and details their position in both the circumplex space and the two-dimensional valence-arousal space [5].

TABLE V. COMPARISON OF THREE EMOTIONAL MODELS, IN TERMS OF VALENCE AND AROUSAL [5]

Degree	Russell	Schubert	Hevner	Valence	Arousal
0◦	Pleasure	Lyrical	Serene/ Graceful	+	o
45◦	Excitement	Bright	Happy	+	+
90◦	Arousal	Dramatic	Exciting	o	+
135◦	Distress	Tense	Exciting	-	+
180◦	Displeasure	Tragic	Sad/ Dreamy	-	o
225◦	Depression	Dark Majestic	Dignified/ Sad/Vigorous	-	-
270◦	Sleepiness	Dreamy	Dreamy	o	-
315◦	Relaxation	Calm	Serene	+	-

3) Psychology of Weather and Human Mind : Human emotions is a complex but influential structure, which is influenced by the slightest change in the environment. There is a weak but significant relationship between weather and human mood. Researchers have hypnotized that mood state mediates the relationship between weather and human behavior. Weather is widely believed to influence people's mood. For example, the majority of people think they feel happier on days with a lot of sunshine as compared to dark and rainy days. Although this association seems to be common sense [25].

Researchers like Howard and Hoffman (1984) have found that there is a significant effect on mood correlated with the weather, especially with regards to humidity (a component of weather not always measured) [25].

Humidity, temperature, and hours of sunshine had the greatest effect on mood. High levels of humidity lowered scores on concentration while increasing reports of sleepiness. Rising temperatures lowered anxiety and scepticism mood scores [25]. The number of hours of sunshine was found to predict optimism scores significantly. As the number of hours of sunshine increased, optimism scores also increased [25].

Another researcher named Keller and his colleagues (2005) examined 605 participants' responses in three separate studies to examine the connection between mood states and weather [26]. They found that:

Pleasant weather (higher temperature or barometric pressure) was related to higher mood, better memory, and ''broadened'' cognitive style during the spring as time spent outside increased. The same relationships between mood and weather were not observed during other times of year, and indeed hotter weather was associated with lower mood in the summer [26].

Research has proven that warm temperatures and exposure to sunshine have the greatest positive impact on moods. A report published in the British Journal of Psychology found that warmer temperatures lowered anxiety and skepticism while more hours of sunshine increased positive thinking. The same study showed that high levels of humidity made it hard to concentrate, increasing fatigue and sleepiness, depresses [27].

For example at high temperature and when barometric wind pressure is high there is a pleasant weather which gives a positive effect on mood[26, 27].On the other hand low temperature high levels of humidity and low hours on sunshine give a negative effect[26].

After the process it gives us a float value which is referenced to our emotion model to get a relevant mood.

The research presented in this thesis attempts to implement the relationship between human emotions and why it is influenced by various attributes of music and weather. The goal of this work was to classify music based on human emotion and current weather to recommend music according to user mood. Also to clarify the classification and update it through machine learning. The mood-weather based classification system is meant to enhance the user's music listening experience to a new level and to remove the hassle of searching through large music database that suits the user need.

III. PROPOSED ARCHITECTURE

A. Music Theory

The field of music psychology dates to the 18th century, beginning with J.P.Rameau in 1772 [7].The psychologically based fields of music perception and explore how scientific representations of audio signals in the environment differ from representations within human mind. This includes the representation of the pitch, harmony, loudness, mode, tempo, rhythm [7]. Henver's studies focus on these six musical features related to human mood [8, 9].

Our proposed system maintains a stable database populated with the most popular tracks. Each of the tracks are taken and driven into the systems feature extractor to classify the mood for the track. The feature extractor process depends on two term; 1) Musical Acoustic Feature and 2) Lyric mining.

1) Musical Acoustic Feature : Based on the discussion states above we select six musical acoustic features for our system; are Mode, Tempo, Pitch, Rhythm, Harmony and Dynamics, which play vital role in deciding the human emotions. Below is a brief description about them and their key role on human mind.

Mode indicates the modality (major or minor) of a track, the type of scale from which it's melodic is derived; is "a set of musical notes forming a scale and from which melodies and harmonies are constructed" [10]. Major modes are often associated with happiness, gracefulness and solemnity while minor modes are related to the emotions of sadness, dreaminess and anger [11].

Tempo is defined as "the speed at which a passage of music is or should be played" [10], and is typically measured in beats per minute (bpm). A fast tempo falls into the range of 140 to 200bpm and slow tempo could be anywhere between 40 and 80 bpm. Depending on other musical factors, a fast tempo can trigger such emotions as excitement, joy, surprise or fear. Similarly a slow tempo is typically of calmness, dignity, sadness, tenderness, boredom or disgust [13].

Pitch (high-low) convey emotional responses include the amplitude envelops and interactions between factors [11]. Pitch level has a natural influence in musical expression. High pitch music is often perceived as happy, serene, dreamy and expressive of surprise, anger and fear. Low pitch is associated with sadness, solemnity and boredom but sometimes with pleasantness, depending on the overall musical context. Pitch variations may also account for expressiveness, high variations associate with happiness and small variations with anger and fear [13].

Rhythm is defined as "the systematic arrangement of musical sounds, principally according to duration and periodic stress" [10]. Rhythm can be categorized as regular/irregular (Watson), smooth/rough (Gundlach), firm/flowing (Hevner) and simple/complex (Vercoe). The variations of the regularity or complexity of a rhythmic pattern in a piece of music trigger emotional responses. Regular and smooth rhythms are representative of happiness, dignity, majesty, and peace, while irregular and rough rhythms pair with amusement, uneasiness and anger.

Harmony (simple-complex) is "the combination of simultaneously sounded musical notes to produce chords" [12]. Simple harmonies, or constant chords, such as major chords, are often pleasant, happy and relaxed. Complex harmonies contain dissonant notes that create instability in a piece of music and activate emotions of excitement, tension, anger and sadness [11].

Dynamics represent varying volume levels of perceived intensity of sound. The dynamics of a piece of music may be either soft or loud [11]. A loud passage of music is associated with intensity, tension, anger, and joy and soft passages are associated with tenderness, sadness, solemnity, and fear. Large dynamic ranges signify fear, rapid changes in dynamics signify playfulness, and minimal variations relate to sadness and peacefulness [13].

2) Lyric Mining : The areas of natural language processing and textual analysis are relevant to the field of music recommendations and classification in that they provide tools with which to extract meaning and context from cultural metadata, such as music reviews or collaborative content websites. A valuable NLP tool is common-sense reasoning, which is practically suited to the analysis of song lyrics as it enables the mining of key concepts and contexts from the lyric. Common sense is defined simply as "good sense and sound judgment in practical matters" [10].

B. Weather Theory

Based on the discussion states above (from chapter 2, section 2.4) we can get a view that weather has some significant contribution on influencing human emotions. One of our systems job is to get weather related data from the current location of the user locations. The key weather attributes are used in our system is temperature, humidity, pressure, wind, sunshine, cloudiness and precipitation; which are mostly responsible to effect on human mind. Each one is described below:

Temperature is the hotness or coldness of a substance and measured with a thermometer. Most temperature scales today are expressed in degrees Celsius (ºC), although one will sometime see Fahrenheit (ºF) in use [28].

Humidity is the amount of water vapour in the air. There are three main measurements of humidity: absolute, relative and specific [29]. Humidity gives rise to most weather phenomena: clouds, rain, snow, dew and fog [28].

Pressure is a force, or weight, exerted on a surface per unit area, and is measured in any unit of force divided by any unit of area, which called Pascal (Pa) [28].

Wind is the flow of gases on a large scale. The air is nearly always in motion, and this is felt as wind. Two factors are necessary to specify wind, its speed and direction. The wind speed can be expressed in miles or kilometres per hour, meters per second, and knots or as a force on the Beaufort scale [28].

Sunshine is the direct solar radiation is not blocked by clouds, a combination of bright light and radiant heat. When it is blocked by the clouds or reflects off other objects, it is experienced as diffused light [28].

Cloudiness is used to define the measurement of cloud; where cloud is a visible mass of liquid droplets or frozen crystals made of water or various chemicals suspended in the atmosphere above the surface of a planetary body [30].

Precipitation is the amount of rain, sleet; snow or hail which falls in a specified time is expressed as the depth of water it would produce on a large, level impermeable surface. Usually it is expressed in millimeters; although inches may sometimes be used [28].

i) The model which we have proposed has three variants:

ii) Positive Effect (excited, happy, satisfied, serene, delighted)

iii) Negative Effect (sad, distressed, tense, and angry)

iv) Tiredness (sleepy, tired, bored)

In order to get the weather data our system call through the World Weather Online (WWO) API. The API first gathers the location of the user and the collects the local weather report of the particular location. Then the raw data is processed through the above three variants.

C. Music-Emotion Model :

As there are various musical emotions related to music listening. In these sense of classifying these emotions we are concentrating on 12 musical emotion or mood state (Excited, Delighted, Happy, Satisfied, Serene Sleepy, Tired, Bored, Sad, Distressed, Tense and Angry) for our system, which represent the core aspects of human emotions and all other emotional mood. By using these twelve mood state and six musical acoustic features we generates a mood state flow model depicted in Figure 3, which is fall under the four quadrate of Russell's circumplex model of emotion [24] and are also listed as adjacent mood in Henver's adjective circle [21].

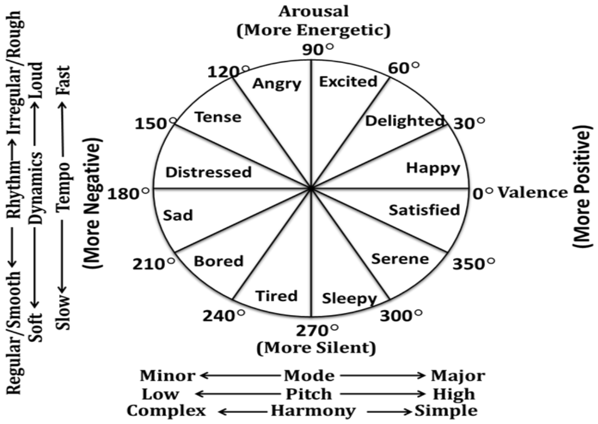

Figure 3 : Mood State flow with Acoustic Feature

Overall system architecture is depicted in Figure 4.

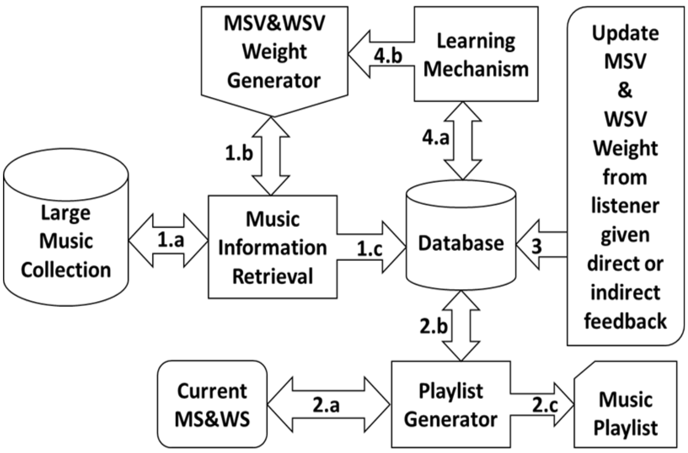

Figure 4 : System Architecture

D. MIR and MSV & WSV weight Generate

1) First it takes a single music file from Large Music Collection and generates a unique key.

i) Extract Meta data (location in data store, title, artist name, album name, genre etc).

ii) Extracts raw data from audio and retrieves six acoustic feature data (mode, tempo, pitch, rhythm, harmony, and dynamics).

iii) For a lyric containing music file Lyric weight retrieves by using text mining.

2) Next it generates MSV (Mood State Value) weight for each music file related with their acoustic features by using Rule-Set for MSV weight with AFV data given in Table 6 which is followed by mood state flow diagram with acoustic feature (see Figure 3) and from those MSV weight corresponding WSV weight will be determined by using Rule-Set for MSV weight with WSV in given Table 7.

3) After retrieving and generating all meta data, AFV data, MSV and WSV weight the system stores them to the database in a single row.

TABLE VI. RULE-SET FOR MSV WEIGHT WITH AFV DATA

Mood State Value	Degree	Acoustic Feature Value						Lyric
		Mode	Harmony	Pitch	Tempo	Rhythm	Dynamics	
Happy	***0°***	+	+	+	+	+	+	+
Delighted	***30°***	+	+	+	+	+	+	+
Excited	***60°***	+	+	+	+	+	+	+
Angry	***90°***	-	-	-	+	+	+	-
Tense	***120°***	-	-	-	+	+	+	-
Distressed	***150°***	-	-	-	+	+	+	-
Sad	***180°***	-	-	-	-	-	-	-
Bore	***210°***	-	-	-	-	-	-	-
Tired	***240°***	-	-	-	-	-	-	-
Sleepy	***270°***	+	+	+	-	-	-	+
Serene	***300°***	+	+	+	-	-	-	+
Satisfied	***330°***	+	+	+	-	-	-	+

TABLE VII. RULE-SET FOR MSV WEIGHT WITH WSV

Mood State Value	Weather State Value						
	Temperature	Humidity	Pressure	Wind	Sunshine	Cloudiness	Precipitation
Happy	+	-	+	+	+	+	+
Delighted	-	-	+	+	-	-	-
Excited	-	-	+	+	+	-	-
Angry	+	+	-	-	+	-	-
Tense	+	+	-	-	+	-	-
Distressed	+	+	-	-	+	+	-
Sad	-	+	+	-	-	+	+
Bore	+	+	+	-	-	+	+
Tired	+	+	+	-	+	-	-
Sleepy	-	-	-	+	-	+	-
Serene	-	-	-	+	-	+	+
Satisfied	-	-	-	+	-	+	+

E. Music Playlist Generator

The playlist generator performs the task of generating the music playlist depending on the preferred mood and current weather by the user.

i) Collects listener current mood state and weather state from listener current location.

ii) Makes a call for a list of music's from database which is highly corresponded with specified mood state and weather state.

iii) Generate a music playlist ordered by higher weighted MSV and WSV.

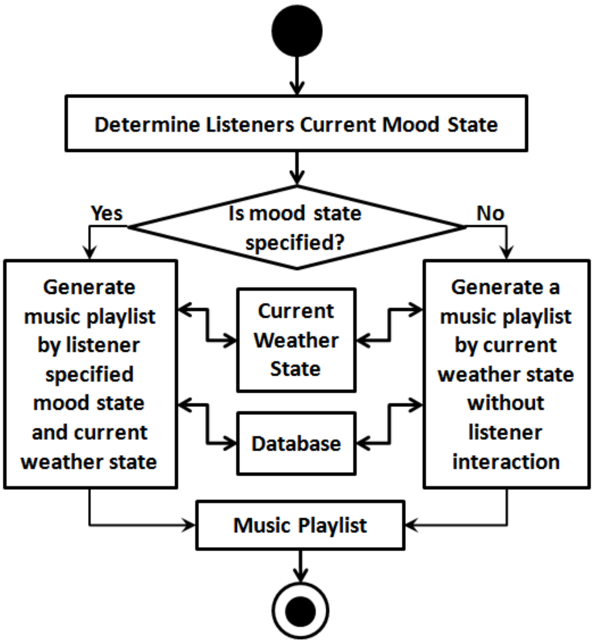

Figure 5 : Automated music playlist generate system

In this process higher weighted music will be suggested by the playlist generator which corresponds to the identified mood state (given by listener) and weather state (collected from listener current geometric location). If a mood state is not specified by listener then the system is able to create a music playlist without listener interaction by selecting those music file which corresponds to the current weather state.

F. *Update MSV & WSV weight from Listener Feedback*

One of the main and essential features of the system is updating MSV and WSV based on user feed-back. In this part when music will be played, system will update the MSV & WSV weight for that particular music for which mood and weather state it was previously suggested. If the music only played by a suggested weather state then WSV weight value will only be updated. Weight value will be updated for each mood and weather state by the given direct/indirect feedback by the listener with value range between (+0.1/-0.1).

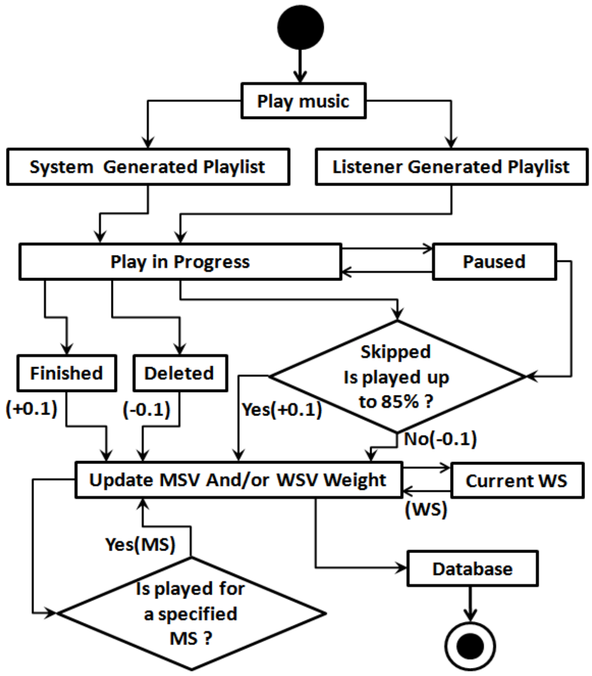

Figure 6 : Update process for MSV and/or WSV weight

G. *Learning Mechanism*

Machine learning is one of the core features of the system. In this learning process system will generate three separate dataset from database; containing each row for music with their AFV data, MSV weight and WSV weight, which is enriched by listener’s feedback. These three dataset are named as AFV&MSV, AFV&WSV and MSV&WSV. From AFV&MSV dataset a decision rule will be generated to define a more appropriate weight for MSV corresponding to their AFV by using data mining algorithm. Similarly from AFV& WSV dataset a decision rule will be generate to define a more appropriate weight for WSV corresponding to their AFV by using data mining algorithm.

Also a relation will be generated between mood and weather from MSV&WSV dataset. From these decisions Rule Set for MSV weight for AFV data and Rule Set for WSV with MSV will be updated. Day by day with more enriched data the accuracy of these three decision rules will be more accurate and system will be able to generate an automated music playlist more near to listener’s satisfaction level.

IV. CONCLUSION

The research presented in this thesis is to find relation amongst music, weather and human mind. Human emotion is a complex subject to analyse as it is not static, which changes with the slightest change in environment. Music also is not an easy nut to crack as it contains a magnitude of independent and dependent parameters.

The main goal of this research paper was to find the relevant factors that exist amongst music, weather and human mind and to classify music based on user mood and current weather. A model that was built to classify music based on musical acoustic features and weather state. James Russel’s dimensional model on emotions and Kate Henver's studies in music and emotions was especially useful for correlating the music features of a song with specific emotions.

To gain our ultimate goal, our system performs some tasks like extracting core music features like pitch, harmony, dynamics, rhythm, mode form a single music track also gathering local weather data and feeding it to our proposed music-emotion model to classify a mood for that particular song.

The combination of audio and weather data content is a circular factor in our mood classification system. Many recent attempts at music mood classification have relied solely on audio content. But adding weather based classification has improved the efficiency of the task thus gathering the knowledge about the relation between human emotions and weather.

One of the weaknesses of classifying system lies in its audio lies in its audio feature extraction stage. A misclassified musical feature such as tempo or mode will have a large on the mood classification of song.

Fault is also part of learning process. By incorporating this type of mood- based digital music classifier into one's everyday music pattern enhances and simulates one's overall music experience.

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