Journal of Science, Computing and Engineering Research (JSCER)
Volume-9, Issue- 4, Mar-Apr 2026.
DOI: *https://doi.org/10.46379/jscer.2026*

EMOTION AWARE MULTILINGUAL CONVERSATIONAL AI WITH CODE SWITCHING SUPPORT

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Article Information

Received : 29 March 2026
Revised : 30 March 2026
Accepted : 31 March 2026
Published : 01 April 2026

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***Abstract*—** The growing need for emotionally intelligent and linguistically inclusive conversational systems has driven the development of an Emotion-Aware Multilingual Conversational AI with Code-Switching Support. This paper presents a comprehensive AI-powered chatbot platform capable of detecting user emotions, understanding mixed-language input such as Hinglish, and generating empathetic, contextually appropriate responses in real time. The system integrates transformer-based models including BERT and MuRIL for multilingual emotion recognition, IndicTrans2 for culturally sensitive translation, and DialoGPT or BlenderBot for coherent multi-turn dialogue generation. A modular pipeline combines preprocessing, language identification, emotion detection, code-switch-aware encoding, retrieval-augmented generation, and post-processing to deliver responses that reflect both the linguistic preference and emotional state of the user. The frontend is built using React, while Flask powers the backend API, with SQLite and MongoDB handling data storage across sessions. The system addresses critical limitations of existing conversational agents, including emotional insensitivity, poor support for code-switched communication, lack of cultural adaptability, and ineffective handling of high-sensitivity domains such as mental health and education. Results demonstrate the platform's capability to process multilingual and code-mixed conversations with emotional awareness, laying a strong foundation for inclusive, human-centered AI communication systems applicable across diverse global populations.

Keywords*— *Emotion-Aware AI, Multilingual Conversational System, Code-Switching, Natural Language Processing, Sentiment Analysis, Transformer Models, Hinglish, Empathetic Dialogue, BERT, MuRIL, IndicTrans2, DialoGPT, Retrieval-Augmented Generation, Emotion Detection, Human-Centered AI.

Citation : ***Dr. J.R. Arun Kumar, Harsh Kumar, Anshul Singh, Akshat Jain****"Emotion Aware Conversational AI with Code Switching Support", Journal of Science, Computing and Engineering Research, 9(04), April 2026.*

I. INTRODUCTION

In the modern age, digital connectivity has reshaped nearly every dimension of human interaction, and the role of Artificial Intelligence in enabling more natural, inclusive, and empathetic communication has become increasingly significant. Traditional conversational systems, while functional, are largely built around rigid language boundaries and emotionally neutral response mechanisms that fail to reflect the diversity of real human communication. Across multilingual societies such as India, users naturally alternate between languages within a single conversation, a phenomenon known as code-switching, producing mixed expressions like Hinglish that existing chatbots struggle to interpret accurately.

To address these fundamental limitations, the Emotion-Aware Multilingual Conversational AI with Code-Switching Support is proposed as a comprehensive, transformer-based solution designed to understand not only what a user is saying but also how they are feeling. The system integrates advanced NLP models including BERT, MuRIL, and IndicTrans2 to detect emotional states, process mixed-language input, and generate contextually appropriate, empathetic responses in real time. By combining emotion detection, multilingual understanding, and dialogue management into a unified pipeline, the system aims to deliver conversations that feel genuinely human, culturally aware, and emotionally intelligent. This approach holds particular value in high-sensitivity domains such as mental health support, education, and customer service, where empathy and linguistic flexibility are essential to meaningful interaction

II. PROBLEM STATEMENT

Despite significant advancements in Natural Language Processing and conversational AI, the majority of existing chatbot systems remain ill-equipped to handle the emotional and linguistic complexity of real-world human communication. Key problems include:

- Most conversational agents operate within a single language framework and are unable to interpret code-switched input such as Hinglish, Tanglish, or Spanglish, producing inaccurate or irrelevant responses when users communicate naturally.
- Existing chatbots generate emotionally neutral replies regardless of the user's affective state, resulting in interactions that feel robotic and insensitive, particularly in domains requiring empathy such as mental health support and counseling.
- There is no unified system that simultaneously integrates emotion detection, multilingual NLP, and code-switch-aware response generation into a single conversational pipeline.
- Current tools such as Google Dialogflow, IBM Watson, and Microsoft LUIS offer either multilingual support or basic sentiment analysis in isolation, but none effectively combine both capabilities with culturally adaptive dialogue management.
- Limited availability of code-mixed training datasets and the absence of real-time emotional and linguistic integration restrict the applicability of existing systems in diverse, multilingual environments.

These challenges contribute to poor user engagement, miscommunication, and a lack of trust in AI systems, particularly among multilingual and emotionally vulnerable populations. A robust, intelligent, and linguistically flexible conversational solution is urgently required to bridge the gap between human communication patterns and current AI capabilities

III. PROPOSED MODEL

The proposed system for the Emotion-Aware Multilingual Conversational AI with Code-Switching Support follows a structured five-stage conversational pipeline. Each stage operates as an independent module while maintaining seamless communication with adjacent components, ensuring real-time performance and scalability.

Entry Point: User Interface → Authentication → Dashboard

Users access the system through a React-based frontend. After successful login or sign-up, they are directed to the main dashboard to initiate a conversation with the Emotion AI.

Stage 1 — Input Capture and Preprocessing

1. **User Input:** The user submits a message in any language or mixed-language format such as Hinglish via text or voice. An ASR module handles voice transcription.

2. **Preprocessing:** Raw input is cleaned, normalized, and tokenized using NLTK and Regex utilities. Code-switched tokens are preserved to maintain cultural and linguistic meaning.

3. **Language Identification:** A lightweight identifier assigns token-level language labels to detect code-switch points, informing all downstream processing decisions.

Stage 2 — Emotion Detection

1. **Emotion Recognition:** BERT and MuRIL models classify the user's emotional state into categories such as joy, sadness, anger, fear, or neutrality, each with a confidence score.

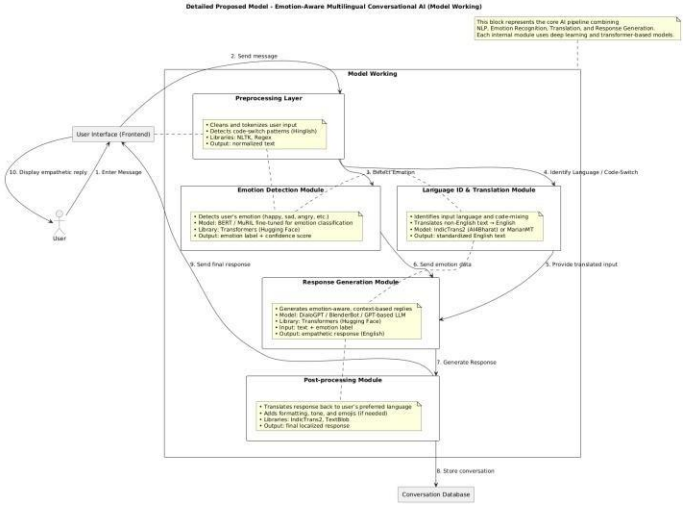

Fig. 1. Block Diagram

2. **Emotion Embedding:** Detected emotions are encoded into fixed-size embeddings and passed to the dialogue manager to guide empathetic response generation.

Stage 3 — Language Identification and Translation

1. **Code-Switch-Aware Encoding:** A multilingual Transformer encoder processes mixed-language input without forcing full translation, preserving cultural and pragmatic nuance.

2. **Selective Translation:** IndicTrans2 translates only segments requiring monolingual processing, while the user's natural language mix is respected throughout the interaction.

Stage 4 — Context and Dialogue Management

1. **Context Manager:** Conversation history, user preferences, and detected emotions are stored and retrieved via a vector database to maintain session continuity and personalization.

2. **Dialogue Manager:** Manages intent detection, conversation state, and response strategy, deciding whether to offer emotional support, provide information, or escalate to a human operator.

3. **Policy Engine:** Enforces cultural norms, language preferences, and safety constraints to ensure all responses are appropriate and sensitive to the user's emotional state.

Stage 5 — Response Generation and Output Delivery

1. **Response Generation:** DialoGPT or BlenderBot generates empathetic, context-aware replies guided by conversation history, emotion embeddings, and language tags.

2. **Post-Processing:** Output is refined to preserve code-mixed phrasing, apply safety filters, and adjust tone and formatting according to the user's language preference.

3. **Output Delivery:** The final response is delivered as text via the frontend or as synthesized speech with emotion-aligned prosody for voice sessions.

4. **Conversation Storage:** All turns, emotions, language labels, and metadata are stored in MongoDB or SQLite for analytics, personalization, and future model retraining

IV. TECH STACK

A. Frontend Development (HTML, CSS, JavaScript)

The frontend is built using HTML, CSS, and JavaScript, ensuring a lightweight, responsive, and platform independent user interface.

- Pages are structured using clean HTML semantics for maintainability.
- CSS is used to ensure a responsive, visually consistent layout across devices.

B. Backend Development (Flask)

The backend is developed using Flask, providing a lightweight and flexible framework for building RESTful APIs that bridge the frontend with NLP and ML components.

- Flask controllers manage client requests including user authentication, message

routing, emotion data handling, and session management.

- The backend integrates security mechanisms such as encrypted password storage and token-based authentication to ensure safe user interactions.

C. Database Management (SQL)

Data storage is handled using an SQL relational database, ensuring structured, consistent, and reliable record management.

D. NLP and AI Models (BERT, MuRIL, IndicTrans2, DialoGPT)

The core intelligence of the system is powered by transformer-based NLP models selected for multilingual and emotion-aware processing.

- BERT and MuRIL handle emotion classification and multilingual language understanding including code-mixed Indian language input.
- IndicTrans2 manages selective translation across Indian languages and English while preserving cultural nuance.
- DialoGPT and BlenderBot drive multi-turn empathetic response generation guided by detected emotions and conversation context.

E. Supporting Libraries and Utilities

A set of well-established libraries supports data processing, model integration, and system monitoring throughout the pipeline.

- Hugging Face Transformers provides pre-trained model architectures for emotion detection, multilingual embeddings, and dialogue generation.
- NLTK and Regex handle text preprocessing including tokenization, normalization, and noise removal.
- NumPy and Pandas support data manipulation and efficient dataset handling during model inference and training.
- Git and GitHub are used for version control, collaborative development, and project management.

F. Modular and Scalable Architecture

The system follows a modular pipeline architecture that supports seamless future expansion.

- New capabilities such as facial emotion recognition, additional language support, domain-specific fine-tuning, or voice integration can be added without disrupting existing functionality.

V. RESULT SCREENSHOT

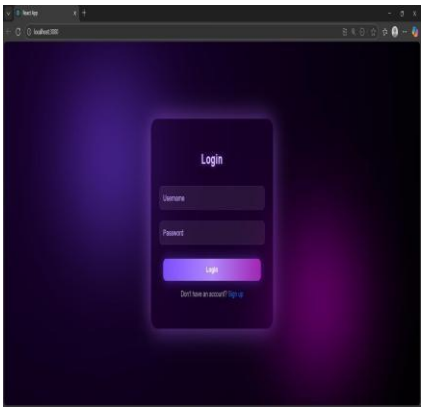

Fig 2.

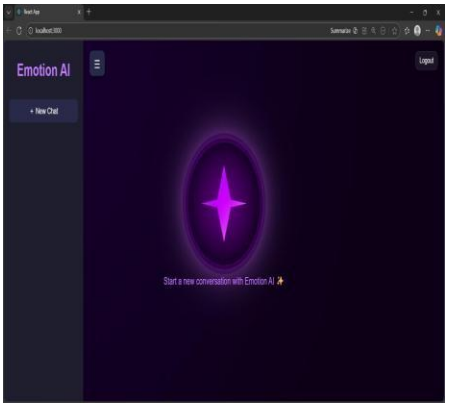

Fig. 3.

VI. CONCLUSION

A. Project Synthesis

- The Emotion-Aware Multilingual Conversational AI with Code-Switching Support is a transformer-based solution designed to bridge the gap between human communication patterns and current AI capabilities.
- Addresses critical limitations of traditional conversational agents including emotional insensitivity, poor handling of code-switched input, and lack of cultural adaptability.
- Integrates emotion detection, multilingual NLP, and empathetic dialogue generation into a unified pipeline delivering conversations that are natural, inclusive, and human-centered.
- Ensures accessibility for diverse linguistic populations through seamless support for code-switched communication such as Hinglish,

making it valuable in domains like mental health, education, and customer service.

B. Core Achievements

- **Emotional Intelligence:** Real-time classification of user emotions including joy, sadness, anger, and fear with empathetic response generation aligned to the user's affective state.
- **Multilingual and Code-Switch Support:** Accurate processing of mixed-language input using BERT, MuRIL, and IndicTrans2 while preserving cultural and linguistic nuance throughout the pipeline.
- **Context-Aware Dialogue:** Multi-turn conversation management with short and long-term memory ensuring personalized and consistent responses across sessions.
- **Modular Architecture:** Independent pipeline modules for preprocessing, emotion detection, translation, dialogue management, and response generation supporting seamless future expansion.

C. Concluding Remarks

- The proposed system is a comprehensive emotionally intelligent communication platform combining advanced NLP, transformer-based models, and culturally aware dialogue management beyond conventional chatbot capabilities.
- Significantly improves user experience and accessibility for diverse multilingual populations, particularly across high-sensitivity domains such as mental health, education, and customer service.
- Future scope includes facial emotion recognition, additional language support, domain-specific fine-tuning, and voice-based interaction through ASR and TTS integration.
- Emphasizes ethical AI, data privacy, and user trust, laying a strong foundation for the next generation of inclusive and empathetic conversational AI systems.

REFERENCES

1. J. Devlin, M. Chang, K. Lee, and K. Toutanova, *BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding*, Proceedings of NAACL-HLT, 2019.
2. S. Khanuja, D. Dandapat, R. Kumar, et al., *MuRIL: Multilingual Representations for Indian Languages*, Findings of the Association for Computational Linguistics (ACL), 2021.
3. Y. Zhang, S. Sun, M. Galley, et al., *DialoGPT: Large-Scale Generative Pretraining for Conversational Response Generation*, Proceedings of ACL, 2020.
4. R. Shuster, D. Kiela, M. Weston, and J. Williams, *BlenderBot: Recipes for Building Open-Domain Chatbots*, arXiv preprint arXiv:2004.13637, 2020.
5. Hugging Face Transformers Documentation Available online at: huggingface.co/docs/transformers.
6. AI4Bharat, *IndicTrans2: High-Quality Machine Translation for 22 Indian Languages*. Available online at: ai4bharat.org/indictrans2 .
7. NLTK, *Natural Language Toolkit Documentation*. Available online at: **nltk.org** .