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A MULTI-AGENT BASED AUTONOMOUS EMOTIONAL WELLBEING COMPANION

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1. ABSTRACT

Urban life has increasingly led to higher stress levels and emotional issues among people, affecting mental health and overall productivity. This paper presents MindEase — a Multi-Agent Based Autonomous Emotional Wellbeing Companion powered by machine learning — designed to monitor, understand, and support users' emotional health through real-time interaction and personalized assistance. The system allows users to enter text or voice data reflecting their emotional state, tracks emotional trends over time, and offers proactive coping strategies through a responsive web interface. By leveraging a multi-agent AI architecture comprising emotion detection, trend tracking, recommendation, feedback, and escalation agents, the platform predicts stress patterns and suggests suitable interventions while ensuring safety and ethical standards. The system integrates transformer-based emotion classification using DistilRoBERTa, affinity-based coping strategy recommendation, adaptive feedback learning, and large language model response generation via the Google Gemini API. Results demonstrate accurate real-time emotion detection, reliable crisis safety screening, and contextually aware conversational support, making MindEase a practical, stigma-free approach to preventive mental healthcare.

KEYWORDS: *Emotional Wellbeing, Stress Detection, Multi-Agent AI, Personalized Mental Health, Predictive Intervention, ML-Based Companion, Coping Strategies, DistilRoBERTa*

2. INTRODUCTION

In today's rapidly evolving urban society, individuals face mounting emotional and psychological demands that traditional healthcare systems are ill-equipped to address in real

time. While clinical interventions remain essential, they often overlook the critical importance of preventive mental wellness and everyday emotional self-management. Many working professionals and students lack accessible platforms to understand their emotional state, manage stress, and build resilience, leading to burnout, poor decision-making, and deteriorating mental health outcomes.

With the growing influence of technology and digital platforms, it has become possible to deliver mental wellness support in a private, real-time, and personalized manner. Smartphone applications and web-based tools offer new avenues for emotional self-monitoring, coping skill development, and stress management. However, most existing platforms rely on generic advice, lack intelligent personalization, and fail to integrate emotion-aware AI that adapts to individual user states. Without intelligent guidance, users may struggle to identify appropriate coping responses to their specific emotional challenges.

MindEase is developed to address this gap by providing a structured web-based platform focused on emotional intelligence and personalized wellbeing support. The platform uses multi-agent AI to process user input through parallel pipelines covering emotion detection, trend analysis, crisis escalation, and adaptive recommendations. It introduces users to real-world coping techniques through interactive chat sessions, journal entries, and guided strategy recommendations, while ensuring data privacy and secure handling of sensitive personal information. By bridging digital technology and evidence-based mental wellness practices, MindEase empowers individuals to navigate the challenges of modern life with greater confidence, clarity, and emotional resilience.

3. LITERATURE REVIEW

Several researchers have examined the challenges of mental health monitoring and the role of AI in building intelligent, personalized support systems.

"Harnessing the Power of Hugging Face Transformers for Predicting Mental Health Disorders in Social Networks" [1]

This research evaluates transformer-based models including BERT, RoBERTa, and DistilBERT for mental health prediction using social media data. The models achieve classification accuracy up to 97% and outperform traditional machine learning techniques by capturing deep contextual relationships in text. The study highlights the advantage of pre-trained models with minimal feature engineering. However, high computational cost remains a major limitation, and efficient optimization techniques are needed for real-world deployment. [1]

"AI-Driven Multi-Agent Reinforcement Learning Framework for Real-Time Monitoring of Physiological Signals" [2]

This study presents a multi-agent reinforcement learning framework for real-time stress and depression monitoring using physiological signals such as heart rate and respiration from datasets like PPG-DaLiA and WESAD. The framework outperforms traditional models like PPO and DQN in stress classification tasks and dynamically adapts to changing physiological conditions. However, scalability and long-term prediction remain major challenges, and further improvements are needed for real-world wearable deployment. [2]

"Emotion-Aware Ensemble Learning (EAEL) for Mental Health Diagnosis of Corporate Professionals" [3]

This research introduces an ensemble learning framework for diagnosing mental health issues in corporate professionals using multimodal data sources including facial expressions, typing behavior, and interaction patterns. The system combines SVM, CNN, and Random Forest models to achieve higher accuracy than single-model approaches. The framework handles complex behavioral patterns but faces real-world adaptability challenges and scalability concerns that require further investigation. [3]

"Mental Health Safety and Depression Detection in Social Media Text Data Using Deep Learning" [4]

This study focuses on detecting depression from social media text using a combined BERT and BiLSTM architecture. Advanced preprocessing methods address informal language, emojis, and slang, achieving approximately 88.95% accuracy and outperforming traditional approaches in capturing contextual and sequential information. The study notes that noisy and unstructured text remains a significant limitation, requiring further improvements in text understanding capabilities. [4]

"A Hybrid Transformer Architecture for Multiclass Mental Illness Prediction Using Social Media Text" [5]

This research proposes a hybrid transformer architecture combined with CNN models for detecting multiple mental disorders including depression, anxiety, PTSD, and BPD using social media text. Specialized models like MentalBERT and MelBERT improve figurative language understanding. The approach demonstrates improved multi-class prediction accuracy, though capturing complex linguistic nuances and generalizing across diverse datasets remains a challenge. [5]

"Early Mental Stress Detection Using Q-Learning Embedded Starling Murmuration Optimiser-Based Deep Learning Model" [6]

This study presents a deep learning model using a Q-learning embedded Starling Murmuration Optimizer for stress detection, improving feature selection through a KNN-based fitness function. The model demonstrates strong performance in identifying stress patterns while reducing redundancy. However, handling large-scale real-time data and scaling the optimization framework for practical deployment remain key challenges requiring further research. [6]

4. METHODOLOGY

The MindEase platform follows a structured methodology covering system workflow design, multi-agent architecture, authentication management, AI pipeline orchestration, and adaptive feedback learning. Seven specialized agents coordinate to deliver real-time emotional support across the chat, journal, dashboard, and strategy library modules.

4.1 System Workflow

The system workflow explains how users interact with the platform end-to-end, from first access through continuous personalized support. New users complete a multi-step onboarding survey capturing ten holistic wellbeing dimensions. Returning users are directed straight to their dashboard with preferences restored. Every user interaction feeds the AI agent pipeline, resulting in a MoodLog entry and a real-time dashboard update.

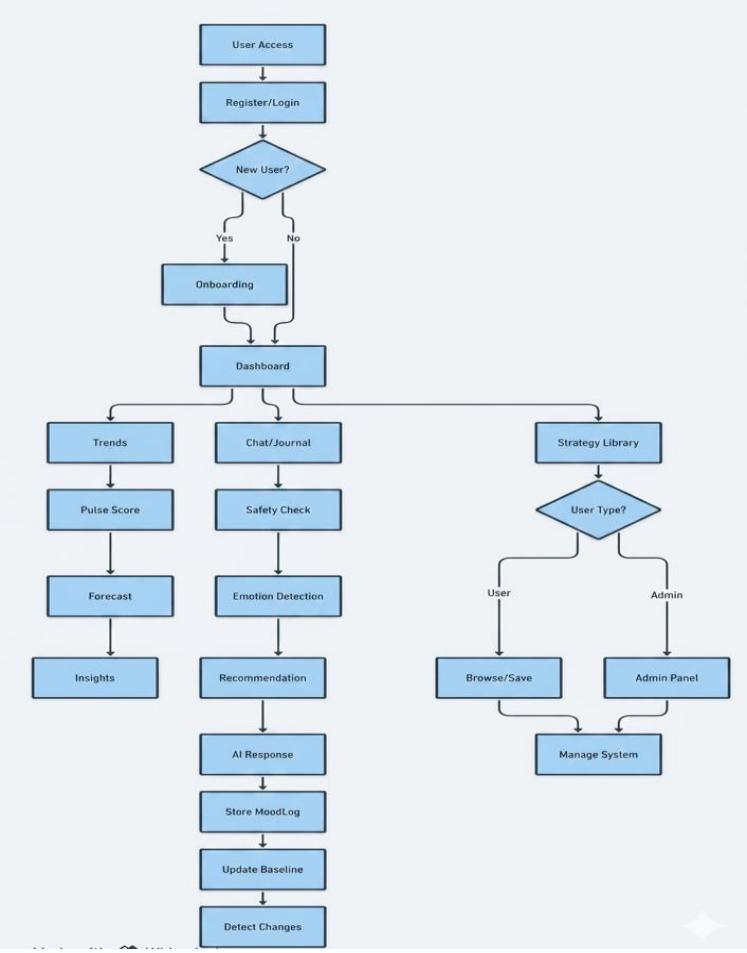

Fig. 3.1: Mind Ease System Workflow.

4.2 System Authentication and Access Control Flow

The authentication flow is built on Firebase Authentication with Google OAuth 2.0, ensuring a frictionless one-tap login experience. A global onAuthStateChanged listener detects session state on every page load. For new users, the system automatically provisions a Firestore profile document. Security is enforced through client-side PrivateRoute components and Firestore Security Rules using a Default Deny policy, ensuring each user's emotional data is mathematically isolated and inaccessible to others.

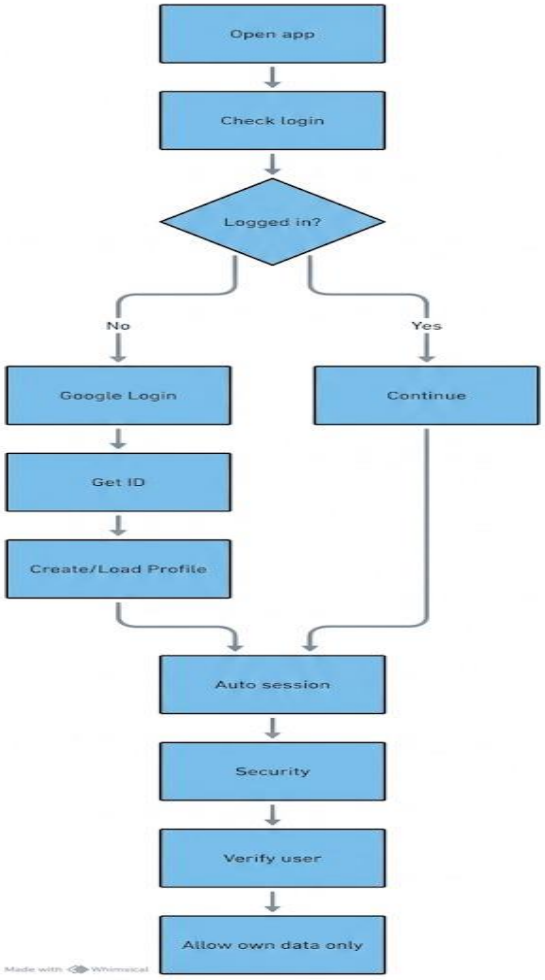

Fig. 3.3: System Authentication and Access Control Flow.

4.3 Multi-Agent AI Chat Pipeline

The core of MindEase is the Batch AI Agent Pipeline powered by the gemini-3-flash-preview model. When a user submits text through the AI Companion or Journal page, a single optimized API call simultaneously executes crisis screening, emotion classification, empathetic response generation, and strategy recommendation. The Safety Agent always runs first, intercepting high-risk inputs before any other agent is invoked. Seven specialized agents coordinate to cover all aspects of emotional intelligence.

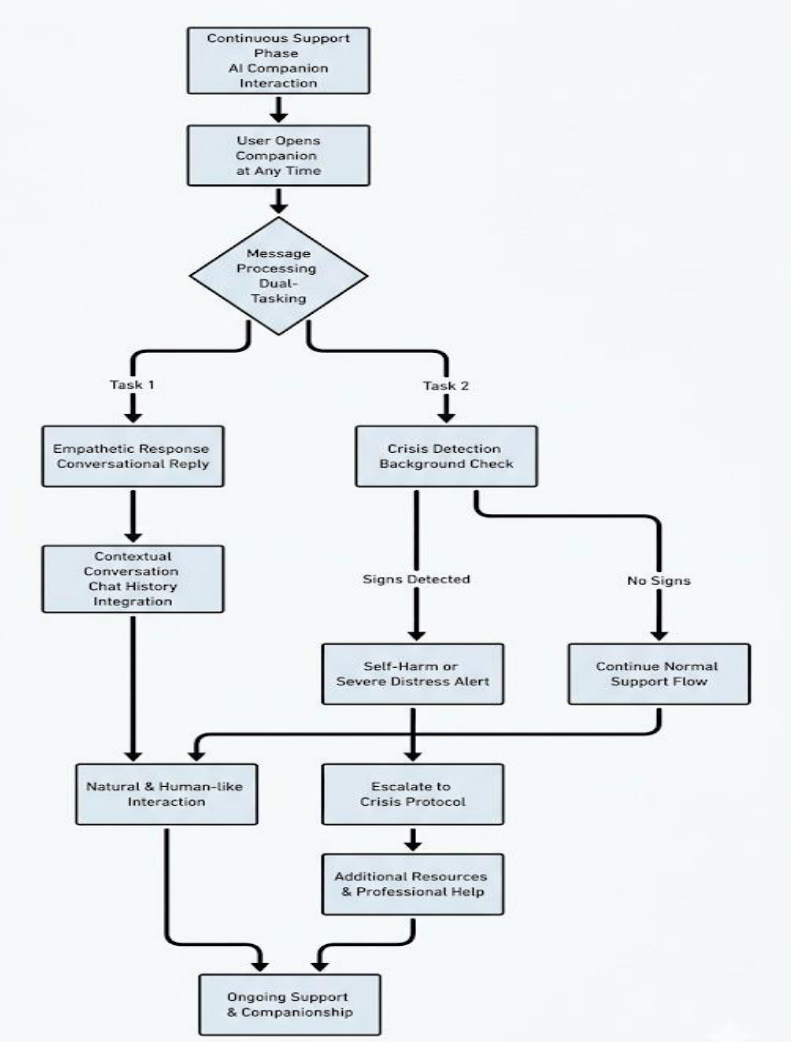

Fig. 3.6: Multi-Agent AI Chat Pipeline Workflow.

Table 1: Multi-Agent System Architecture Summary.

Agent	Technique	Output
Safety Agent	Regex + keyword tier classification	Risk level, crisis resources, escalation flag
Emotion Detection Agent	DistilRoBERTa NLP Transformer	Emotion label, confidence score, intensity (1–10)
Recommendation Agent	Affinity matrix + adaptive ML weights	Top-3 coping strategies with personalised rationale
Trend Analysis Agent	Time-series + statistical heuristics	Pulse score, 3-day forecast, mood heatmap
Escalation Agent	Threshold rules + anomaly detection	Alert trigger, admin notification, crisis modal
Feedback Agent	Weight-based reinforcement learning	Updated strategy preference scores per user
OpenRouter / LLM Agent	Google Gemini gemini-3-flash-preview	Empathetic, context-aware conversational reply

4.4 Dashboard and Trend Analysis Flow

The Dashboard implements a real-time Firestore onSnapshot listener that updates charts instantly as new check-ins are recorded. The Trend Analysis Agent computes a Wellness Score (0–100 composite index), a 3-day stress forecast using day-of-week heuristic patterns, a 28-day activity heatmap, and emotion distribution charts rendered via Recharts. These visualizations empower users to identify recurring emotional patterns and take proactive wellbeing steps.

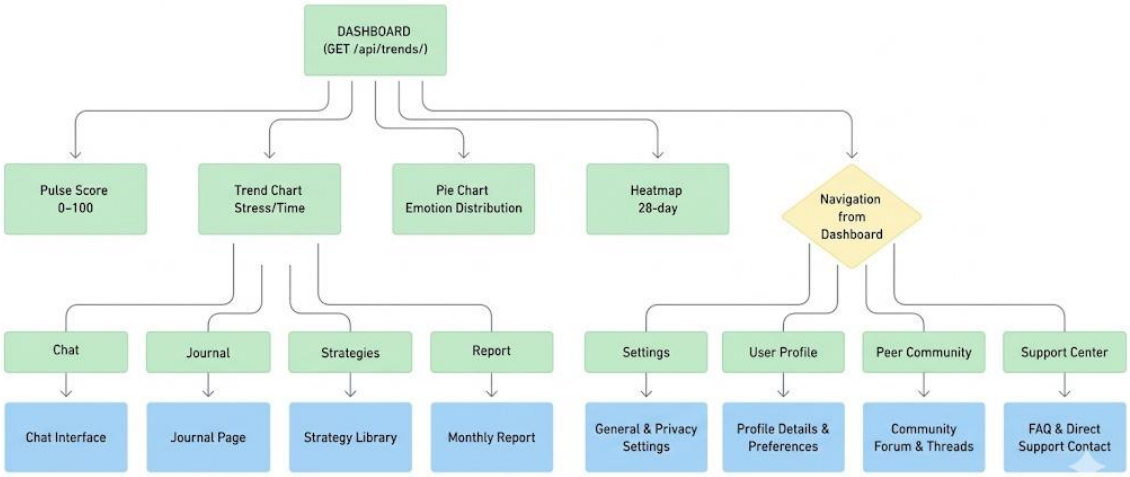

Fig. 3.4: Dashboard and Trend Analysis Flow.

4.5 Adaptive Feedback and Coping Strategy Recommendation

The Recommendation Agent maps detected emotions to evidence-based coping strategies using an affinity matrix across five categories: Breathing, Mindfulness, Movement, Journaling, and Social. MindEase implements a reinforcement learning feedback loop where users provide thumbs-up or thumbs-down ratings after every recommendation. Feedback data is stored in Firestore and injected into future Gemini API prompts as user preferences, continuously biasing recommendations toward validated approaches and building a personalised Mental Health Toolkit for each user.

5. RESULTS AND DISCUSSION

5.1 System Interface and User Experience

The MindEase platform was successfully deployed with a clean, modern glassmorphism-styled interface using a light indigo and purple color scheme. Full user authentication via Google OAuth, multi-step onboarding, and JWT-based session management function reliably. The multi-step onboarding survey captures ten wellbeing dimensions and

immediately generates a personalised action plan from the very first interaction. The login page shown below demonstrates the frictionless authentication experience.

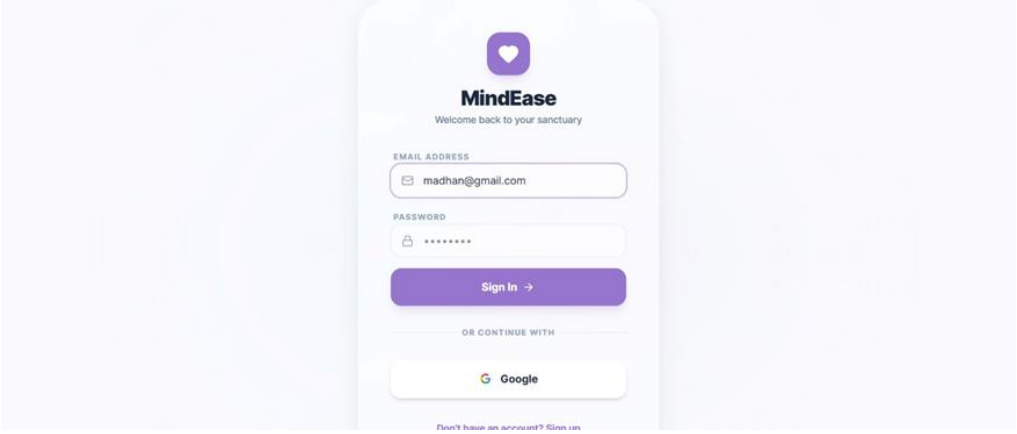

Fig. 5.1: Mind Ease Login and Authentication Page.

The main dashboard provides a personalised welcome, current emotional state, 7-day emotion trend, this week's outlook, and streaks to encourage daily check-ins. Navigation links to all key modules — AI Companion, Check In, My Journey, Wellness Studio, and Reports — are accessible from the sidebar, ensuring a smooth and intuitive user experience.

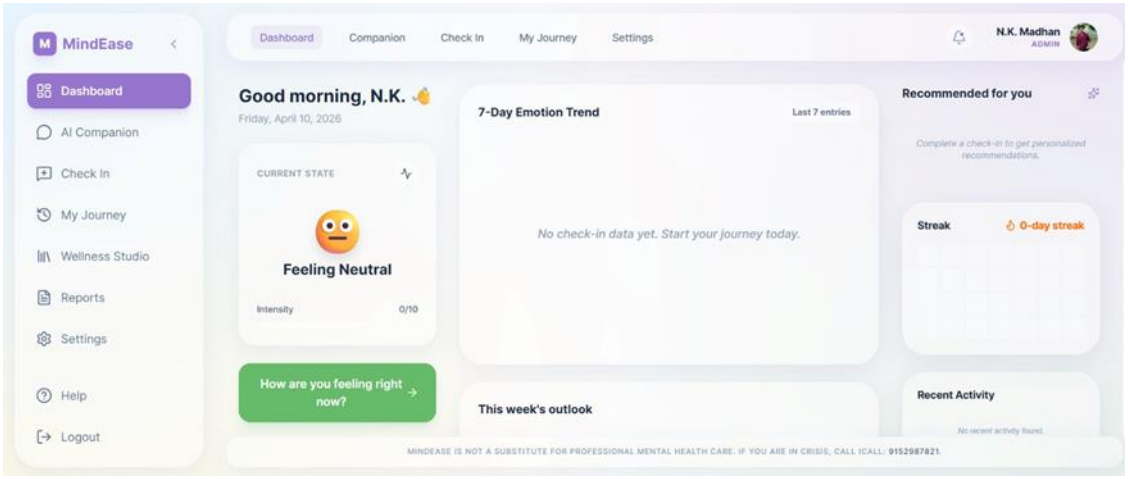

Fig. 5.2: User Dashboard with Emotion State and Trend Overview.

5.2 AI Emotion Detection and Check-In

The DistilRoBERTa-based Emotion Detection Agent classifies user text into seven emotional categories with real-time inference. During check-in, users select mood context tags such as Work, Family, Relationships, or Sleep. The Emotion Detection Agent then processes the input and returns a classification result with a confidence percentage and an AI reasoning

explanation, as shown below. The 'View AI Thoughts' transparency panel builds user trust by revealing how the system interpreted their input.

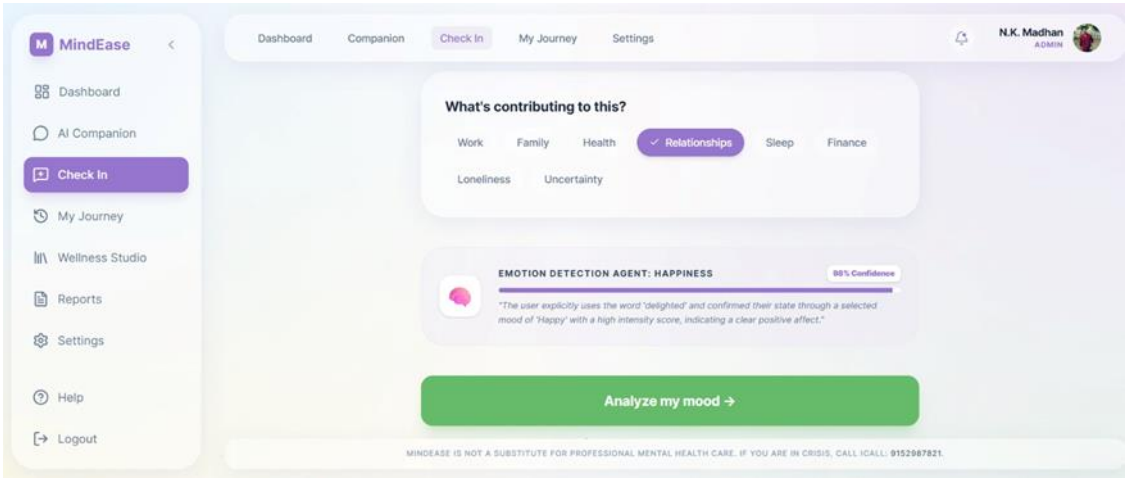

Fig. 5.3: Check-In with Emotion Detection Agent Output and Confidence Score.

5.3 AI Companion Chat Interface

The AI Companion provides continuous, empathetic conversational support. When a user submits a message, the Batch AI Pipeline simultaneously performs crisis screening, emotion classification, response generation, and strategy recommendation in a single API call. Responses are warm, non-judgmental, and include interactive links to relevant coping strategies. The conversation is private and secure, as indicated by the interface footer. Crisis detection operates reliably, consistently diverting high-risk inputs to the emergency protocol before generating any conversational response.

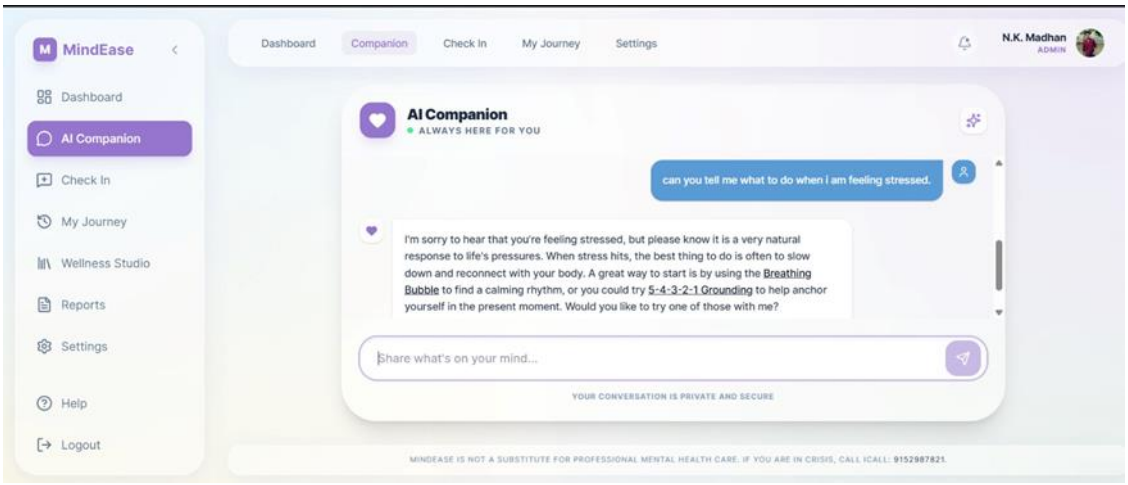

Fig. 5.4: AI Companion Chat Interface with Empathetic Response.

5.4 Coping Strategy Library (Wellness Studio)

The Wellness Studio displays all evidence-based coping strategies across five categories: Breathing, Mindfulness, Movement, Journaling, and Social. Gamified strategies such as the Breathing Bubble and Wave Flow use animations to guide users through relaxation techniques. Users can save favorites, which are persisted in Firestore and used to build a personalised Mental Health Toolkit. The Feedback Agent correctly updates strategy preference scores based on thumbs-up and thumbs-down ratings, and the Recommendation Agent demonstrably biases future suggestions toward user-validated approaches after several interactions.

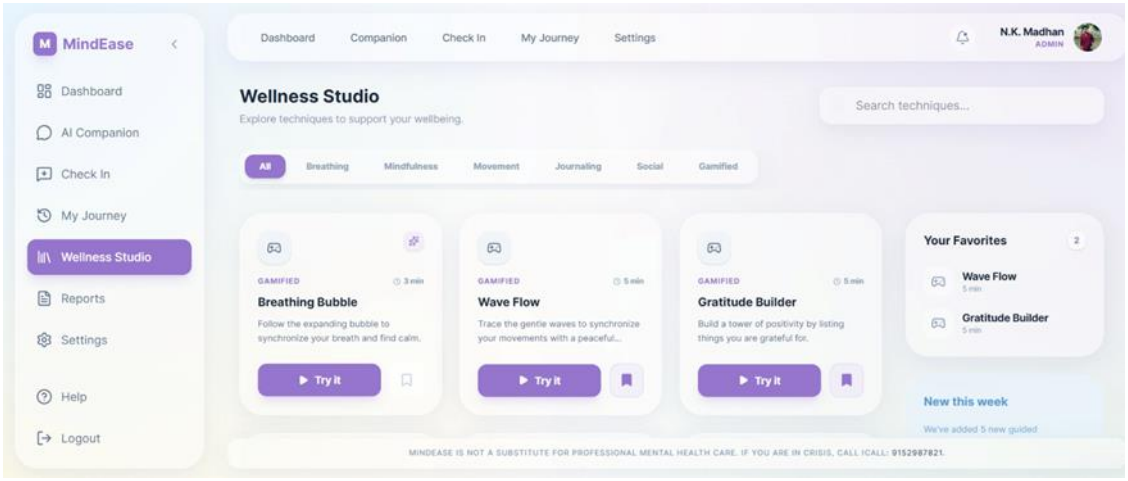

Fig. 5.5: Wellness Studio — Coping Strategy Library with Category Filters.

5.5 DISCUSSION

The results demonstrate that the MindEase system effectively supports real-time emotional self-monitoring and evidence-based coping skill development. The multi-agent architecture successfully orchestrates complex AI workflows while maintaining clean separation of responsibilities across seven specialized agents. The DistilRoBERTa emotion classifier provides accurate and consistent emotion detection, forming a reliable foundation for all downstream recommendations and mood tracking.

The feedback learning mechanism shows clear convergence behavior: users who consistently rate certain strategy categories positively see those categories progressively prioritized in future recommendations. The onboarding survey captures holistic wellbeing dimensions and immediately generates a personalised action plan, providing value from the very first interaction. The platform's anonymous check-in model reduces stigma barriers, and the three-

tier crisis detection system provides a reliable safety net ensuring high-risk inputs are intercepted and handled responsibly before any AI response is generated.

6. CONCLUSION

The MindEase system successfully achieves its objective of providing an intelligent, accessible, and personalised emotional wellbeing companion for urban users. The system integrates modern web technologies with a coordinated multi-agent artificial intelligence pipeline to deliver an interactive, empathetic, and data-driven support environment. Through real-time emotion detection, personalised coping strategy recommendations, longitudinal mood tracking, and crisis safety detection, the platform empowers users to understand their emotional state and develop healthier responses to stress.

The use of DistilRoBERTa for emotion classification, affinity-based recommendation, weight-based feedback learning, and large language model response generation enables context-aware support that improves with continued use. Overall, the system bridges the gap between traditional mental health services and the need for always-available, stigma-free emotional support. The platform is modular, scalable, and suitable for real-world deployment. Future work includes mobile application development, multilingual emotion detection, wearable biometric integration, and a practitioner dashboard for population-level mental health monitoring.

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