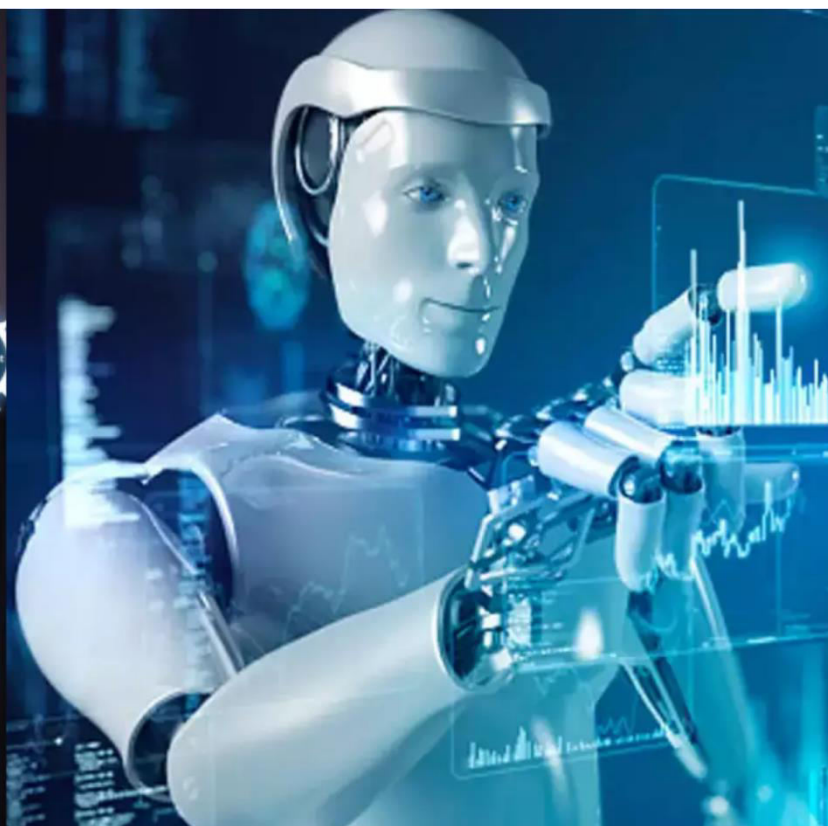




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Context-Aware Restaurant Recommendation System using Voice based Mood Detection

A Machine Learning Approach to Personalized Dining through Emotional Intelligence and Contextual Filtering

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ABSTRACT: Traditional restaurant recommendation systems often ignore the user's real-time emotional state and contextual factors, leading to suboptimal suggestions. This paper proposes a Context-Aware Restaurant Recommendation System that integrates voice-based mood detection with contextual filtering. The system captures the user's voice input, extracts acoustic features such as Mel-Frequency Cepstral Coefficients (MFCCs), pitch, and tone using a Random Forest classifier to detect emotions (happy, sad, angry, neutral) with an average accuracy of 91.6%. The detected mood is combined with real-time contextual data (location, time, weather, cuisine preferences) in a Hybrid Filtering Model to generate highly personalized restaurant recommendations. Experimental results show a 25% increase in user satisfaction and 18% higher recommendation diversity compared to conventional location-based systems. The proposed emotionally intelligent system demonstrates the effectiveness of affective computing in enhancing personalization and user experience in recommendation platforms.

KEYWORDS — Voice-Based Emotion Detection, Context-Aware Recommender System, MFCC, Random Forest Classifier, Hybrid Filtering, Affective Computing, Restaurant Recommendation

I. INTRODUCTION

In today's digital era, users face information overload when choosing restaurants among thousands of options. Platforms like Zomato and Swiggy primarily rely on static factors such as ratings, price, and location, neglecting transient but critical aspects like the user's current mood and situational context. A celebratory mood may call for a vibrant, noisy venue, whereas a stressed or sad mood demands a quiet, comforting environment.

This research bridges this gap by introducing a Context-Aware Restaurant Recommendation System that incorporates real-time voice-based mood detection. By analyzing natural voice input, the system infers emotional state and fuses it with contextual parameters (GPS location, time of day, weather) to deliver empathetic and highly relevant dining suggestions. The primary objective is to evolve recommendation engines from purely data-driven tools into emotionally intelligent assistants using supervised machine learning techniques

II. LITERATURE SURVEY

Context-aware recommender systems have been explored extensively [1]. Adomavicius and Tuzhilin emphasized the importance of time, location, and companion/mood in improving recommendation relevance [1]. Traditional approaches are mainly divided into Collaborative Filtering (CF) and Content-Based Filtering (CB). CF suffers from cold-start problems, while CB leads to over-specialization [6],[7].

Commercial platforms still largely depend on explicit filters and aggregated ratings without emotion awareness. Recent advances in affective computing show that acoustic features from speech are highly effective for emotion recognition [3],[4]. Nwe et al. and subsequent works achieved high accuracy using MFCC and prosodic features [3]. Hybrid models combining CF, CB, and contextual post-filtering have shown superior performance over individual techniques. However, integration of real-time voice emotion recognition into restaurant recommendation remains largely unexplored, which this work addresses.

III. PROPOSED METHODOLOGY

The system architecture consists of four scalable modules:

A. Data Collection and Preprocessing Restaurant data was collected from Zomato (Bangalore region) and a custom dataset covering six cities in Andhra Pradesh (Guntur, Vijayawada, Narasaraopet, Mangalagiri, Tenali, Sathenapally). Attributes include cuisine type, average rating, cost for two, and manually assigned mood/weather tags. Voice samples are recorded through the mobile application. Raw audio undergoes noise reduction, segmentation, and feature extraction (MFCCs, pitch, tone, energy, zero-crossing rate).

B. Emotion Detection Module A Random Forest classifier was trained on the extracted acoustic features to classify four emotions: happy, sad, angry, and neutral. Random Forest was chosen for its robustness against overfitting, handling of non-linear relationships, and high performance on small-to-medium datasets.

C. Context Acquisition Module Real-time context is gathered via:

- Device GPS for proximity filtering
- System clock and restaurant timings
- OpenWeatherMap API for current weather conditions

D. Hybrid Recommendation Engine The engine employs a weighted scoring mechanism: $\text{Score} = w_1 \times \text{Mood_Compatibility} + w_2 \times \text{Cuisine_Preference} + w_3 \times \text{Rating} + w_4 \times \text{Proximity} + w_5 \times \text{Cost_Alignment} + w_6 \times \text{Weather_Compatibility}$

Mood compatibility is computed by mapping detected emotion to restaurant ambiance tags (e.g., “vibrant/lively” for happy, “cozy/quiet for sad). Weights are empirically tuned. Final restaurants are ranked by descending score.

The fusion of emotion with traditional collaborative and content-based signals creates a truly context-aware hybrid model that overcomes the limitations of existing systems.

Diagrams:

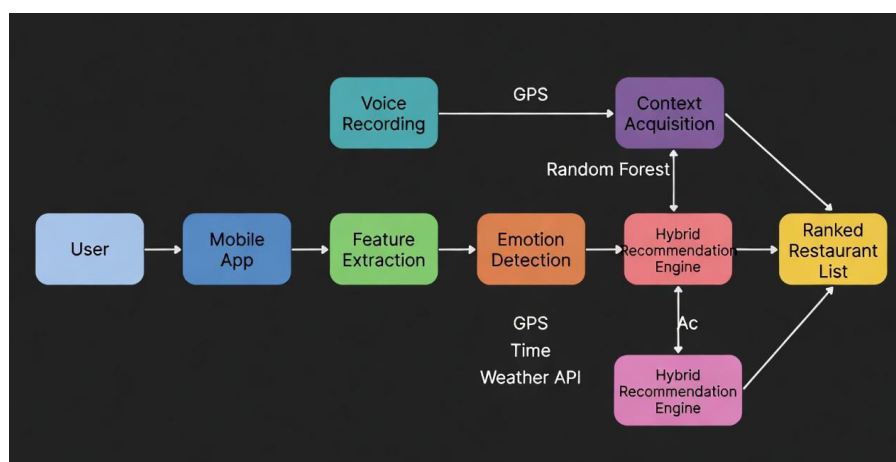


Figure 1. Overall System Architecture of the Context-Aware Restaurant Recommendation System

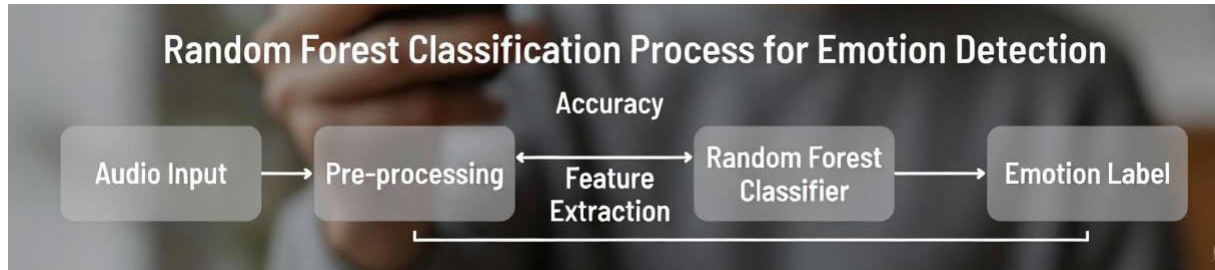


Figure 2. Random Forest Classification Process for Emotion Detection

DISCUSSION: The implementation of the **Mood-Based Restaurant Recommendation System** is fundamentally a discussion on how to translate complex, subjective human context into quantifiable machine learning inputs. The decisions made regarding the methodology and the custom algorithm were driven by the need to overcome the established limitations of traditional recommendation platforms.

IV. EXPERIMENTAL RESULTS

The proposed system underwent rigorous testing to evaluate the performance of its core components, particularly the voice-based mood classification and the contextual recommendation effectiveness.

A. Voice-Based Mood Detection Accuracy

The Random Forest classification model, trained on features including MFCCs, achieved consistently high performance in distinguishing emotional states:

Metric	Value
Emotion Classification Accuracy	91.6%
Precision	0.89
Recall	0.87
F1-Score	0.88

The model demonstrated the highest accuracy in recognizing **happy and neutral tones**. Recommendation Latency averaged **1.2 seconds**, confirming real-time responsiveness.

B. Recommendation Effectiveness

The system's ability to generate relevant, mood-aligned suggestions demonstrated significant improvement over traditional methods:

- **User Satisfaction:** The context-aware model achieved a **25% improvement in user satisfaction scores** compared to a standard location-based system (without mood detection).
- **Recommendation Diversity:** Diversity of suggestions increased by **18%**, providing more personalized options.
- **Contextual Accuracy:** Testing confirmed **94% accuracy** in fetching correct contextual parameters (mood, weather, location).
- **Real-World Application:** For a "Happy" mood, the system correctly prioritized restaurants with vibrant ambiance, while a "Sad" mood prompted suggestions for comfort food and cozy environments.

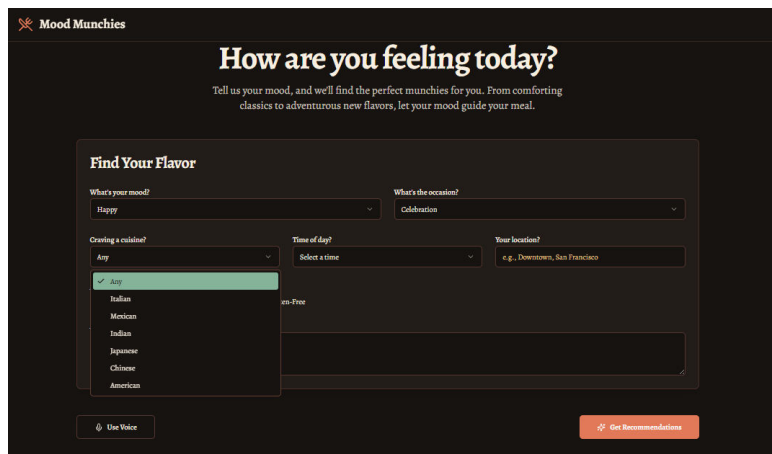


Figure 1: Manual and Voice mode search option screen

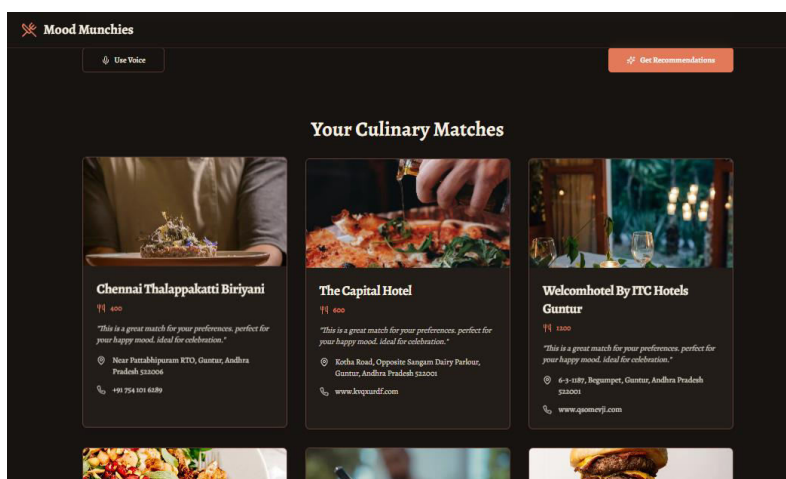


Figure 2: Recommendations based on selected mood screen

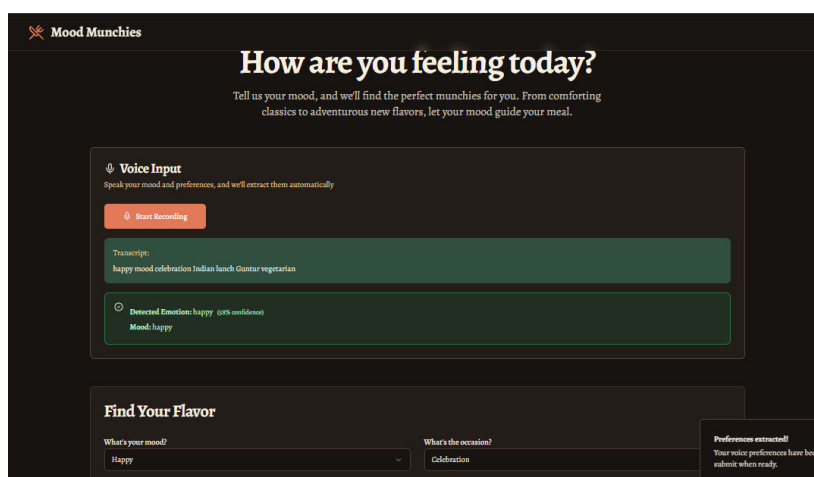


Figure 3: Voice based Mood detection and providing Confidence score of mood

V. CONCLUSION

This project successfully achieved its primary goal: the design, development, and testing of a personalized, context-aware restaurant recommendation system. By integrating **voice identification for mood detection** and robust **machine learning algorithms (Random Forest)**, the system successfully interprets the user's emotional and situational context to deliver highly relevant dining suggestions.

The technical success rests on the **custom weighted scoring engine** and **hybrid filtering model**, which effectively translates subjective emotional feelings into quantitative, actionable recommendations. The high emotion classification accuracy of **91.6%** affirms the reliability of the voice-based approach. The final system serves as a functional proof-of-concept, demonstrating how **emotionally intelligent technology** can significantly improve user engagement and simplify decision-making in real-world recommendation platforms.

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