iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** V **Month of publication:** May 2026

DOI: https://doi.org/10.22214/ijraset.2026.82229

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com

AI Chatbots for Mental Health Assistance: Transforming Digital Mental Healthcare through Conversational Artificial Intelligence

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Abstract: ***Mental health disorders have emerged as a major global public health concern, significantly affecting individuals across all age groups. The increasing prevalence of depression, anxiety, stress-related disorders, and emotional instability has created substantial pressure on traditional healthcare systems. Despite growing awareness regarding mental well-being, access to professional psychological support remains limited due to high treatment costs, shortage of trained therapists, geographical barriers, and social stigma associated with seeking mental healthcare. In this context, Artificial Intelligence (AI)-driven conversational agents, commonly known as AI chatbots, have gained considerable attention as scalable and accessible digital mental health solutions. Traditional mental healthcare systems often face challenges including lack of accessibility, shortage of mental health professionals, social stigma, high treatment costs, and delayed diagnosis. Artificial Intelligence (AI)-powered chatbots have emerged as a promising solution to provide accessible, scalable, and affordable mental health assistance. These chatbots use Natural Language Processing (NLP), Machine Learning (ML), sentiment analysis, and conversational AI techniques to interact with users in a human-like manner and provide emotional support, counseling guidance, mood tracking, and crisis intervention. This research paper critically examines the role of AI chatbots in mental health assistance by analyzing their underlying technologies, operational architecture, therapeutic applications, advantages, limitations, and ethical implications. The paper further presents a conceptual framework for an intelligent mental health chatbot capable of personalized interaction, emotional recognition, and adaptive support mechanisms. The paper also proposes a conceptual framework for an intelligent mental health chatbot capable of personalized interaction and emotional analysis. The study highlights how AI can complement traditional therapy while emphasizing the importance of privacy, emotional intelligence, and responsible AI implementation in healthcare systems.***

Keywords: Artificial Intelligence, Mental Health, Chatbots, Natural Language Processing, Machine Learning, Emotional Support, Healthcare Technology.

I. INTRODUCTION

Mental health is increasingly recognized as a critical component of overall human health and social well-being. According to reports published by the World Health Organization (WHO), mental disorders contribute significantly to the global burden of disease, particularly among adolescents and young adults. Depression alone affects hundreds of millions of individuals worldwide and remains one of the leading causes of disability. The rapid growth of digital technologies has transformed healthcare delivery models by introducing intelligent systems capable of assisting healthcare professionals and patients alike. Among these technological innovations, AI-powered chatbots have emerged as a promising solution for improving mental healthcare accessibility and engagement. These conversational systems simulate human-like interactions using Natural Language Processing (NLP), Machine Learning (ML), sentiment analysis, and deep learning techniques. Unlike traditional healthcare systems that depend heavily on physical consultations and therapist availability, AI chatbots can provide immediate and continuous support to users through digital platforms. Their ability to offer anonymous interaction further encourages individuals to seek assistance without fear of social judgment or discrimination. Recent advancements in Generative AI and Large Language Models (LLMs) have significantly improved conversational quality, contextual understanding, and emotional adaptability in chatbot systems. Consequently, AI mental health assistants are increasingly being integrated into mobile healthcare applications, wellness platforms, and digital therapy environments. This paper aims to provide a comprehensive study of AI chatbots for mental health assistance by examining their technological foundations, practical applications, research developments, challenges, and future opportunities in digital healthcare ecosystems.

Mental health is an essential component of human well-being that affects emotional, psychological, and social functioning. According to global health reports, millions of individuals suffer from mental health disorders such as depression, anxiety, stress disorders, and loneliness. Despite the growing need for mental healthcare, access to professional therapists remains limited due to economic, geographical, and social barriers.

Technological advancements in Artificial Intelligence have introduced new approaches for improving healthcare services. AI-based chatbots are software systems designed to simulate human conversation using text or voice interactions. These systems can understand user queries, analyze emotions, and provide appropriate responses. In mental healthcare, chatbots are increasingly being used to offer emotional support, cognitive behavioral therapy (CBT)-based conversations, stress management guidance, and mental wellness recommendations.

The growing popularity of AI chatbots in healthcare can be attributed to their 24/7 availability, anonymity, cost-effectiveness, and ability to handle multiple users simultaneously. Applications such as Woebot, Wysa, Replika, and Youper have demonstrated the practical use of conversational AI in mental health support.

This paper focuses on analyzing AI chatbots for mental health assistance, their architecture, applications, challenges, and future research opportunities.

II. OBJECTIVES OF THE STUDY

The primary objectives of this research are:

1) To understand the role of AI chatbots in mental health assistance.
2) To analyze technologies used in mental health chatbots.
3) To examine benefits and limitations of AI-based counseling systems.
4) To propose a conceptual framework for an intelligent mental health chatbot.
5) To identify ethical and privacy concerns associated with AI mental healthcare.
6) To explore future directions for AI-powered mental health systems.

III. LITERATURE REVIEW

The development of conversational agents for psychological assistance has evolved considerably over the past several decades. Early research in conversational computing introduced systems such as ELIZA, developed by Joseph Weizenbaum in 1966, which simulated psychotherapeutic dialogue using simple pattern-matching techniques. Although technologically limited, ELIZA demonstrated the potential for human-computer interaction in therapeutic contexts.

Contemporary AI-based mental health systems employ advanced machine learning algorithms, Natural Language Processing techniques, and deep neural networks to facilitate more sophisticated interactions. Recent studies have emphasized the effectiveness of chatbot-assisted Cognitive Behavioral Therapy (CBT) in reducing symptoms of mild anxiety and depression.

Fitzpatrick et al. (2017) evaluated Woebot, an AI conversational agent designed to deliver CBT-based interventions. Their findings indicated that regular engagement with the chatbot contributed to measurable reductions in depressive symptoms among users. Similarly, Fulmer et al. (2018) examined the impact of psychological AI systems such as Tess and reported positive outcomes related to emotional support and stress reduction.

Research conducted by Miner et al. (2016) highlighted the growing role of conversational AI in responding to mental health-related queries. Their study emphasized the importance of chatbot reliability, emotional sensitivity, and ethical responsibility in healthcare communication.

Recent advancements in transformer-based language models and Generative AI have significantly improved contextual understanding and conversational fluency in chatbot systems. These developments have enabled AI systems to provide increasingly personalized interactions based on user behavior, emotional patterns, and conversational history.

Despite these advancements, existing literature identifies several critical challenges. Researchers continue to express concerns regarding emotional authenticity, algorithmic bias, privacy protection, and the inability of AI systems to replace professional psychological expertise in severe psychiatric conditions.

Overall, the literature suggests that AI chatbots possess substantial potential as supportive mental healthcare tools; however, their implementation must be accompanied by strong ethical frameworks, human supervision, and responsible AI governance.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com

Researchers and healthcare organizations have increasingly explored AI-driven mental health systems over the last decade. Early chatbot systems were rule-based and capable of responding only to predefined user inputs. Modern AI chatbots utilize NLP and deep learning techniques to generate context-aware responses.

One of the earliest conversational agents in psychology was ELIZA, developed in the 1960s, which simulated a psychotherapist using pattern matching techniques. Although limited in intelligence, ELIZA demonstrated the potential of computer-based therapeutic conversations.

Recent systems such as Woebot use cognitive behavioral therapy principles to help users manage stress and anxiety. Studies indicate that regular interaction with such systems can improve emotional awareness and reduce symptoms of mild depression.

Wysa, another AI mental health chatbot, combines AI-driven conversations with meditation, breathing exercises, and emotional tracking. Research findings suggest that users appreciate the anonymity and convenience offered by AI-based mental health tools.

Several studies have highlighted the role of NLP in understanding human emotions.

Sentiment analysis techniques help chatbots identify positive, negative, or neutral emotional states. Deep learning models such as Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM), and transformer-based models have significantly improved chatbot response quality.

However, existing research also identifies several limitations including emotional misunderstanding, lack of empathy, privacy concerns, and inability to handle severe psychiatric conditions. Therefore, AI chatbots are currently viewed as supportive tools rather than replacements for professional therapists.

IV. TECHNOLOGIES USED IN AI MENTAL HEALTH CHATBOTS

A. Artificial Intelligence

Artificial Intelligence enables chatbots to simulate intelligent human-like conversations. AI algorithms analyze user input, predict emotions, and generate appropriate responses.

B. Natural Language Processing (NLP)

NLP allows machines to understand human language. It includes:

- Tokenization
- Text classification
- Named Entity Recognition
- Sentiment Analysis
- Intent Recognition

NLP helps chatbots interpret user emotions and conversational context.

C. Machine Learning

Machine Learning algorithms improve chatbot performance through continuous learning from user interactions. ML enables personalized recommendations and adaptive conversations.

D. Deep Learning

Deep learning models such as LSTM and transformers help generate more natural and context-aware responses.

E. Sentiment Analysis

Sentiment analysis identifies emotional states such as happiness, sadness, anger, fear, or stress from user messages.

F. Speech Recognition

Voice-based mental health chatbots use speech recognition systems to understand spoken language and provide audio responses.

G. Cloud Computing

Cloud platforms enable scalable chatbot deployment and real-time data processing.

V. WORKING MECHANISM OF AI MENTAL HEALTH CHATBOTS

The working process of an AI mental health chatbot generally involves the following stages:

1) User Input Collection
2) Language Processing
3) Emotion Detection
4) Intent Recognition
5) Response Generation
6) Recommendation Delivery
7) Feedback Learning

When a user sends a message, the chatbot analyzes the text using NLP techniques. Sentiment analysis identifies emotional tone, while machine learning models determine user intent. Based on this analysis, the system generates supportive responses, therapeutic exercises, motivational suggestions, or emergency recommendations.

For example, if a user expresses anxiety, the chatbot may recommend breathing exercises, mindfulness activities, or positive affirmations.

VI. APPLICATIONS OF AI CHATBOTS IN MENTAL HEALTH

1) Emotional Support: AI chatbots provide immediate emotional support to users experiencing loneliness, stress, or anxiety.
2) Cognitive Behavioral Therapy (CBT): Many mental health chatbots incorporate CBT techniques to help users identify negative thought patterns.
3) Mood Tracking: Chatbots can monitor emotional patterns over time and help users recognize behavioral triggers.
4) Stress Management: AI systems guide users through meditation, relaxation, and breathing exercises.
5) Suicide Prevention Support: Some advanced chatbots detect high-risk emotional patterns and encourage users to contact emergency services or mental health professionals.
6) Mental Health Awareness: Chatbots educate users about mental wellness, coping strategies, and healthy habits.
7) Therapy Assistance: AI chatbots can assist therapists by collecting patient data and monitoring progress.

VII. PROPOSED SYSTEM ARCHITECTURE

The proposed AI mental health chatbot system consists of the following modules:

1) User Interface Layer: This layer allows users to communicate with the chatbot through mobile applications or web platforms.
2) NLP Processing Module: The NLP engine processes user text, removes unnecessary words, and identifies keywords and emotions.
3) Emotion Recognition Module: This module uses sentiment analysis and machine learning algorithms to detect emotional states.
4) Response Generation Module: The chatbot generates supportive and context-aware responses using deep learning models.
5) Recommendation Engine: This module provides personalized recommendations such as meditation exercises, motivational activities, and therapy suggestions.
6) Database Management System: The system stores user interaction history securely for personalized assistance.
7) Emergency Alert System: If severe emotional distress or suicidal tendencies are detected, the chatbot recommends contacting professionals or emergency services.

VIII. COMPARATIVE ANALYSIS

A. *Comparative Analysis of Popular AI Mental Health Chatbots*

Chatbot	Primary Technology Used	Key Features	Advantages	Limitations
Woebot	NLP + CBT-Based AI	Cognitive Behavioral Therapy conversations, mood tracking	Evidence-based therapeutic support, user-friendly interface	Limited emotional depth in complex conversations
Wysa	AI + Emotional Wellness Engine	Meditation, stress management, emotional support	Anonymous interaction, multilingual support	Requires internet access and user engagement
Replika	Generative AI + Deep Learning	Personalized conversational companionship	Human-like interactions and adaptive learning	Risk of emotional dependency
Youper	AI + Mental Health Analytics	Mood monitoring and anxiety management	Personalized emotional analysis	Limited support for severe mental illnesses
Tess	Psychological AI Framework	Emotional assistance and counseling support	Scalable mental health intervention	Requires supervision for critical conditions

B. Comparative Analysis of Traditional Therapy and AI Chatbots

Parameters	Traditional Therapy	AI Mental Health Chatbots
Availability	Limited to appointment schedules	Available 24/7
Cost	Expensive in many regions	Relatively low-cost
Accessibility	Limited in rural or remote areas	Accessible through smartphones and internet
Human Empathy	High emotional understanding	Simulated empathy only
Scalability	Limited by therapist availability	Can support thousands of users simultaneously
Privacy and Anonymity	May involve social stigma	Higher anonymity and user comfort
Crisis Handling	Effective in severe cases	Limited crisis intervention capability
Personalization	Highly personalized	Moderately personalized through AI learning

C. Comparative Analysis of AI Techniques Used in Mental Health Chatbots

AI Technique	Purpose in Mental Health Chatbots	Advantages	Challenges
Natural Language Processing (NLP)	Understanding user conversations	Enables human-like communication	Difficulty understanding sarcasm and ambiguity
Machine Learning	Learning from user interactions	Improves personalization	Requires large datasets
Deep Learning	Advanced contextual understanding	Better response generation	High computational cost
Sentiment Analysis	Emotion detection	Identifies emotional state quickly	Emotion misclassification possible
Speech Recognition	Voice-based communication	Enhances accessibility	Accent and noise sensitivity
Large Language Models (LLMs)	Context-aware conversation generation	More intelligent and adaptive responses	Ethical and privacy concerns

IX. ADVANTAGES OF AI CHATBOTS IN MENTAL HEALTHCARE

1) 24/7 Availability: AI chatbots provide continuous support without time limitations.
2) Cost-Effective Solution: Chatbots reduce healthcare costs by offering affordable mental wellness support.
3) Accessibility: People in remote areas can access mental health assistance through internet-enabled devices.
4) Anonymity and Privacy: Users often feel more comfortable discussing emotional problems anonymously.
5) Scalability: A single chatbot system can simultaneously support thousands of users.
6) Early Detection: Continuous monitoring enables early identification of mental health risks.

X. CHALLENGES AND LIMITATIONS

1) Lack of Human Empathy: AI systems cannot fully replicate human emotions and empathy.
2) Data Privacy Concerns: Sensitive mental health data may be vulnerable to breaches or misuse.
3) Misinterpretation of Emotions: Chatbots may incorrectly interpret emotional expressions or sarcasm.
4) Dependence on Technology: Excessive dependence on AI systems may reduce human interaction.
5) Ethical Issues: Questions related to accountability, transparency, and decision-making remain significant concerns.
6) Limited Crisis Handling: AI systems may not effectively manage severe psychiatric emergencies.

XI. ETHICAL CONSIDERATIONS

Ethics plays a crucial role in AI-based mental healthcare systems. Developers must ensure fairness, transparency, confidentiality, and user safety.

Important ethical considerations include:

1) Protection of sensitive user data

2) Informed user consent
3) Bias-free AI algorithms
4) Responsible use of emotional data
5) Human supervision in critical cases
6) Transparency regarding AI limitations

Healthcare organizations should establish ethical frameworks and regulatory guidelines for AI mental health applications.

XII. FUTURE SCOPE

AI chatbots for mental health assistance have significant future potential. Emerging technologies may improve emotional intelligence and personalization.

Future developments may include:

1) Integration with wearable devices for real-time stress monitoring.
2) Multilingual conversational systems.
3) AI systems capable of detecting emotional changes through voice and facial expressions.
4) Integration with virtual reality therapy environments.
5) More personalized therapeutic recommendations.
6) Advanced crisis detection mechanisms.
7) Emotionally adaptive conversational AI.
8) AI-human collaborative mental healthcare systems.

With advancements in Generative AI and Large Language Models (LLMs), future chatbots may become more context-aware and emotionally responsive.

XIII. CONCLUSION

Artificial Intelligence-driven chatbots represent a transformative advancement in the field of digital mental healthcare. By integrating technologies such as Natural Language Processing, machine learning, sentiment analysis, and deep learning, these systems provide scalable and accessible emotional support services capable of addressing growing global mental health demands.

The study demonstrates that AI chatbots can effectively support mental wellness through mood tracking, stress management, therapeutic conversations, and personalized recommendations. Their continuous availability, affordability, and anonymity make them particularly beneficial for individuals who face barriers in accessing traditional psychological services.

However, despite significant technological progress, AI chatbots continue to face important limitations. Challenges associated with emotional intelligence, empathy simulation, data privacy, ethical accountability, and crisis management remain critical concerns in real-world healthcare implementation. Consequently, AI-based mental health systems should not be viewed as replacements for qualified mental health professionals but rather as complementary tools designed to enhance healthcare accessibility and early intervention. Future research should focus on improving contextual understanding, emotional adaptability, multilingual interaction capabilities, and responsible AI governance frameworks. Integrating multimodal technologies such as speech analysis, facial emotion recognition, wearable sensors, and virtual reality environments may further improve the effectiveness of digital mental healthcare systems.

In conclusion, AI chatbots possess immense potential to revolutionize mental healthcare delivery by bridging gaps between patients and mental health resources. With ethical implementation, technological refinement, and collaborative integration with healthcare professionals, conversational AI systems may become an essential component of future intelligent healthcare ecosystems.

AI chatbots are transforming the field of mental healthcare by providing accessible, affordable, and scalable emotional support systems. Through technologies such as NLP, machine learning, and sentiment analysis, these systems can assist users in managing stress, anxiety, and emotional challenges.

Although AI chatbots offer several benefits including continuous availability and personalized interaction, they still face limitations related to empathy, privacy, ethical concerns, and crisis management. Therefore, AI chatbots should be viewed as supportive tools that complement professional mental healthcare rather than replace therapists.

Future research should focus on improving emotional intelligence, ensuring ethical AI implementation, strengthening data security, and integrating multimodal technologies for enhanced mental health support.

The growing adoption of AI in healthcare indicates that intelligent chatbot systems will play an increasingly important role in promoting global mental wellness and early mental health intervention.

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SUGGESTED RESEARCH METHODOLOGY FOR IMPLEMENTATION (OPTIONAL SECTION)

If this research paper is extended into a practical project, the following methodology can be used:

Step 1: Data Collection

Collect conversational mental health datasets from publicly available sources.

Step 2: Data Preprocessing

Clean text data by removing stop words, punctuation, and unnecessary symbols.

Step 3: Model Training

Train NLP and sentiment analysis models using machine learning algorithms.

Step 4: Chatbot Development

Develop the chatbot interface using Python, TensorFlow, or conversational AI frameworks.

Step 5: Testing and Evaluation

Evaluate chatbot performance using:

- Accuracy
- User satisfaction
- Response relevance
- Emotional recognition accuracy

Step 6: Deployment

Deploy the chatbot on web or mobile platforms.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com

RESULT EXPECTATIONS

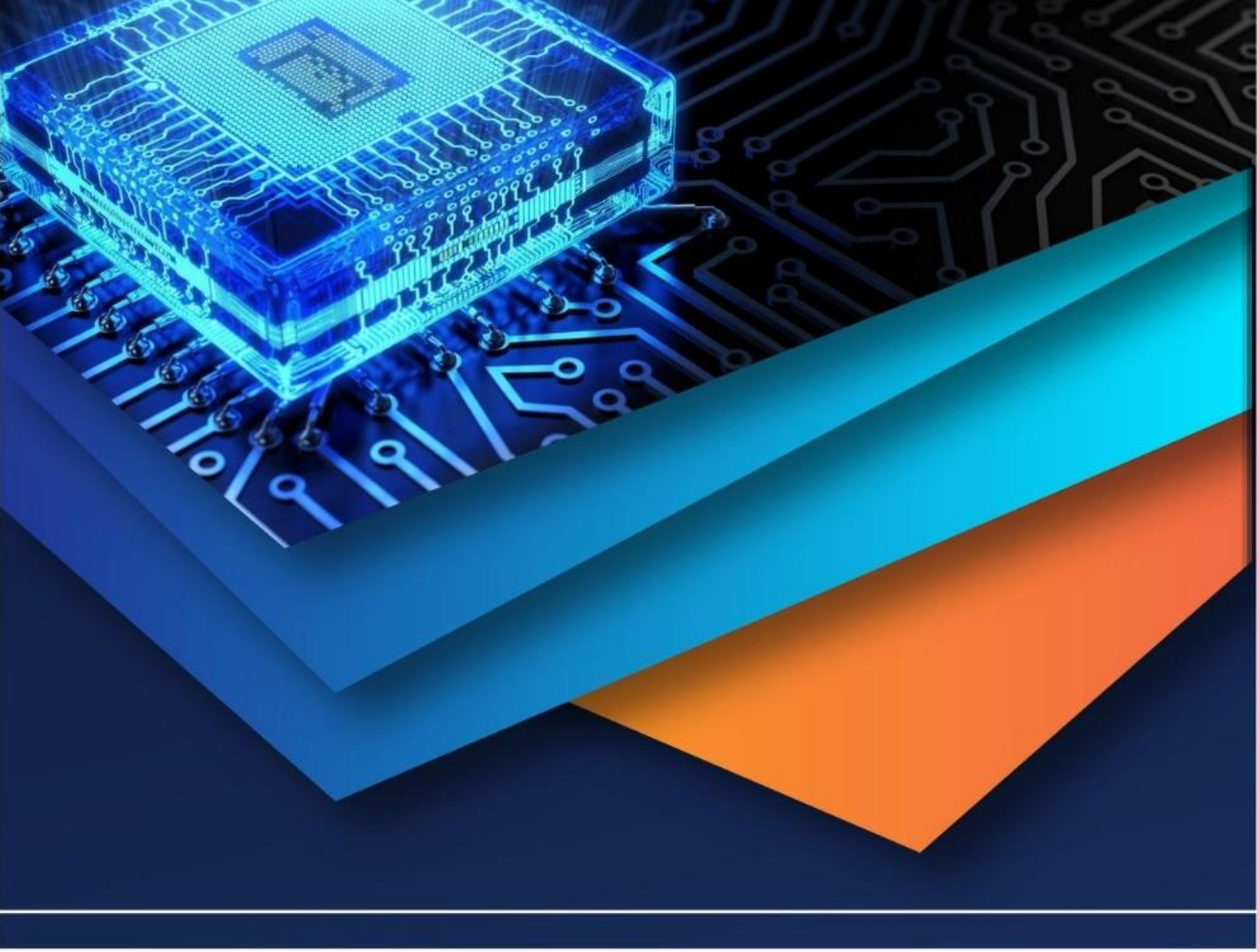
The expected outcomes of the proposed system include:

- Improved emotional support accessibility.
- Faster response time for mental health assistance.
- Reduced mental healthcare costs.
- Better user engagement through personalized conversations.
- Enhanced awareness regarding emotional well-being.

FINAL REMARKS

Artificial Intelligence has the potential to reshape the future of mental healthcare. AI chatbots can bridge the gap between increasing mental health demands and limited healthcare resources. However, balancing technological innovation with ethical responsibility is essential for creating trustworthy and effective mental health systems.

The future of AI mental health assistance lies in collaborative intelligence where AI systems and healthcare professionals work together to provide safer, smarter, and more compassionate mental healthcare solutions.



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