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PeacePulse : Smart Mental Health Companion Application

Dr. A. A. Khatri[1], Vethekar Harshada Jalindar[2], Wagh Kalyani Ashok[3], Dumbre Pavankumar Padmakar[4]
[1,2,3,4]Department of Computer Engineering, JCOE, Kuran Savitribai Phule Pune University Pune, India
khatrianand@gmail.com[1], harshadavethekar@gmail.com[2], kalyaniwagh1012@gmail.com[3], pawandumbre007@gmail.com[4]

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Abstract

Peace Pulse is an app that supports better emotional well-being, mindfulness, and prevention of common mental health issues. Its approach of applying advanced machine learning and AI-powered features provides access to and scale of services far beyond the availability of conventional mental health care services. Key functionalities include: a first-level emotional support conversational chatbot, an interactive users' forum to tell their personal stories, contact with therapists, ideas for self-care activities, stress assessment, mindfulness-based games and exercises. With AI-based insights that can be leveraged for user engagement strategies, the PeacePulse provides a holistic approach to mental health management, making psychological support more accessible and welcoming.

INTRODUCTION

Mental health disorders continue to pose a global challenge, affecting over a billion individuals and significantly influencing daily functioning, productivity, and societal well-being. Despite advancements in mental health awareness, barriers such as high treatment costs, social stigma, and limited access to professional care persist, leaving many without adequate support. The consequences of untreated mental health conditions can be severe, contributing to increased rates of chronic illnesses, workplace absenteeism, and suicide.

In response to these challenges, mobile health applications have gained traction as effective, accessible, and scalable tools for mental wellness. By integrating self-help mechanisms, real-time tracking, and artificial intelligence-driven interventions, these applications provide on-demand support tailored to individual needs. Features such as cognitive behavioral therapy (CBT)-based exercises, mindfulness training, and chatbot-assisted conversations empower users to manage their mental well-being more effectively. Additionally, these platforms enhance privacy and reduce stigma, encouraging broader adoption among individuals hesitant to seek traditional therapy.

This paper introduces **PeacePulse**, a mobile mental health application designed to facilitate self-care, psychoeducation, and behavior modification. With its development , this study assesses its core functionalities, engagement strategies, and impact on user well-being. Furthermore, it examines the potential for enhanced personalization and integration with professional mental health services to optimize effectiveness. By addressing the growing demand for digital mental health solutions, **PeacePulse** aims to bridge existing care gaps

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and extend support to diverse populations worldwide.

LITERATURE REVIEW

Dhanasekar, Varshaa, et al. “A Chatbot to Promote Students’ Mental Health Through Emotion Recognition.” 2021 Third International Conference on In ventive Research in Computing Applications (ICIRCA), IEEE, 2021[1] The paper describes the development of a mental health app that supports self-care activities using Flutter. It includes features like a chatbot, which is implemented with Dialogflow, an NLP-based platform, to simulate empathetic conversations and provide relevant responses.

Erqsous, Moath, et al. ”Poster: Opportunities and Challenges in Mental Health Mobile Applications.” 2024 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE). IEEE, 2024[2] This paper develops a machine learning-based system to detect early signs of mental health issues in children using a survey dataset. It employs three algorithms—K-Nearest Neighbors (KNN), Random Forest, and Multi-Layer Perceptron (MLP)—to predict the need for mental health intervention, with KNNproviding the best results.

Francese, Rita, and Pasquale Attanasio. ”Emotion detection for supporting depression screening.” Multimedia Tools and Applications 82.9 (2023):12771 12795.[3] The paper develops an application named EDApp, designed to support depression screening by capturing nonverbal cues (emotions) from patients’ images and audio recordings while they complete a depression questionnaire. The EDApp application utilizes Convolutional Neural Networks (CNNs) for both image-based and speech-based emotion recognition, focusing on detect ing sadness, a key emotion associated with depression.

Huang, Wumin, et al.”Research on Mental Health of College Students Based on Branch and Bound Algorithm.” 2023 4th International Conference on Information Science and Education (ICISE-IE). IEEE, 2023.[4] The paper develops a method to assess and assist college students’ mental health using the Branch and Bound (BB) algorithm. This algorithm is used to handle optimization problems efficiently by narrowing the solution space, which helps in mental health evaluation and intervention decision-making for students. Through this method, personalized mental health support can be provided by optimizing decision-making in treatment selection and resource allocation.

Kamoji, Supriya, et al. ”Mental Health Prediction using Machine Learning Models and Large Language Model.” 2024 Second International Conference on Inventive Computing and Informatics (ICICI). IEEE, 2024[5] The paper develops a mental health prediction platform using ensemble learning techniques and a Large Language Model (LLM). The ensemble learn ing involves algorithms like AdaBoost, voting, and bagging, with Random Forest identified as the optimal choice. Additionally, the system integrates Google Gemini, an LLM, to generate personalized insights based on user in put, enhancing the predictive capability and providing contextually relevant mental health information.

Kadam, Sandeep U.,et al. "Improve the performance of non-intrusive speech quality assessment using machine learning algorithms." *NeuroQuantology* 20.10 (2022): 12937[10].

In this piece of research, we introduced a novel methodology for evaluating the content of speaking. We suggest a methodology for speech quality assessment (SQA) that makes use of non-matching references because humans have the capacity to evaluate quality independently of the speech substance. Because of this, it's possible that new research avenues will become available for the advancement of SQA techniques

PROBLEM STATEMENT

Develop a cross-platform Flutter-based mental health app that offers personalized resources, mood tracking, guided exercises, and secure communication with professionals, ensuring accessibility and user-friendliness.

METHODOLOGY

This section outlines the approach taken to develop the PeacePulse mobile application involves several key phases, each focused on delivering a user-friendly, secure, and effective platform for mental wellness support. The methodology is structured into primary steps, ensuring a comprehensive and user-centric design.

Data Collection:

Dataset Compilation:

A comprehensive dataset of mental health information is collected, including anonymized medical histories, psychological assessments, stress levels, mood variations, and self-reported symptoms.

Data sources include surveys, questionnaires, user feedback, and publicly available mental health datasets to enhance personalization.

The dataset enables the app to provide tailored mental health recommendations, coping strategies, and self-care routines based on individual needs.

Real-time User Input:

Users can input real-time mental health data such as mood fluctuations, sleep patterns, anxiety triggers, and daily stress levels.
Continuous updates allow the system to refine and personalize wellness plans, self-help exercises, and mental health strategies dynamically.

User Profiling :
Mental Health Assessment:
The app creates a personalized user profile based on collected data, considering factors such as stress levels, past mental health history, sleep quality, and emotional well-being.
This profile serves as a foundation for customized mental health recommendations.
Customization and Goal Setting:
Users set specific mental health objectives, such as reducing anxiety, improving sleep, managing stress, or tracking depression symptoms.
The app adjusts therapeutic suggestions, mindfulness exercises, and behavioral interventions based on user-defined goals.

Feature Development :
Mood Tracking and Monitoring:
The app allows users to log daily mood changes, stress triggers, and emotional patterns.
AI-driven insights help detect trends and provide proactive recommendations for mood enhancement.
Stress and Anxiety Management:
Personalized self-care routines, breathing exercises, meditation guides, and journaling features help users manage anxiety and stress.
The app offers scientifically backed stress relief techniques, including guided therapy exercises and mindfulness practices.
Sleep and Well-being Optimization:
The system integrates sleep tracking and provides tailored sleep hygiene recommendations.
AI-based suggestions include relaxation techniques, bedtime routines, and insights on sleep cycles.

Personalization Engine:
Machine Learning Integration:
The app uses machine learning to analyze behavioral patterns, stressors, and responses to previous interventions.
AI refines recommendations by predicting the most effective therapy exercises, self-care strategies, and coping mechanisms.
Real-Time Updates and Adjustments:
As users log new mental health data or modify their goals, the personalization engine recalibrates recommendations to ensure continued relevance.
Adaptive strategies adjust based on progress, ensuring a dynamic approach to mental well-being.
Behavioral Tracking and Adaptive Feedback:
The system monitors adherence to wellness activities, tracking mindfulness practices, therapy sessions, and lifestyle changes.
If users struggle with adherence, alternative and easier-to-follow techniques are suggested.
Data Enhancement:
User data is anonymized and used to refine collective insights, improving recommendations for individuals with similar mental health conditions.
The system allows interaction with mental health professionals, ensuring AI-generated wellness plans align with expert-approved methods.

Community Engagement and Support :
Expert Consultation:
The app connects users with psychologists, therapists, and mental health coaches through in-app consultations and AI-assisted therapy sessions.
This ensures users receive credible, professional-backed mental health guidance.
Peer Support and Forum:
A dedicated community space allows users to share experiences, provide emotional support, and discuss coping strategies.
Users can access mental health forums, guided discussions, and Q&A sessions with mental health professionals.

Intelligent Reminder and Alert Systems:
Mental Health Reminders:
The app sends reminders for scheduled therapy sessions, mindfulness exercises, hydration, and self-care activities.
Notifications encourage consistency in mental well-being routines.
Mood-Based Alerts:
Users receive timely alerts for significant mood changes, prolonged stress levels, or signs of emotional distress.
If concerning patterns are detected, the app recommends interventions or prompts users to seek professional support.

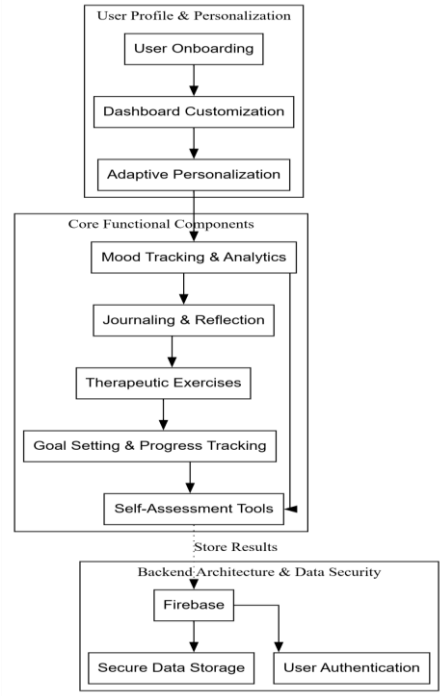

Fig 1: Workflow

SYSTEM ARCHITECTURE

User Input Model:

Mental Health Data Acquisition:

Collects inputs from users such as mood logs, stress levels, sleep patterns, and daily activities to personalize recommendations.

Mental Health Challenge Identification:

Users specify concerns such as anxiety, depression, burnout, or sleep issues, enabling tailored mental health insights and interventions.

Core Functional Models:

Responsible for the overall functioning of the application.

Mood and Stress Tracking:

- Emotional State Monitoring: Users log daily moods, stress levels, and emotional triggers.
- Sentiment Analysis: AI assesses journal entries and chatbot interactions to detect mood trends.

Anxiety and Depression Management:

- Symptom Assessment: Determines the severity of anxiety and depression using validated scales (e.g., GAD-7, PHQ-9).
- AI-Based Coping Suggestions: Provides relaxation techniques, cognitive behavioral therapy (CBT) exercises, and guided breathing.
- Personalized Self-Care Plans: Generates customized mental wellness routines based on user responses and behavior patterns.

Sleep and Well-Being Optimization:

- Sleep Pattern Analysis: Tracks sleep cycles and disturbances via user input and wearable integration.
- Guided Relaxation Techniques: Provides sleep hygiene tips, meditation, and calming audio to improve sleep quality.
- AI-Powered Sleep Insights: Identifies potential causes of poor sleep and suggests corrective actions.

Community Support System:

- Peer-to-Peer Support: Connects users with similar experiences for shared support and motivation.
- Q&A Forums: Allows mental health experts to answer user-submitted queries on stress, anxiety, and well-being.
- Confidential Chat Feature: Offers private conversations with mental health professionals or AI-based chatbots for guidance.

Backend Services :

- AI-Powered Mental Health Analytics:
- Processes user data to provide predictive mental health insights and behavior-based recommendations.
- Data Processing & Security Layer:

User Data Encryption & Privacy Protection:

Implements end-to-end encryption (E2EE) for all personal and sensitive health data.

Uses anonymization techniques to prevent direct identification of users, ensuring compliance with data protection laws (GDPR, HIPAA).

Secure Authentication & Access Control:

Uses multi-factor authentication (MFA) and role-based access control to ensure only authorized users can access data.

Employs OAuth 2.0 and token-based authentication for secure login and session management.

Cloud-Based Data Storage & Processing:

Utilizes secure cloud platforms (e.g., AWS, Google Cloud, or Azure) to store encrypted user data.

Implements automated backups and redundancy mechanisms to prevent data loss.

API Integration for External Data Sources:

The backend connects with third-party APIs (e.g., wearables, fitness trackers) to incorporate biometric and lifestyle data.

Enables seamless integration with telehealth platforms for professional consultation services.

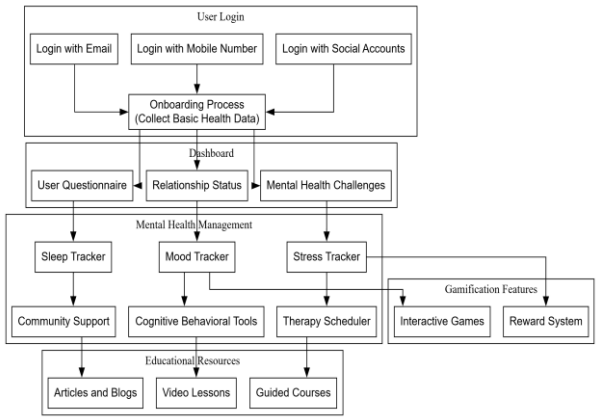

Fig 2. System Architecture

CONCLUSION

The Peacepulse is an app which focuses on accessibility and personalization for support when it truly matters in-user's paths for improving their overall well-being. It takes its features along with what one needs-mood monitoring, guided exercise, communication with mental health professionals-and makes an individual take that lead to improve one's life mentally. Its User friendly interface and engagement with the resources that are accessible, conductive to self-care and emotional resilience. As mental health problems continue to rise worldwide, PeacePulse is doing its part in filling the gap between the individual and mental health resources. Its architecture is strong enough to support seamless functionality across platforms while its machine learning capabilities can provide tailored recommendations that will enhance user engagement.

FUTURE SCOPE

The scope of development of mental Health application like Peacepulse is promising, focused on advanced personalization through AI and machine learning for tailored recommendations and predictive analytics to identify users at risk. Integrating telepathy services and collaborating with licensed professionals will enhance access to support, while gamification and community features can boost user engagement. Additionally, integrating wearable devices for biometric monitoring and focusing on preventive mental health through early intervention programs can provide real-time insights into user well-being. Overall, these developments aim to make mental health support more accessible, engaging, and effective for diverse populations.

References

Dhanasekar, Varshaa, et al. "A Chatbot to Promote Students' Mental Health Through Emotion Recognition." 2021 Third International Conference on In ventive Research in Computing Applications (ICIRCA), IEEE, 2021.

Erqsous, Moath, et al. "Poster: Opportunities and Challenges in Mental Health Mobile Applications." 2024 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE). IEEE, 2024.

Francese, Rita, and Pasquale Attanasio. "Emotion detection for supporting depression screening." Multimedia Tools and Applications 82.9 (2023):12771 12795. .

Huang, Wumin, et al. "Research on Mental Health of College Students Based on Branch and Bound Algorithm." 2023 4th International Conference on Information Science and Education (ICISE-IE). IEEE, 2023.

Kamoji, Supriya, et al. "Mental Health Prediction using Machine Learning Models and Large Language Model." 2024 Second International Conference on Inventive Computing and Informatics (ICICI). IEEE, 2024.

Kataru, Sriteja, Kathleen King, and Lachin Fernando. "Machine Learning Based Early Detection and Intervention for Mental Health Issues in Children."2024 IEEE 48th Annual Computers, Software, and Applications Conference (COMPSAC). IEEE, 2024.

Mange,Dhanvi, et al. "Application for performing self care activities using f lutter." 2023 2nd International Conference on Vision Towards Emerg ing Trends in Communication and Networking Technologies(ViTECoN). IEEE,2023.

Mao, Lanfang. "Design of a College Student Mental Health Assessment System Based on Improved Apriori Algorithm." 2024 IEEE 2nd International Conference on Image Processing and Computer Applications (ICIPCA). IEEE, 2024.

Rahman, Syed Azizur, et al. "Enhancing Mental Health Care with the Kalman Filter: Predictions, Monitoring, and Personalization." 2024 IEEE 48th Annual Computers, Software, and Applications Conference (COMPSAC). IEEE, 2024.

Kadam, Sandeep U.,et al. "Improve the performance of non-intrusive speech quality assessment using machine learning algorithms." *NeuroQuantology* 20.10 (2022): 12937.

Thotad, Puneeth N., et al." Mental Health Tracker Using Machine Learning Approaches." 2023 4th

IEEE Global Conference for Advancement in Tech nology (GCAT). IEEE, 2023.