Harmony For The Mind: AI-Powered Music Curation For Mental Well-Being

[1]Dr. Harshita Kumar- Dean of School of Sound, Music & Cinematics, Universal AI University, Mumbai, kirtana,venkatesh@universalai.in
[2]Maanya Sharma- Student of BA. in Audio and Music Production, Universal AI University, Mumbai, maanya,sharma@universalai.in
[3]Kirtana Venkatesh-Student of B.tech in Sound Engineering, Universal AI University, Mumbai, Harshita, kumar@universalai.in

Abstract:

This is an exploratory research conducted to delve into the potential of Artificial Intelligence in its assistance in the world of music and mental well-being. Music is known to possess a great deal of power in shaping a person's mood, there has been empirical data substantiating the apparent relation of such, and unsurprisingly so, has its place in sound therapy and healing. Often, humans struggle with not finding the right music at the right time that renders the flavors that their emotional palette is consciously or unconsciously starving for. Spotify and other music apps have the technology to curate playlists according to the user's past music consumption. This research aims to conceptualize the extension with the use of AI, which can be integrated with PPG (Photoplethysmography) technology and can be used to detect the immediate emotional state of the person to accordingly curate a suitable music that perfectly amalgamates the user's music preference and the type of music the current emotional state demands of. Thus serving to elevate or give emotional relief to the person, enhancing the listening experience, and further instigating a healthy emotional balance of the mind in the long run. This would require AI to be able to detect and categorize music based on musical complexities: frequencies, beats, scales, melodic patterns, and collective rhythms. To achieve this, AI will have to compute and decipher music and its nuances like a human sound engineer. This study aims to evaluate the degree to which this can contribute to ameliorating anxiety emerging in this generation and maintaining mental well-being.

Keywords: Music, curation, Mental well-being, Artificial intelligence, Anxiety, Photoplethysmography, technology

INTRODUCTION:

Anxiety epidemic: Anxiety is a natural human response to feeling threatened, and stressed under pressure, which can range from mild to severe. Now in today's time, more than ever teenagers have started feeling anxious and distressed. Feeling anxious is a part of the normal range of human emotions just as anger, happiness, or sadness. The healing power of music: Music can evoke different emotions and it even drives an individual to different states of mind it is one of the best medicines that helps a person emotionally, mentally, spiritually, socially, and even physically. Music therapy is one of the methods that is used to heal the person in all given aspects. Certain frequencies like 400 hertz, promote relaxation and inner peace. Science has proved that chanting om enhances the nervous system and reduces stress and anxiety which eventually improves physical and mental well-being. Likewise, studies have shown that Listening to certain ragas of Hindustani classical for at least 30-40 minutes every day for about 20 days can decrease systolic and diastolic blood pressure as well as help reduce daily life stress and anxiety. When a piece of music is being made it has certain elements such as the tempo, lyrics, and the melody, which all together give a feel to the music and that is how it influences the cognitive processes and triggers memories. Across cultures, lullabies, chants, and ceremonial music have been used to induce states of relaxation, facilitate meditation, and promote emotional healing. By recognizing and honoring the rich cultural heritage of music, we gain a deeper appreciation for its enduring therapeutic value in promoting relaxation and stress reduction. AI-powered virtual assistants and chatbots provide real-time support and guidance to users, offering personalized recommendations and feedback based on individual needs and preferences.

Contribution of AI in music therapy: AI is changing the way we experience music therapy, making it more personal and effective. In the past, therapists would carefully create playlists based on what they knew

about a person's tastes and emotional needs. But now, AI takes things to another level by analyzing large amounts of data to understand how different types of music affect our emotions. It keeps learning and adjusting, fine-tuning playlists to help reduce stress and improve mental well-being. This smarter, more intuitive approach makes music therapy even more powerful and meaningful. It gives you a personalized experience instead of a generic playlist. For example- having a smart DJ who knows exactly what you need, whether it's soothing background music to help you concentrate at work or an upbeat playlist to keep you energized during a workout. It adapts to your mood and activities, making every moment feel just right.

Understanding Anxiety and Its Neurochemical Basis

Anxiety- Our helpful neighbor we all know aren't we? Anxiety is a normal stress response, with features of tension, worried thoughts, and physical responses like elevated heart rate. In terms of neurochemistry, anxiety is the dysregulation of neurotransmitters such as serotonin, dopamine, and gamma-aminobutyric acid (GABA). Serotonin controls mood stability, whereas GABA is an inhibitory neurotransmitter that dampens overactive neural activity. Dopamine modulates reward and motivation systems. Anxiety is chronic when these systems are overactive or out of balance, creating persistent worry or fear. Whereas some anxiety is okay, for example, it enhances attention during exams or performances-it activates the flight or fight response if you are charged by a tiger-not so universal?-Well, should I phrase it honey-bee? If sustained, higher levels interfere with daily life and mental well-being, though. Stress hormones such as cortisol engulf the brain when anxiety is ongoing, affecting memory, decision-making, and managing emotions.

Music Frequencies and Mood Modulation

Research in neuroscience shows that specific sound frequencies influence neurochemical processes tied to mood. For example:
- Low-frequency sounds (e.g., 432 Hz) are believed to induce relaxation by synchronizing brainwaves with delta or theta states, promoting calmness.
- Alpha waves (8-12 Hz), can reduce cortisol and increase dopamine, promoting relaxation.
- Theta waves (4-8 Hz) may enhance emotional insight.
- Delta waves (0.5-4 Hz) aid deep relaxation.
- Studies show music at 60-80 beats per minute can synchronize with heart rate, lowering anxiety by modulating brainwave patterns.
- High-tempo music boosts adrenaline temporarily, useful for pre-performance jitters but potentially overwhelming if sustained.

This interaction between auditory stimuli and brain chemistry underscores how targeted music interventions can mitigate anxiety symptoms effectively.

The 2025 Anxiety Epidemic: Rising Global Issue

The world is struggling with what most professionals are referring to as an anxiety epidemic. This widespread and mounting mental health crisis is touching millions worldwide. Although solid, completed global statistics for 2025 have yet to be fully assembled, projections and initial data from the ongoing studies, along with trends over the last few years, indicate a grim picture of increasing anxiety rates.

Several factors seem to be driving this epidemic in 2025, both long-term trends and newer shifts in society:

Post-Pandemic Fallout: The pandemic caused by the COVID-19 virus, which initiated a 25% jump in anxiety incidence in 2020 as estimated by the World Health Organization (WHO), is still having far-reaching consequences. Long-term lingering effects like economic uncertainty, loss, and loss of social connections have maintained high anxiety levels through 2025.Technological Overload: Social media expansion and ubiquitous connectivity, as indicated in X posts charting trends in mental health alongside technology uptake between 2000 and 2025, are increasingly in the frame. The stress of dealing with notifications, social comparison, and information overload can overload cognitive abilities, with young adults (18–29) most frequently reporting the highest anxiety levels.

Global Instability: Recent events, such as economic instability, and climat

How AI Will Achieve Mood Recognition and Music Recommendation

AI uses photoplethysmography (PPG) from watches to record heart rate and respiration, analyzing patterns like heart rate variability (HRV) to detect emotions. Machine learning algorithms, such as recurrent neural networks (RNNs) or long short-term memory (LSTM) networks, are learned on these measurements to detect subtle states, like low-level versus high-level anxiety.

Music Recommendation Strategy

For minimal anxiety with confusion, AI prescribes a vulnerable-appearing song to validate emotions, followed by a bridging song for relief. For excessive anxiety, it prescribes immediate uplifting, soothing music. This is achieved by analyzing music characteristics like tempo and lyrics and mapping them to the user's state using audio signal processing and natural language processing.

Supporting Technology

PPG is sufficient for heart rate and can be utilized to estimate respiratory rate, and experiments suggest the feasibility of Respiratory Rate Estimation from Photoplethysmography (PPG). No additional hardware beyond ordinary smartwatches is needed for practicality.

Case Study on Facebook's Biometric Data Incident

The Facebook case was a BIPA violation of the use of facial recognition data without adequate consent, which was settled for $650 million in 2021 Patel v. Facebook: Facebook Settles Illinois Biometric Information Privacy Act ("BIPA") Violation Suit. This presents challenges we can expect to see, such as getting informed consent, being transparent, and keeping our data safe for collecting our physiological data. Similar risks include legal liabilities and loss of user trust if data is mishandled, which we'll address by adhering to BIPA requirements and the Belmont Report's principles, as seen in "Biometric Information Privacy Act - Wikipedia" Biometric Information Privacy Act - Wikipedia.

Methodology for our research

This study aims to verify the accuracy of mood recognition by AI and song recommendation based on wearable sensor inputs (e.g., pulse sensor, PPGT heart rate, and respiration rate) and music listening history. Experimental protocol adheres to ethical standards outlined in the Belmont Report to ensure participant well-being, justice, and scientific integrity.

What is the Belmont Report?

The Belmont Report is a document of ethics on research and outlines three broad principles that include respect for persons, beneficence, and justice. They are applied in regulating the ethical conduct of research on human subjects.

How We Will Carry Out This Test:

Stage 1: Testing the mood detectionThe participants will individually report their mood immediately before putting on the wearable sensor. Participants will be fitted with sensors which when they obtain the physiological data, will sense the mood of the user.The participants will evaluate the accuracy of mood recognition.If the output from AI is not picking up the mood at the right time then the AI model will be designed to improvise.
Stage 2:Testing song recommendation The AI shall be trained and tested on different songs of different genres, types, and languages. Since it's Reinforcement Learning (RL) AI it will learn and improve its accuracy through trial and error.
Stage 3: this is the integration of both these AI models to determine the user's mood and suggest songs based upon it.The model will be trained on a list of say 50 downloaded songs of different styles, genres,

and themes. The AI will be tested against how well and quickly it's capable of identifying the mood of the participant and thus recommend a song that will meet the emotional needs of the participant. Here there is Participants will make them do so and give their subjective feedback on them.

Belmont Principles Compliance:
Respect for Persons:
Obtain informed consent from participants, explaining the aim of the study, risks, and benefits.
For children, obtain parental permission and child assent, but allow them to withdraw if they object.
Clearly explain and provide advanced materials to allow for understanding.

Beneficence :
Minimize risks by using non-invasive sensors and monitoring for psychological distress.
Maximize benefits by enhancing AI algorithms to become more accurate at detecting mood and personalizing suggestions.Offer access to counselors in case the participants feel emotional discomfort.
Justice :
Use a diverse sample to prevent excessive use of vulnerable groups or omission of underrepresented groups.Make sure that there is fair selection and that the benefits of the study are available to similar groups when applied in the future.
Challenges and Anomalies :
Placebo Effect: Mitigated by using control groups and recording external factors that affect mood.
Mood Swings: Account for sudden mood changes through repeated measures and cross-validate self-evaluations with AI predictions
Data Privacy: Protect participant data through anonymization, encryption, and limited access
Formal Approval of Results :
Everything will be reviewed and approved by an Institutional Review Board (IRB) to ensure ethical compliance.IRB monitoring will focus on minimizing risks, safeguarding informed consent, and ironing out aberrancies in the process of collecting and analyzing data.
Adhering to the principles of Belmont will render the research ethically solid because it will increase knowledge in AI-based mood detection and musical experience personalization.

Case study-Survey Results
We conducted a survey, with 104 participants, to determine music listening behavior, the impact of music on mood, and attitudes towards AI-based music curation systems. The survey was intended to determine user needs and preferences for creating an AI-based system that curates playlists according to real-time emotional states, specifically for mental well-being. Here, we analyze the overall responses to each of the major questions, consider the need for such a service, and discuss how it fills gaps in existing music sites.

Survey Methodology
The survey was sent online and consisted of demographic questions, questions regarding listening behavior for music, music, and mood, interest in being recommended music by AI, usage of music to manage emotions, and preferred features. The feedback was collected to evaluate user demand, find out where the current systems fall short, and inform the development of an AI system.

Mood and Music

- **Anxiety Frequency:** 27.88% (29) experience anxiety "frequently" or "almost all the time," 38.46% (40) "occasionally," and 11.54% (12) "don't know," totaling 65.38% (68) experiencing some level of anxiety.
- **Music's Influence on Mood:** 55.77% (58) believe music significantly influences their mood, 35.58% (37) moderately, 7.69% (8) slightly, and 0.96% (1) not at all, totaling 91.35% (95) acknowledging significant or moderate influence.

● **Dedicated Playlists**: 51.92% (54) have mood-specific playlists (25 update often, 14 rarely or prefer new ones), 25% (26) prefer manual search, and 23.08% (24) rely on pre-made playlists or radio.
● **Frustration with Music Selection**: 46.15% (48) feel frustrated "occasionally," 34.62% (36) "rarely," 9.62% (10) "frequently," and 9.62% (10) "never."
● **Algorithm Performance**: 46.15% (48) say recommendations match their mood "most of the time," 34.62% (36) "sometimes," 7.69% (8) "almost always," 9.62% (10) "rarely," and 1.92% (2) "never."
● **Satisfaction with Algorithms**: Ratings ranged from 1 (very dissatisfied) to 5 (very satisfied), with 47.12% (49) rating 4, 26.92% (28) rating 3, 6.73% (7) rating 5, 13.46% (14) rating 2, and 5.77% (6) rating 1, averaging 3.34.

Interest in AI Recommendations
● **Likelihood of Using AI**: 38.46% (40) is "very likely," 30.77% (32) "somewhat likely," 17.31% (18) "neutral," 6.73% (7) "unlikely," and 6.73% (7) "not at all," totaling 69.23% (72) open to AI mood-based curation.

Use of Music for Emotional Management
●59.62% (62) use music "frequently" or "occasionally" to manage stress/anxiety, 21.15% (22) are interested but haven't yet, and 19.23% (20) don't think it helps.
●**Comfort with Physiological Data**: Ratings ranged from 1 (not comfortable) to 5 (very comfortable), with 38.46% (40) rating 5, 27.88% (29) rating 4, 17.31% (18) rating 3, 9.62% (10) rating 2, and 6.73% (7) rating 1, averaging 3.78.
●**Important Factors for Recommendations**: Genre (60.58%, 63), lyrics (52.88%, 55), instrumentation (40.38%, 42), familiarity (30.77%, 32), tempo/BPM (19.23%, 20), and novelty (17.31%, 18).

6. Mindful Listening:
Though most perceive music's mood effect, others are less attentive and deny its therapeutic nature. Our system can especially help such users by confirming feelings with the right song selection and creating mindfulness.

Desired Features
● Respondents expressed interest in real-time mood detection, personalization based on listening history, genre, lyrics, and instrumentation, mood-shifting options (e.g., uplifting music when sad), seamless integration across platforms, no ads, high-quality audio, and avoiding frequently skipped songs while suggesting new artists.

CONCLUSION
The survey identifies a high level of interest in AI-powered, mood-based music recommendation services. By filling gaps in existing services—algorithmic shortcomings, matching moods, and playlist organization—your service can emerge as a front-runner in customized music experiences. Emphasize providing precise, user-friendly, and privacy-respecting solutions to drive user satisfaction and adoption.
Commercialization: Commercializing means working with streaming platforms such as Spotify for access to music libraries and user listening data (with permission). Factors to consider are:
Partnership Strategy: Collaborating with a single platform (e.g., Spotify) provides a competitive advantage, potentially licensing to others to avoid copying. Alternatively, collaborating with several (Netflix, YouTube) increases to suggest movies or videos based on mood, utilizing listening data.
Data Privacy: Clear contracts will restrain data utilization, without taking advantage of partners. We're tool suppliers, not consumers, but we'll advocate open practice and user control.

Hacker Risks: The danger of hackers using biometric information as a method of tracking, is reduced by secure security and encryption with ongoing monitoring.Formal Approval and Verification: For research, IRB approval ensures ethical compliance. For commercialization, seek industry certifications (e.g., ISO 27001 for data security), validating trustworthiness through audits and third-party reviews.

Proposed Solutions: Addressing Anxiety Across Contexts

Our AI-based music suggestion platform provides solutions for various situations:

Students Under Examination: Collaboration with learning portals and entrance exam preparation apps or coaching centers, to provide the service of playlist creation aimed at minimizing test anxiety and improving concentration. For example, 10 Hz binaural beats coordinate brain waves, promoting concentration without stimulation.Musicians Overcoming Stage Fright: By creating relaxing playlists before performances—comprising known melodies combined with calming frequencies—we assist in balancing cortisol levels and instilling confidence. Integrations with practice apps for performers could make this feature a seamless part of practice regimens.Healthcare and Hospitals: Patients undergoing surgeries gain much from curated playlists that can minimize preoperative anxiety.

Fitness Centers: Tailored workout playlists enhance motivation and stamina while relieving performance anxieties.Corporate Wellness Programs: Offices that implement music therapy have increased productivity by as much as 15%.Another Study shows that employees' productivity, mood, and concentration can be enhanced with music. For example, one study said that 88% of employees doing data entry, math problem-solving, and proofreading did more accurate work, and 81% worked at a faster pace when they had music playing. Companies such as Google, WME, and Gucci have added sound therapy sessions, or "sound baths," to their employee wellness initiatives. The sessions are designed to lower stress, boost creativity, and improve overall health.

Case Study on Spotify's Sustainability Initiatives

Spotify has considerably advanced in merging sustainable practices within its operations to align with international environmental aspirations. Some major initiatives are:

Energy-Efficient Data Centres : Spotify uses cloud services such as Google Cloud Platform (GCP) and Amazon Web Services (AWS), both operated on renewable power. GCP's pledge for 100% carbon-free electricity by 2030 aligns with Spotify's sustainability goals.

Carbon Neutrality Targets: The firm reduces greenhouse gas emissions and offsets remaining emissions with verified schemes such as reforestation.

Sustainable Product Design: Personalized playlists reduce duplicate streaming, while products such as the podcast carbon calculator encourage environmentally friendly content production.

Transparency and Reporting: Yearly sustainability reports provide an overview of Spotify's performance, providing transparency into its carbon footprint and how it is reducing it.

Our AI-based mood detection system can utilize their sustainability model:

- Utilize GCP for energy-efficient data processing and track emissions through GCP's Carbon Footprint Tool.
- Reduce data usage by retaining only anonymized, necessary biometric data and discarding unused datasets after analysis.
- Offset carbon emissions from research operations through verified schemes, following Spotify's lead.
- Implement rigorous ethical standards, such as data anonymization and encryption, to ensure GDPR and BIPA compliance.
- For platforms lacking robust sustainability practices, we'll impose clear standards through contractual agreements, third-party audits, and educational advocacy.

This alignment ensures our research contributes to both mental wellness and environmental sustainability, supporting global efforts to combat climate change.

Future Research Scope

In the future, the scalability of our system will involve integrating smartwatches with phones to further enhance mood detection. By incorporating phone facial detection (with permission via Spotify settings), we can interpret facial expressions to further enhance emotional insights. This will enable more precise recommendations, along with incorporating AI to detect the location and activity of the user to then suggest for instance- high-energy tracks for exercise, concentration music for work, or motivational playlists for walking, making the AI more relevant.Also, developing a dedicated phone assistant AI would form an expansive mental health ecosystem. This would include incorporating music and mood control into daily life with the added security of sustainability via resource efficiency and carbon offsetting.With participants' consent, anonymized data may be used for clinical research, with ethical use and compliance with principles of beneficence and justice.

Widening Listening Horizons: Neuroscience and Creativity

Listening to new genres or styles beyond the comfort zone enhances neuroplasticity—the capacity of the brain to create new connections. Such practice enhances cognitive flexibility, empathy, and flexibility—traits needed for innovation, particularly for right-brained creatives. Exposing oneself to diverse musical forms stimulates several parts of the brain at once, boosting cross-modal thinking and problem-solving abilities.To promote discovery, our service offers a distinctive "Genre Expansion" feature:Users choose parameters like genre mix, period (modern or classical), language, or instrumentation.The AI creates playlists (keeping in mind the present mood of the individual) mixing new things with known ones, allowing for gradual adjustment. For instance, following a rock number, the next song may include similar guitar riffs but in a jazz context.This method avoids overwhelming while keeping one interested, creating receptiveness to new things.By blending deliberate curation with consumer agency, we hope to enable genre extension to be fun instead of intimidating, finally making users' musical tastes and brains richer.

Music as Medicine

Anxiety is still a widespread condition across the board, but it can be alleviated by innovative platforms such as ours. Whether helping students tackle exams, helping musicians overcome stage fright, soothing patients preparing for surgery, inspiring corporate teams, or simply for any average man out there who is as average as people's passion for music, our service uses the power of music as a universal language to build strength and bonding. In addition, by inviting listeners to venture outside of their normal orbit, we create new opportunities for individual development and creativity while addressing the burgeoning world anxiety epidemic head-on.In addition, we seek to research collaborations with healthcare providers and educational institutions to study the effect on mental health outcomes of the platform. With subject permission, data could be used for clinical investigations in an anonymous format, such that ethical principles of beneficence and justice are maintained.

Conclusion: Impact on Mental Wellness

Our platform is an innovative AI-driven solution that is designed to deliver personalized musical experiences for music lovers. Globally, it assists in tackling the on-rising epidemic of anxiety by offering a very accessible, non-invasive technology that promotes emotional balance and attentiveness through utilization.Contrary to viewing AI as a force of threat, this study sheds light on the potential for advancing human well-being through thoughtful integration of technology. By integrating AI with the centuries-old healing potential of music, we are returning to a centuries-old tradition of using sound to create harmony in the mind and soul.

Bibliography:
- Estimation of Respiratory Rate from Photoplethysmography (PPG)
- Emotion Recognition Using Heart Rate Variability and Skin Conductance
- Heart Rate Variability as a Measure of Anxiety in Psychiatric Disorders
- Respiratory Sinus Arrhythmia and Heart Rate Variability in Children with Anxiety Disorders
- Automatic Music Mood Classification Using Multi-Modal Attention Framework
- Machine Learning Model for Mapping of Music Mood and Human Emotion Based on Physiological Signals

- Music Therapy for Emotional Regulation: A Systematic Review
- Personalized Music Recommendation for Emotional Support
- Patel v. Facebook: Facebook Settles Illinois Biometric Information Privacy Act ("BIPA") Violation Suit
- Biometric Information Privacy Act - Wikipedia
- https://www.theguardian.com/music/2025/mar/07/high-suicide-rates-show-music-industry-profoundly-dangerous-researchers-say