IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

AI Wellness Companion: Integrated DASS-21 Screening, Emotion Analysis, and Chatbot

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Abstract

The increasing demand for accessible mental well being support has led to the development of digital platforms that combine structured assessment with conversational assistance. This project presents the AI Wellness Companion, a non diagnostic web based support system that integrates the Depression Anxiety Stress Scales (DASS-21), text based emotion analysis, and a chatbot style interface within a unified application. The system uses the DASS-21, a 21-item self report instrument designed to screen for levels of depression, anxiety, and stress, alongside free text emotion evaluation through a machine learning model employing TF-IDF representations for classification. Built on the Flask framework, the application coordinates routing, data handling, and user interaction. A chatbot component further incorporates emotion predictions with a local small language model hosted on the Ollama server using the Llama 3 model to deliver empathetic and safety focused responses, with fallback templates ensuring reliability. By integrating structured self assessment with unstructured text interpretation, the approach enhances user engagement and self reflection, promoting a balanced model of digital well being support. The paper discusses the conceptual foundation, architecture, and methodological choices made during the design, stating that the tool complements professional mental health care rather than replacing it.

Keywords

mental wellness, DASS-21, TF-IDF, text classification, Flask, chatbot, Ollama, Llama 3

1. Introduction

In recent years there have been many developments in the public's understanding of mental health and emotional well being, which has resulted in an increased demand for affordable, easily accessible self care technologies. While the use of Artificial Intelligence in Health Technology has greatly improved diagnostics, treatment planning, and patient interactions, it is still largely underutilized in terms of providing non diagnostic wellness support. Ideally, mental health support systems should allow users to assess their current state of mind, identify early warning signs of distress, and engage in guided self regulation processes without barriers related to accessibility, cost, or social stigma. Unfortunately, the current mental health infrastructure continues to be far from reaching this goal. Professional interventions are often hampered by limited access, staff shortages, and social stigma related to

accessing mental healthcare resources, especially in resource poor or culturally conservative environments [5][6][7]. Moreover, most digital mental wellness applications currently available either include self assessment tools or conversational assistants. however, most do not offer a comprehensive framework that ties together formal screening with empathetic interaction and relevant contextual feedback.

The primary issue identified within this dissertation stems from the fragmentation of digital wellness solutions available today. Digital wellness application that focus solely upon using standardized screening instrument (such as the Depression Anxiety Stress Scale DASS-21) will often lack real time engagement with users and meaningful interpretations of unstructured user input [1][2][3][4]. On the other hand, digital wellness applications utilizing chatbots will often prioritize interaction at the expense of accuracy, they often utilize pre programmed responses that do not adapt dynamically to a users current emotional context. These gaps result in a disconnection between formally assessing users emotional state and providing them with relevant personalized emotional feedback reducing the utility and reflection potential of digital wellness tooling. Prior research has made some progress towards developing integrated systems for mental health monitoring and conversational AI, including tools for analyzing users sentiments in relation to mental health issues and training mental health chatbots with large datasets. However, prior research has also indicated many obstacles exist regarding ethics and technical feasibility including data privacy, model transparency and psychological safety when developing such systems [8][10].

The AI Wellness Companion, a web based, non diagnostic system that combines text based emotion analysis, structured self assessment, and AI supported conversational feedback, is presented in this paper. The DASS-21 scoring framework, TF-IDF based emotion classification, and a safety constrained Llama 3 chatbot that can be accessible via the Ollama local model server are all integrated into the application [1][8][12]. By combining qualitative emotional reflection from natural language input with quantitative assessment of stress, anxiety, and depression, this hybrid approach tackles the current fragmentation. The system's conceptual foundation is a user centric cognitive support model that prioritizes guided self reflection over intervention. The research provides a fresh framework for responsible, intelligent, and accessible digital communication by bridging the interpretive gap between standardized psychometrics and sympathetic discourse.

2. Related Work

The integration of digital technologies into mental health assessment and self care has expanded over the past decade, reflecting an accelerating trend toward user centered, accessible mental wellness support [5][7]. These developments align with the World Health Organization's (WHO) recognition of self care interventions as a foundational component of global health and well being [5][6]. The WHO defines self care as an individual's ability to maintain health, prevent illness, and cope with stress, emphasizing the role of evidence based interventions supported by digital technology [5][7]. This framework underscores the necessity of mental wellness systems that empower users to engage in structured self assessment, reflection, and behavioral regulation elements central to the conceptual design of the AI Wellness Companion.

A considerable body of research has examined the Depression Anxiety Stress Scales (DASS-21) as a foundational psychometric tool for screening psychological states in both general and clinical populations [1][2][3][4]. The DASS-21 is validated as a reliable short form measure that captures depression, anxiety, and stress through self report responses [2]. detailed its psychometric robustness and contributed to the development of even shorter derivatives, demonstrating its flexibility and clinical utility. Digital implementations of DASS-21, such as those detailed by Pioneer Health TMS and Novopsych [3][4]. illustrate its adaptability to web based contexts, confirming its potential as a

structured foundation for self guided mental health evaluations. Yet despite this robust validation, DASS-21 in isolation provides only a static snapshot of user states, lacking analytical depth in interpreting free text emotional expressions limiting its capacity for personalized or dynamic feedback. Parallel research streams have investigated natural language processing (NLP) and machine learning as means of augmenting emotional understanding in digital health platforms. The TF-IDF (Term Frequency Inverse Document Frequency) model remains a fundamental vectorization technique for text based sentiment and emotion classification due to its interpretability and efficiency . By mapping text into weighted numeric features, TF-IDF models enable algorithms to detect patterns in emotional tone and sentiment. Their use in mental health analytics has demonstrated practical value for lightweight, interpretable machine learning pipelines making them suitable for integration within resource conscious web applications such as Flask based systems [9].

Concurrently, research and industry advancements in conversational AI have enabled responsive and context aware interfaces supporting emotional and cognitive self reflection. The release of the Meta Llama 3 model, one of the most capable open large language models (LLMs) [10][11], has expanded opportunities for localized, ethically deployable AI systems that can function offline or within controlled environments. Leveraging such a locally hosted framework through the Ollama server minimizes privacy risks associated with cloud based interactions, aligning with broader ethical imperatives in digital mental health applications [5][6]. Despite these advancements, many commercial chatbots such as Woebot and Wysa remain limited by closed architectures, data opacity, and predefined conversational constraints, resulting in reduced adaptability and interpretive precision.

Collectively, these studies and frameworks reflect significant progress toward accessible, AI enhanced mental health tools. However, persistent limitations remain regarding the integration of psychometric assessment, emotion aware NLP, and safe, context sensitive conversational AI within a unified platform. The AI Wellness Companion distinguishes itself by bridging these domains: combining validated psychometric measures (DASS-21) [1][2], interpretable text analytics (TF-IDF)[8], and an adaptive, locally hosted AI dialogue system (Llama 3 via Ollama) [10][11]. This study thus builds upon the methodological reliability of existing screening tools, the analytic precision of machine learning, and the empathic affordances of conversational AI contributing an ethically grounded, user oriented framework for digital well being support.

3. Proposed System

The proposed AI Wellness Companion comprises three primary analytical layers and one delivery layer, as shown in Figure 1. The first analytical component is the DASS-21 questionnaire module [1][2], which collects structured self report responses and computes subscale scores for depression, anxiety, and stress across seven items per construct. The second analytical layer is the text analysis module, which transforms user written reflections into TF-IDF feature vectors for emotion classification [8]. The third layer is the chatbot module, which generates supportive, non clinical responses informed by the outputs of the previous components and guided by ethical safety boundaries [5][6]. Finally, the delivery layer utilizes the Flask web framework [10] , to manage routing, user sessions, data handling, and results visualization within a unified web interface.

In this implementation, the chatbot module interacts with a locally hosted Ollama server through its default endpoint http://localhost:11434/api/chat, using the Llama 3 model tag. This local inference design ensures that all conversation data remain on the user's machine rather than being transmitted externally, aligning with privacy principles in digital well being research [5],[6]. The chatbot receives recent conversational context along with emotion predictions from the TF-IDF classifier and applies a structured system prompt that defines it as a supportive mental health assistant. The model's responses are constrained to three to six empathetic, safety conscious sentences that avoid diagnostic language

while encouraging help seeking if distress appears elevated. If the Ollama response call fails or returns null content, the chatbot automatically switches to a template based fallback, selecting prewritten, emotion specific supportive messages. This redundancy ensures reliability, emotional continuity, and responsible engagement even under model unavailability.

3.1. System Architecture

The overall architecture of the AI Wellness Companion can be represented through a four stage modular pipeline:

- **Input Stage:** Collection of structured questionnaire responses and free text user reflections via the web interface.
- **Processing Stage:** Computation of DASS-21 subscale scores and TF-IDF based text preprocessing.
- **Inference Stage:** Emotion classification and severity interpretation based on the processed input data.
- **Response Stage:** Rendering of the combined results, feedback, and chatbot generated supportive suggestions.

In addition to emotion classification, the system also integrates DASS-21 assessment for mental health evaluation. The predicted results are further processed by a response engine, which generates appropriate chatbot responses. All user interactions and results are optionally stored in a secure database for future analysis. This modular configuration enables independent enhancement of each layer. For example, the current classifier could later be replaced with a transformer based NLP model while preserving the same questionnaire and interface logic. Such extensibility makes Flask and Llama 3 via Ollama appropriate for iterative prototyping and educational research.

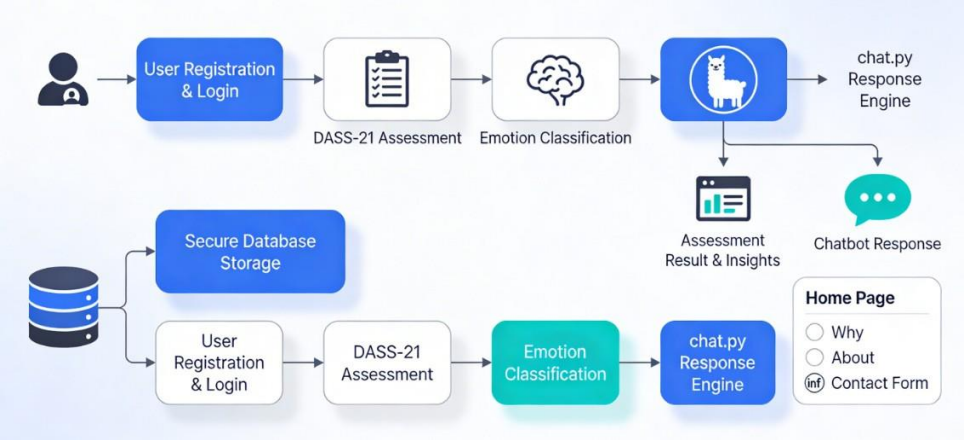


Figure 1: System architecture of AI Wellness Companion

4. Materials and Methods

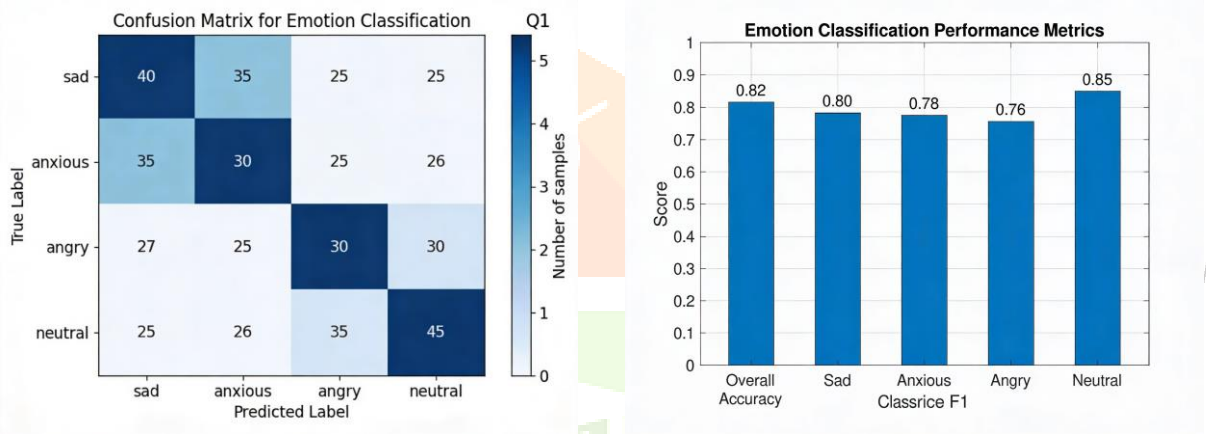
This research adopts a design and implementation methodology, focusing on the prototype development of an integrated digital well being system rather than on clinical validation. The approach combines structured psychometrics (DASS-21), classical NLP based emotion analysis (TF-IDF), and a local AI driven conversational interface (Ollama Llama 3) housed within a Flask based web framework. Model performance was evaluated on a held out test set using accuracy and a confusion matrix to examine class wise errors.

4.1. DASS-21 Module

The DASS-21 module uses the standard 21-item instrument divided into three seven item subscales for depression, anxiety, and stress [1][2][3][4]. Each item is rated from 0 to 3 based on the individual's experience over the past week. Subscale totals are computed via prescribed item groupings, and results are optionally multiplied by two for comparability with the extended DASS-42 metric structure. Within this project, the module functions as a screening and self reflection aid, not as a diagnostic instrument, aligning with the ethical boundaries of wellness technology [5].

4.2. Text Processing and Emotion Classification

When a user submits a message, the system immediately initiates text processing. The input text is first converted into TF-IDF vectors, enabling the model to identify the most relevant emotion related words in the context. These features are then passed to a pre trained Logistic Regression classifier, which predicts the emotional state of the user as sad, anxious, angry, or neutral. To ensure efficient deployment, the trained model along with the TF-IDF vectorizer is serialized using Joblib. This allows seamless integration into the web application. The Flask framework manages the end-to-end pipeline, where each incoming message is processed through text cleaning, feature extraction, and emotion prediction stages, and the results are returned to the user in real time.



(a) Confusion matrix. (b) Accuracy and class wise F1 scores.

Figure 2: Emotion classification performance of the AI Wellness Companion, showing (a) the confusion matrix and (b) overall and class wise metrics.

4.3. Web Implementation

The Flask micro web framework , provides lightweight routing, dependency management, and HTML templating for delivering the integrated modules [9][10]. Separate backend scripts manage form processing, session control, model loading, and result rendering to maintain modular cohesion. This design facilitates maintainability and encourages incremental updates such as substituting more advanced NLP architectures or expanding the emotion label taxonomy in future iterations.

4.4. Ethical Constraints

The system engages with emotionally sensitive user content, the design prioritizes ethical responsibility and scope definition. The web interface, documentation, and chatbot prompt clearly state that the system is a wellness support tool, not a substitute for medical diagnosis or therapy. It explicitly avoids deterministic statements or emergency commands and instead encourages users with high stress or depression indicators to seek professional help Maintaining computation locally via Ollama ensures that

user text remains private, addressing confidentiality and data minimization principles central to digital mental health applications [5][6].

4.5. Chatbot Implementation

The chatbot uses a Python wrapper hooked up to Ollama's local API http://localhost: 11434/api/chat, running conversations through the Llama 3 language model. When you chat, the app builds the dialogue, labels each message (User or Assistant), adds your latest input, and sends the whole batch to the model. The system prompt guides the assistant to reply with warmth and emotional support usually 3 to 6 sentences, steering clear of diagnoses and nudging you toward professional help if things seem serious. It throws in the predicted emotion label so the assistant can match its tone and keep the conversation on target.

If the API fails or doesn't respond, the chatbot doesn't leave you hanging. It switches to a backup generator that pulls from customized templates based on how you're feeling (stressed, sad, neutral), so you always get a reply that fits, even if the tech stumbles. With this mix of generative models and smart backup logic, the system keeps things adaptable, stays safe, and never lets your data leave your device.

5. Implementation Workflow

The implementation workflow begins with data preparation and model training. First, the DASS-21 questionnaire items and associated scoring logic are encoded into the application so that each of the three subscale scores depression, anxiety, and stress can be computed consistently from user responses using the documented item mappings.[1][2] Second, an emotion labelled text dataset is used to train a TF-IDF feature extractor and logistic regression classifier [8], once training is complete, this pipeline is serialized and linked to the Flask backend so that it can be invoked efficiently during inference.

During runtime, user provided text is passed through the same preprocessing and TF-IDF vectorization pipeline before the stored model generates an emotion label, which is then combined with the DASS-21 summary scores to drive both the chatbot's response logic and the structure of the user facing dashboard. A typical application flow is as follows: the user opens the web application and reads a scope and safety disclaimer, completes the DASS-21 form, reviews the resulting severity feedback, enters a reflective free text message, receives an emotion label inferred by the classifier, and finally receives a supportive chatbot reply that is informed by both the questionnaire scores and the predicted emotional state.

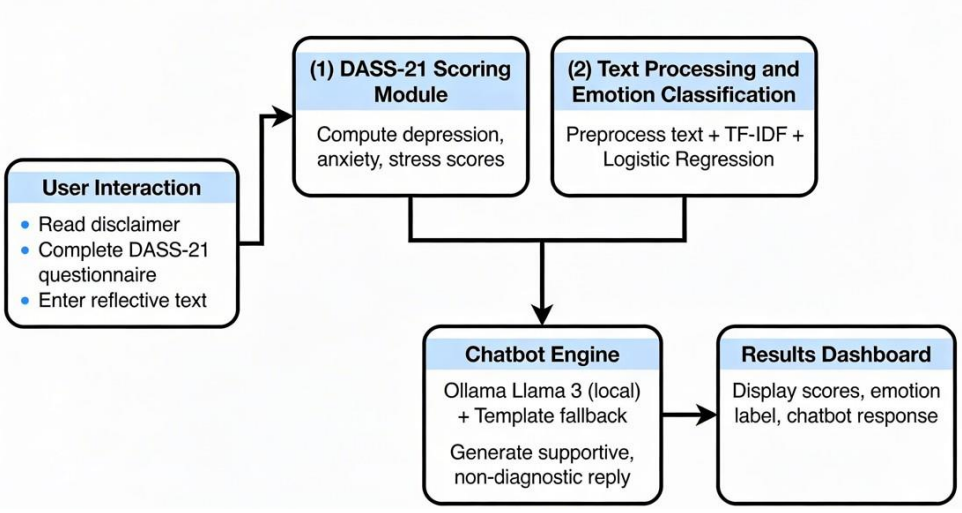


Figure 3: Workflow of the system

6. Results and Discussion

The results are primarily reflected in system performance and functional usefulness. System performance is reflected in the ability of the emotion classification model to reach reasonable accuracy and related metrics on a held out test set, and in the consistent computation of DASS-21 subscale scores for all completed questionnaires. Functional usefulness is evident in the stable behaviour of the web interface, the successful generation of chatbot responses, and the way questionnaire feedback and emotion labels are combined coherently during test interactions. Taken together, these outcomes suggest that the integrated pipeline from user input through analysis to supportive feedback works as intended at the prototype stage.

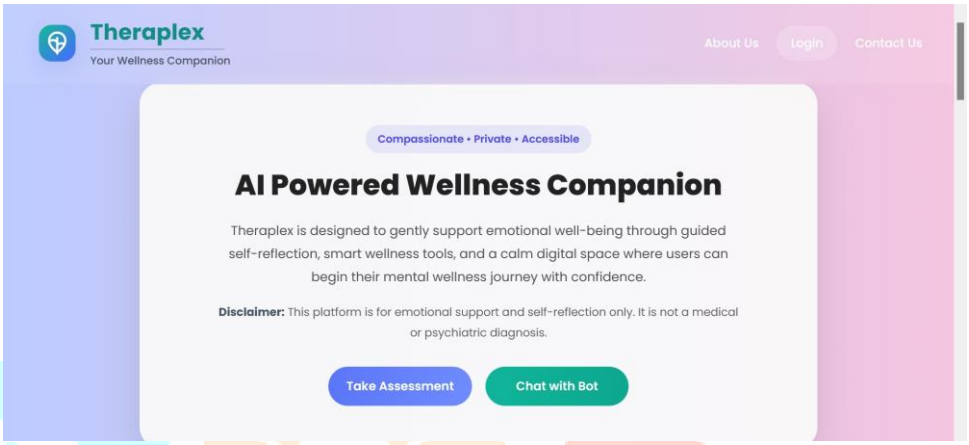


Figure 4: User interface of the web application

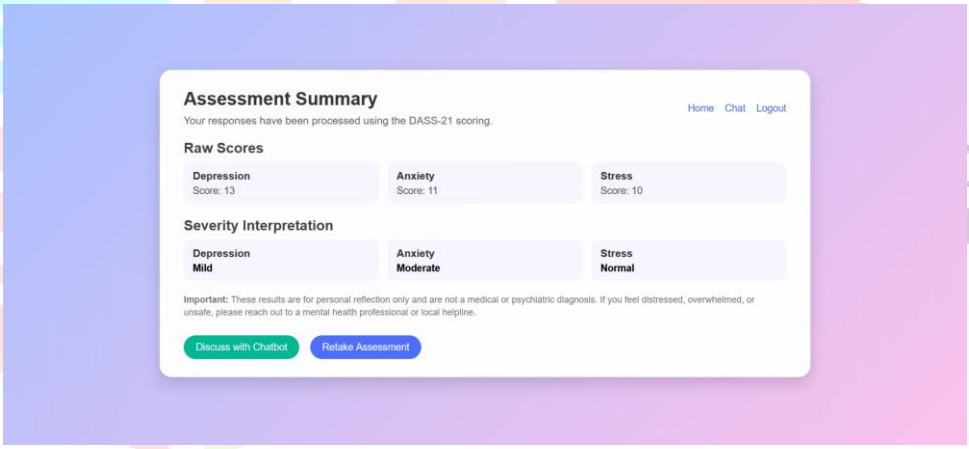


Figure 5: DASS-21 questionnaire score interface

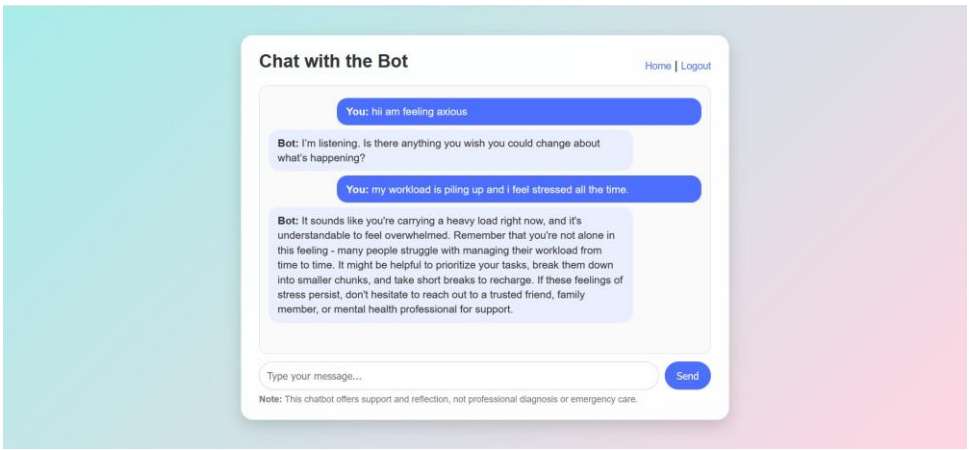


Figure 6: Chatbot response output

7. Discussion and Limitations• The study shows that integrating DASS-21 scores, emotion classification, and a chatbot interface made the system feel more engaging than using any single component on its own.

- The DASS-21 module gave users a structured way to reflect on depression, anxiety, and stress levels, which helped anchor the rest of the feedback.

- Allowing users to write free text reflections added an extra layer of nuance, because they could describe their experiences in their own words instead of only picking fixed options.

- The chatbot helped translate numerical scores and emotion labels into short, supportive messages, which fits with a wellness focused, self care orientation rather than a diagnostic one.
- Implementing the conversational layer with a local Ollama Llama 3 model, together with an emotion-aware template fallback, showed that it is technically feasible to offer context sensitive responses while keeping data on the user's own machine.

- At the same time, It is recognized that the system has clear limitations.

- The DASS-21 results are based entirely on self report, so they can be affected by how honest users are, their momentary mood, and how they interpret the questions. • The TF-IDF based classifier cannot fully capture deeper semantic meaning, sarcasm, mixed emotions, or culturally specific expressions, so the emotion labels should be seen as approximate.

- Even with careful prompting, chatbot outputs may appear more authoritative than they actually are, which is why clear disclaimers and cautious wording are essential. • This project does not test clinical outcomes or long term impact, it demonstrates feasibility and supportive potential in an academic prototype, not a validated mental health intervention.

8. Future Scope• Future work will extend the emotion analysis pipeline beyond TF-IDF and logistic regression toward transformer based architectures to capture richer semantic and contextual information in user text.

- Subsequent studies will move from purely technical evaluation to empirical user studies assessing usability, perceived support, and short term emotional impact in realistic usage settings.

- The prototype may be broadened by adding further wellness oriented scales, exploring multilingual and culturally sensitive adaptations, and integrating external psychoeducational and professional support resources to situate the system within a wider digital mental health ecosystem.

9. Conclusion

This paper has presented the design and rationale of an AI Wellness Companion that integrates DASS-21 screening, text based emotion classification, and chatbot interaction into a single web platform. The system employs DASS-21 as a structured self report mechanism, uses TF-IDF with logistic regression for practical free text emotion analysis, and relies on Flask for lightweight application delivery, all combined with a locally hosted Ollama Llama 3 chatbot and a template based fallback to avoid transmitting sensitive data to external servers. The resulting architecture is academically meaningful

because it shows how interpretable methods and accessible development tools can be assembled into a wellness support application with a clearly defined, non diagnostic scope. At the same time, it must be explicitly framed as a supportive aid that encourages appropriate help seeking rather than as a substitute for professional mental health care. Future work can build on this prototype by incorporating larger evaluation datasets, more advanced language models, usability and impact studies, multilingual extensions, and personalization strategies, while maintaining strong safety constraints and transparent communication with users.

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