Science Journal of University of Zakho
DOI: https://doi.org/10.25271/sjuoz

Original Article

A HYBRID HUMAN-AI WEB SYSTEM FOR REAL-TIME MENTAL HEALTH COUNSELLING AND CHRONIC DISEASE MANAGEMENT

Maaruf Mohammed Lawal [1], **and Abdulrashid Abdulrauf** [2,*]

[1] Department of Computer Science, Ahmadu Bello University Zaria, Kaduna State, Nigeria.
[2] Department of Computer Science, Federal Polytechnic Kaltungo, Gombe State, Nigeria.

**Corresponding author, E-mail:* abdulrashid.abdulrauf2022@nda.edu.ng (Tel +234-7061161090).

Received: 03, Aug, 2025

Accepted: 03, Dec, 2025

Published: 09, Apr, 2026

ABSTRACT

This research examines the creation and implementation of an online communication and engagement platform for patients with chronic diseases and their counsellors, designed to enhance mental health support through real-time counselling and intelligent virtual assistance. The paper tackles the shortcomings of current systems, which frequently do not offer true offline functionality but instead require continuous connectivity. Our system is optimized for low-bandwidth environments, integration of AI with human interaction, and accessibility for those with limited digital access. The objective was to develop an interactive, secure, and scalable platform that merges rule-based virtual assistance with live l interaction to provide ongoing, context-sensitive care. The platform was created using Flowise, Firebase, Grop API, and SerpAPI, facilitating secure user enrolment, scheduling of appointments, group support, and immediate communication. Validation in a simulated setting confirmed its effectiveness, showing advancements in data precision, responsiveness, and information dissemination. Security was maintained through HTTPS encryption, encrypted data storage, role-based access controls, and protocols for patient consent and data anonymization. The findings indicated that integrating a Flowise-based assistance with human counsellors enhanced system flexibility, accuracy, and patient engagement. In summary, this study offers a powerful solution for addressing gaps in digital mental health provision, especially for underprivileged communities.

KEYWORDS: Artificial Intelligence, Chronic Disease, E-counselling, Flowise, Web-based.

1. INTRODUCTION

According to the World Health Organization (WHO), noncommunicable diseases (NCDs) were responsible for at least 43 million deaths in 2021, accounting for about 75% of all non-pandemic-related deaths worldwide. NCDs, which include heart disease, stroke, cancer, diabetes, and chronic respiratory diseases, collectively cause 74% of global deaths. Over three-quarters of these deaths, including 86% of the 17 million premature deaths (before the age of 70), occur in low- and middle-income countries (WHO, 2025). Telehealth technologies offer a promising approach for addressing ongoing health challenges. For example, e-counseling enables remote patient support and has been shown to enhance both engagement and health outcomes (Sharma *et al.,* 2022).

E-counseling platforms utilize web-based technologies and artificial intelligence (AI) to provide customized support, addressing the physical and psychological dimensions of chronic illness (Paalimäki-Paakki *et al.,* 2022). Virtual assistants (VAs) particularly improve access to care by providing real-time guidance and advice, especially for patients facing challenges accessing traditional healthcare services (Sqalli & Al-Thani, 2020). These systems are becoming increasingly crucial for chronic disease management, as they promote self-management and encourage behavior change through evidence-based methods such as cognitive-behavioral therapy (CBT) (Tao *et al.,* 2023). Studies indicate that VAs have a significant positive impact on patient outcomes. For instance, Roca *et al*. (2021) found that a VA enhanced medication adherence (MPR increased from 0.79 to 0.93), lowered HbA1c levels, and improved depression scores in patients with type 2 diabetes and concurrent depression. Nonetheless, many VAs require continuous internet access and may not perform well in areas with low bandwidth, particularly in rural regions where connectivity is often limited (Yu *et al.,* 2023). Issues related to privacy and the challenges of rule-based systems in addressing complex inquiries also remain (Saeidnia *et al.,* 2024; Curtis *et al.,* 2021).

Building on these advancements and challenges, this research develops an e-counseling system specifically designed for chronic disease management, incorporating a Flowise-based virtual assistant to provide immediate support when human counsellors are unavailable due to time or connectivity issues. The system, built with HTML, CSS, JavaScript, and Firebase, is optimized for low-bandwidth settings and ensures secure data management, categorizing patients by condition and linking them to specialized counsellors. This method aims to improve accessibility, personalization, and adherence to treatment protocols, thereby enhancing long-term health outcomes for individuals with chronic conditions.

2. REVIEW OF RELATED WORKS:

Roca *et al.* (2021) performed a nine-month pilot study assessing a virtual assistant designed for individuals with both type 2 diabetes and depression. This assistant, incorporated with Signal for secure communication, delivered reminders, scheduled appointments, and offered educational materials. Results showed improved medication adherence (MPR increased from 0.79 to 0.93), reduced HbA1c (from 7.6% to 7.3%), and lower depression scores (PHQ-9 from 13.2 to 8.6). Despite its effectiveness, limitations included a small sample size and dependence on continuous internet access, which constrained scalability. This study addresses this issue by optimizing for low-bandwidth environments.

Maisto *et al.* (2021) presented a systematic review of digital interventions for psychological comorbidities in chronic illness. The review revealed that platforms incorporating CBT techniques significantly reduced depression and anxiety, particularly those offering two-way communication. However, many lacked real-time interaction a gap the proposed system addresses by integrating a Flowise-based virtual assistant capable of immediate support when counsellors are unavailable.

Curtis *et al.* (2021) reviewed 45 virtual health assistant implementations, highlighting that empathetic behavior, conversational tone, and relatable avatars improved user satisfaction in 71% of studies. While most assistants employed complex AI, only 30% used rule-based systems. The proposed system aligns with findings that favor simplicity and usability, offering a rule-based assistant that remains reliable and user-friendly for patients with varying levels of digital literacy.

Zhang *et al.* (2023) conducted a comparison between rule-based virtual assistants and those that utilize large language models (LLMs) like GPT-4. While LLMs delivered 100% clinical accuracy in complex queries, rule-based assistants were favored by 60% of users for their simplicity and lower technical barriers. This supports the design choice of using a rule-based Flowise assistant in the proposed system, especially in contexts prioritizing ease of use over complexity.

Yu *et al.* (2023) examined chronic disease management, noting that self-management improves quality of life and reduces costs, while the COVID-19 pandemic accelerated the shift toward telehealth. They compared traditional approaches with telehealth strategies, highlighting both the benefits and challenges of each.

Bitar and Alismail (2021) examined the impact of e-counseling in addressing challenges like geographic isolation, social stigma, and mobility issues that chronic disease patients often encounter. They underscored the significance of virtual healthcare for mental well-being, especially among underserved groups. The current system reflects this understanding by integrating both medical and psychological assistance within its e-counseling model.

Tao *et al.* (2023) investigated the application of cognitive behavioral therapy (CBT) in online environments and discovered considerable decreases in anxiety and depressive symptoms among patients with chronic illnesses. The integration of CBT-informed support into the counseling strategy of the proposed system aims to mirror and enhance these therapeutic advantages via digital platforms.

Rehman and Sajjad (2025) explored the integration of AI in mental health counseling through the perspectives of both counselors and students. Using qualitative interviews with 20 counselors and 20 students, their study applied Braun and Clarke's (2006) thematic analysis framework and identified eight key themes, including user satisfaction, perceived effectiveness, stigma and acceptance, confidentiality, personalization, emotional concerns, cultural and religious sensitivity, and recommendations. The findings revealed that while AI-powered counseling tools provide accessible, flexible, and cost-effective support, they face limitations in empathy, emotional connection, and managing high-risk cases. Furthermore, their effectiveness was found to vary across cultural contexts, with notable gaps in religious sensitivity

Zhu *et al.* (2024) addressed the growing demand for psychological counseling among college students by developing an AI-based counseling assistance platform. Their study integrated AI and network technologies to improve accessibility, timeliness, and personalization of counseling services. The platform incorporated several core components, including a psychological counseling dialogue model, ontology graph construction, user intention understanding, and an intelligent conversation engine. To achieve this, the authors employed key technologies, including a counseling dialogue structure model, a BERT-based ontology extraction algorithm, a joint extraction strategy for identifying entities and relationships in psychology, and a hybrid network model for intent recognition.

Hybrid human-AI counseling platforms are not entirely new, as similar systems have been deployed in both academic and commercial contexts. However, to the best of our knowledge, only a limited number of studies have specifically focused on hybrid AI counseling systems that combine artificial intelligence with continuous human oversight; most existing work is empirical or exploratory rather than implemented prototypes. However, the novelty of our proposed system lies in its combined focus on technical integration, low-resource adaptability, and cultural contextualization. Specifically, the system is optimized for use in developing regions where bandwidth is often limited, employing a lightweight frontend, text-only interaction, and Firestore's real-time synchronization to ensure functionality under low-connectivity conditions. In addition, the integration of Flowise, a visual, no-code LLM orchestration tool, with Firebase authentication and Firestore databases provides a deployable, adaptable prototype that distinguishes it from prior frameworks. Furthermore, drawing on the work of Tao *et al.* (2023) and Rehman and Sajjad (2025), the system embeds CBT-informed support structures alongside cultural and religious sensitivity, addressing adoption barriers related to stigma and trust in mental health care. To contextualize these contributions, Table 1 presents a structured comparison of selected AI-assisted counseling systems.

Table 1: Comparison with existing studies

Study	Target Population	Core Features	Strengths	Limitations	Distinction vs. Proposed System
Tao *et al.* (2023).	Patients with chronic illnesses	Online CBT, digital self-management	Reduced anxiety & depression	Limited interactivity; no hybrid integration	Our system embeds a CBT-informed design but adds a human–AI hybrid structure
Zhu *et al.* (2024).	College students	AI dialogue model, ontology graph, BERT-based extraction, hybrid intent recognition	High personalization, scalable	Limited to academic settings, assumes stable internet	Our system adapts to low-bandwidth and chronic disease management

Rehman & Sajjad (2025)	Students & counsellors	Qualitative thematic study on AI in counseling	Identified cultural/religious sensitivity gaps	No technical system; qualitative only	Our system operationalizes their findings with cultural adaptation
Proposed System (2025)	Patients with chronic illnesses (low-resource settings)	Flowise–Firebase integration, low-bandwidth optimization, CBT-informed support, cultural sensitivity, hybrid human–AI workflow	Deployable in bandwidth-limited regions; blends AI efficiency with human empathy	Early-stage prototype, evaluation still in progress	Novel contribution: technical integration + cultural sensitivity + low-bandwidth optimization

3. PROPOSED SYSTEM

Analysis of the Current System:

The current system refers to a system described in prior literature (Roca *et al.,* 2021) that implemented a signal-driven virtual assistant designed to improve medication adherence among individuals with type 2 diabetes and depression. It employs a microservice architecture that adheres to the HL7 FHIR standard for secure handling of health data. Interaction is conducted via structured numeric responses, providing medication reminders up to three times per dose at 10-minute intervals, along with weekly adherence summaries and educational YouTube content. Nurses configure the system and assist patients during clinic visits, while the app integrates both medication and appointment management. Though effective in reducing HbA1c levels and improving adherence, the system faces limitations in user accessibility and scalability.

Identified Problems in the Current System:

Despite promising outcomes, the current system demonstrates critical limitations. The sample size in trials was small, and the system's reliance on internet connectivity and app availability affected consistent usage. Patients with low digital literacy found it challenging to navigate the numeric menu structure. Additionally, lapses such as failure to update medication cycles or uninstalling the app led to termination of reminder services, thereby compromising adherence tracking.

Analysis of the Proposed System:

To address the study gaps, the proposed system introduces a web-based e-counselling and virtual assistant platform designed as a hybrid human–AI framework to improve overall decision-making accuracy. It uses Flowise, a low-code/no-code platform, to deploy AI-powered virtual assistants integrated with Firebase for secure, real-time data handling. Unlike the previous system, it combines automated chatbot support with human counsellors to deliver personalized, scalable, and empathetic care. Key features include;

1. Disease-Specific Peer Support Groups: This is facilitated by trained counsellors, these groups provide tailored emotional and informational support.
2. Real-Time Interaction Tools: They includes group chat, voice calls, and private counseling sessions for accessible, continuous support.
3. Hybrid Virtual Assistant: A Flowise-based rule-driven AI assistant handles common inquiries and escalates complex cases to human counsellors.
4. Secure Cloud Services: Firebase provides backend services, including real-time synchronization, data storage, and user authentication.

System Development Methodology:

The Waterfall Software Development Life Cycle (SDLC) model was selected due to its structured, linear approach, suitable for projects with clearly defined requirements and objectives. The model facilitates a disciplined process with sequential stages, each building upon the previous one, as shown in Figure (1). The following phases were followed:

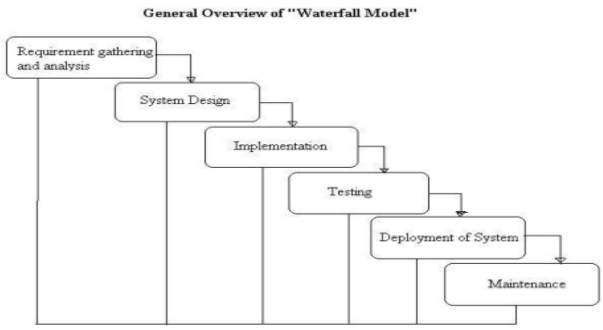

Figure 1: Proposed System Model.

1. Requirement Analysis: Gathering functional and non-functional requirements from patients and counsellors.
2. System Design: Translating requirements into architectural blueprints and visual UML models.
3. Implementation: Developing the user interface and backend services using HTML, CSS, JavaScript, Firebase, and Flowise.
4. Testing: Conducting unit, integration, and system testing to validate performance and adherence accuracy.
5. Deployment: Hosting the web-based system on a secure server.
6. Maintenance: Providing system updates and improvements based on user feedback and emerging needs.

Technology and Language Selection:

The following technologies were employed for system implementation:

- Frontend: HTML, CSS, and JavaScript for creating a responsive user interface.
- Backend: Firebase for secure authentication, real-time database interaction, and cloud storage.
- AI Integration: Flowise, an open-source low-code platform, was adopted to rapidly build and deploy AI-powered conversational agents using rule-based workflows and API integrations such as Groq API and SerpAPI.

3.6 Input and Output Design

The system's interaction flow and data structure are visualized using several UML and system diagrams, which clarify both user and system behaviors.

Use Case Diagram (Unified Modeling Language use case diagram of the system): It illustrates primary actors (patients, counsellors, and administrators) and their interactions with system functions such as registration, login, appointment scheduling, real-time chat, and AI-assisted queries. This highlights user roles and responsibilities within the system.

DOI: https://doi.org/10.25271/sjuoz.2026.14.2.1753

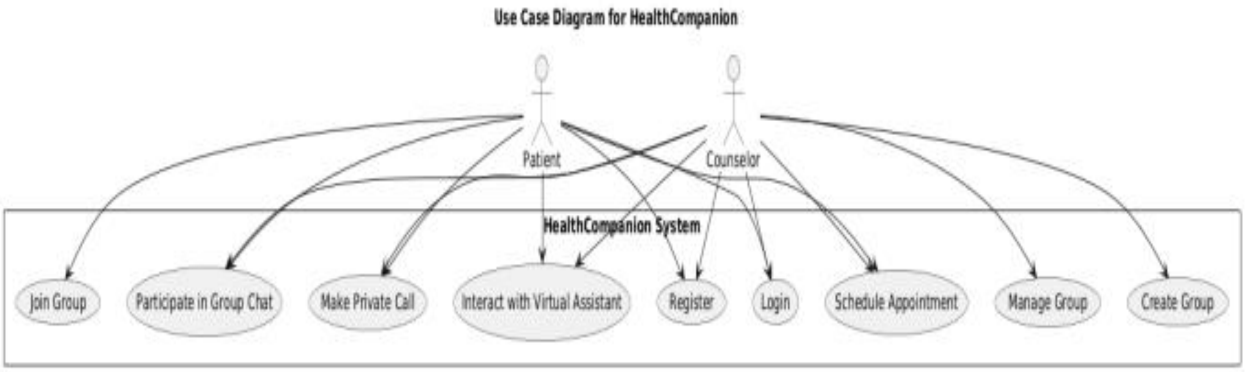

Figure 2: System Use Case Diagram.

Class Diagram (UML class diagram of the backend implementation): Key classes include User (with subclasses Patient, Counsellor, Admin), ChatSession, Appointment, and Message. Attributes and methods are defined for each class, showing object-oriented structure and relationships in the system.

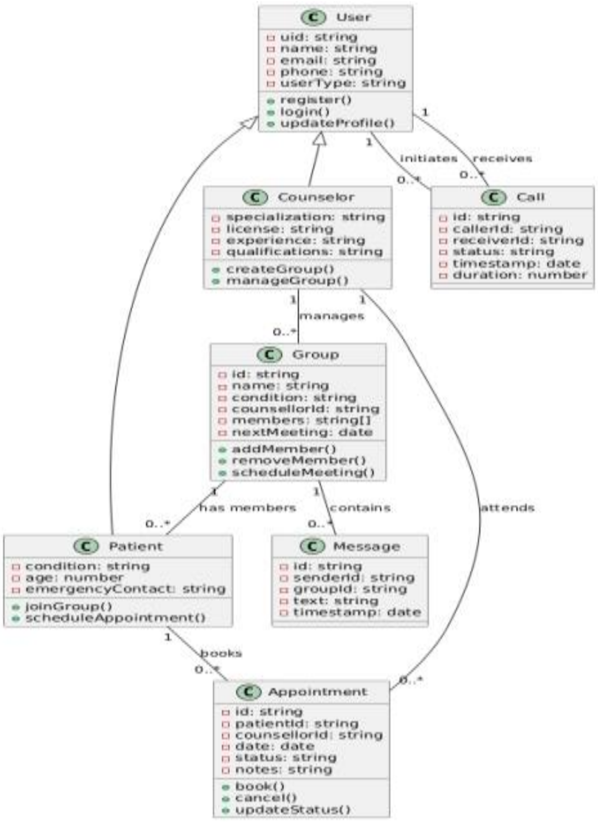

Figure 3: Class Diagram.

Sequence Diagram: UML sequence diagram shows the step-by-step communication process between patient, Flowise assistant, counsellor, and Firestore database. It demonstrates message flow for login, initiating a counselling session, AI chatbot handling simple queries, and escalation to a human counsellor when required.

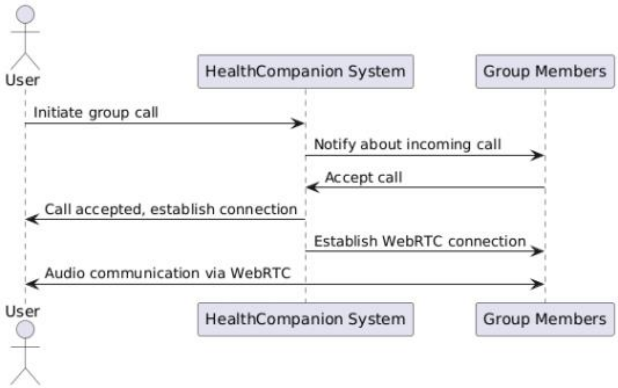

Figure 4: System Sequence Diagram.

Activity Diagram (UML activity diagram representing patient workflow): It begins with system login, flows through decision nodes for AI chatbot response vs. counsellor intervention, and ends with either resolution of the query or scheduling of a follow-up session. Swimlanes indicate roles of patient, AI assistant, and counsellor.

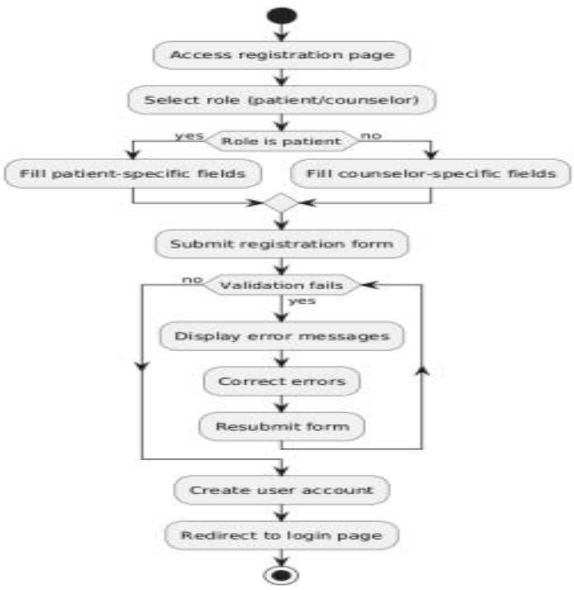

Figure 5: Activity Diagram.

System Architecture Diagram: This offers a technical overview of frontend, backend, database, and AI model interactions.

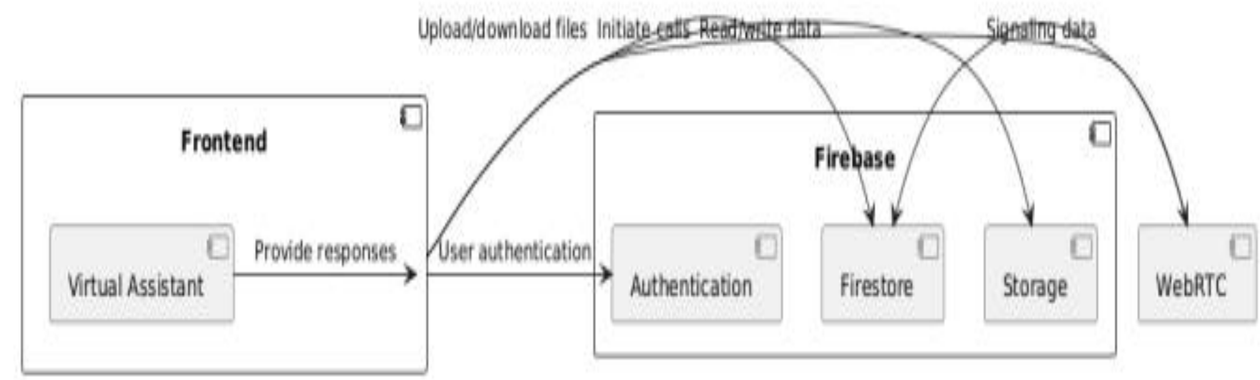

Figure 6: System Architecture Diagram.

Implementation, Results and Discussion:

Implementation:

The implementation phase focused on developing a web-based e-counselling platform named HealthCompanion, aimed at enhancing medication adherence and patient engagement for chronic disease management. The system integrates a Flowise-based virtual assistant using LLMs, human counsellor interaction, and a Firebase backend to enable secure, intelligent, and accessible care.

Flowise Implementation:

Figure 7 shows the Flowise application launched locally using npx flowise start, which opens the dashboard on localhost:3000. From the dashboard, users navigate to the Credentials page to configure API keys for the project. This system integrates Grop API to enable LLM-powered, context-aware responses for counselling and reminders, and SerpAPI to retrieve real-time information from Google Search, such as health news and medication updates enhancing the assistant's intelligence and responsiveness.

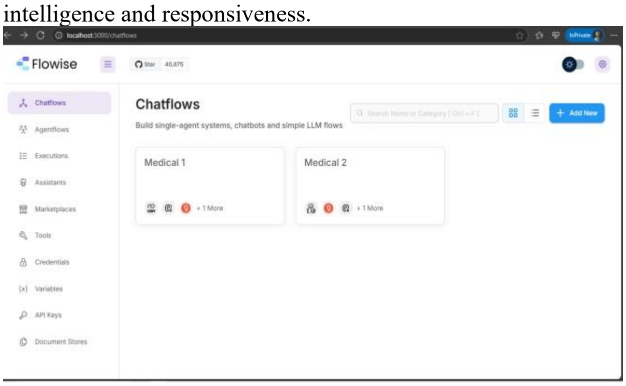

Figure 7: Flowise Dashboard.

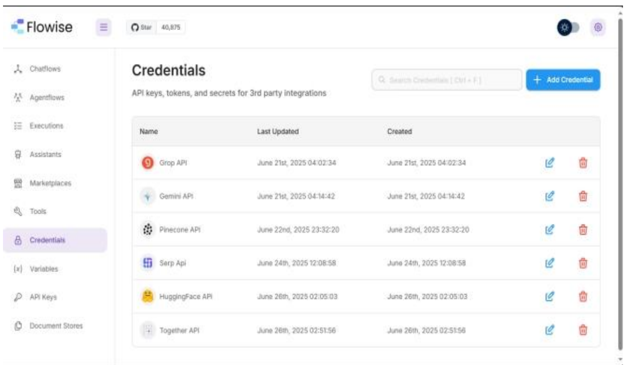

Figure 8: Credentials Page.

As shown in Figure 8, After the credentials have been collected and generate, navigates to the chatflow to build and deploy the assistant.

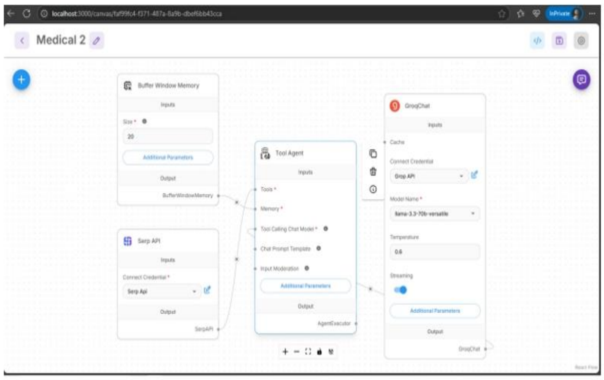

Figure 9: Virtual Assistant workflow.

For the workflow, Langchain is used, and the chat model is GropChat for the user interactions. Tools used were the Serp API whose function is to search for real time data and retrieve them. The memory is buffer window memory which acts as the memory for the workflow and stores and retrieve information recently ask or answered on the virtual assistant.

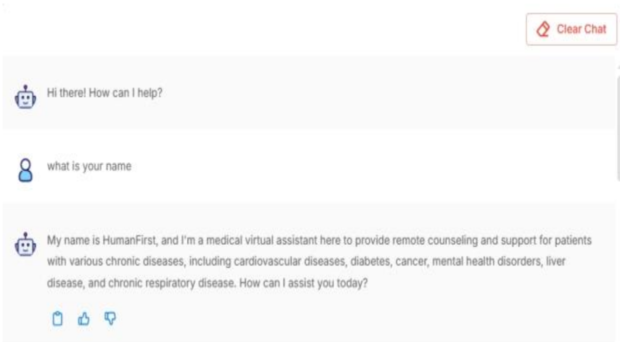

Figure 10: Virtual assistant implementation.

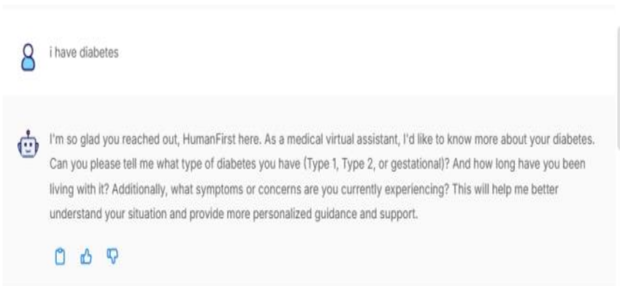

Figure 11: Virtual assistant implementation.

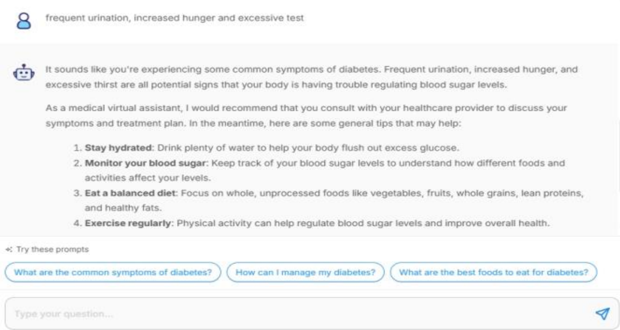

Figure 12: Virtual assistant implementation

Figures 10, 11 and 12 show how the virtual assistant functions properly. It is role based, giving detailed information and explanation, as well as follow up prompts for better user interaction with feedback.

User Interface Implementation:

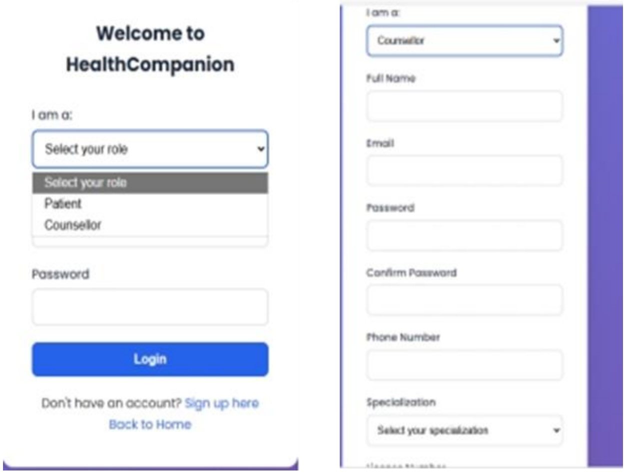

Figure 13: Login and Signup screens.

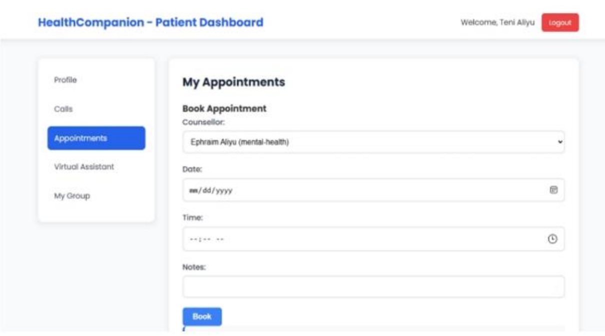

Figure 14: Users Dashboard.

Figure 14 shows the HealthCompanion patient dashboard interface. The dashboard provides the patient with several core functionalities: View Profile, Calls, Appointments, Virtual Assistant, and My Group. The highlighted section in the figure displays the Appointments tab, where a patient can conveniently book a session with a listed counsellor (in this case, *Ephraim Aliyu* for mental health support).

The booking form includes input fields for the appointment date, time, and optional notes, making it user-friendly and interactive. The backend integration with Firebase ensures that counsellor data is dynamically fetched and that scheduled appointments are stored in real time. Also, counsellors have administrative privileges to create and manage medical support groups, coordinate discussions, and monitor the health journey of assigned patients.

4. DISCUSSION

The system was deployed and tested in a simulated online counselling environment with 20 participants (10 patients, 5 counsellors, 5 observers), aligning closely with the study's objectives of enhancing offline usability, integrating human-AI interaction, and improving accessibility for digitally marginalized users. Quantitative evaluation included chatbot response accuracy (89%), average system response time (2.1 seconds), and usability scores based on SUS (System Usability Scale) averaging 78.5/100, indicating above-average usability. Task success rate for appointment scheduling was 95%. These metrics demonstrate measurable improvements compared to baseline rule-only assistants reported in literature (Curtis *et al.,* 2021). User registration captured patient and counsellor data in Firestore with timestamps and unique identifiers. Appointment scheduling triggered confirmation messages and backend record creation, while the real-time call system facilitated counsellor-patient interaction, with Firebase tracking call events. The group interaction module enabled disease-specific support groups coordinated by counsellors, incorporating live chat and scheduled calls. The virtual assistant, combining rule-based logic with AI capabilities, served as a first-response tool by answering health-related queries and providing follow-up prompts, particularly when human support was unavailable.

Security was enforced through HTTPS-encrypted connections, Firebase's Firestore secure data storage, role-based access control, and additional measures, including anonymization of sensitive records and mandatory informed consent during registration. Compared to the base system, which was limited in scope, this implementation is broader, more interactive, and highly adaptable. The integration of SerpAPI enabled dynamic, real-time information retrieval, significantly enhancing the assistant's accuracy and relevance. This directly supports the study's aim of improving accuracy through ensemble learning and context-aware support mechanisms, ensuring continuous care and timely information delivery.

CONCLUSION

The development and deployment of the online counselling system successfully addressed the core objectives of the study, particularly in enhancing low-bandwidth usability, integrating human-AI collaboration, and ensuring accessibility for digitally marginalized users. Beyond technical contributions, the study emphasized ethical safeguards, including privacy compliance, informed consent, and responsible AI deployment in healthcare contexts. Through the seamless integration of automated virtual assistance and real-time counsellor engagement, the platform provided a holistic, responsive mental health support solution. Key functionalities, including secure user registration, appointment scheduling, real-time communication, and group-based support, were effectively implemented and tested in a simulated environment. The inclusion of a rule-based virtual assistant equipped with Grop API and SerpAPI integration significantly improved the system's responsiveness and accuracy. These APIs enabled context-aware responses and real-time information retrieval, reinforcing the platform's ability to deliver intelligent, relevant support. Moreover, robust security measures, including HTTPS encryption, encrypted data storage on Firebase, and role-based access controls, ensured data privacy and integrity. Compared to earlier models, this implementation is more dynamic, adaptable, and user-centric.

Acknowledgments:

The authors would like to express their sincere appreciation to all participants who took part in the testing and evaluation of the system.

Ethical Approval:

The study did not require ethical approval, as it did not involve human participants or animal subjects.

Author Contributions:

M.M.L: Contributed to the study conception, design, data collection, and drafted the initial manuscript. A.A.: Contributed to the provided critical revision of the manuscript for important intellectual content; supervised the overall project and handled funding.

Conflict of interest:

The authors declare no conflict of interest.

Funding:

This research received no external funding.

REFERENCES

Bitar, H., & Alismail, S. (2021). The role of eHealth, telehealth, and telemedicine for chronic disease patients during COVID-19 pandemic: A rapid systematic review. *Digital Health*, 7, 20552076211009396. https://journals.sagepub.com/doi/10.1177/20552076211009396

Curtis, S., Smith, A., & Johnson, B. (2021). Improving user experience of virtual health assistants: Scoping review. *Journal of Medical Internet Research*, 23(12), Article e31737. https://doi.org/10.2196/31737

Maisto, M., Diana, B., Di Tella, S., Matamala-Gomez, M., Montana, J. I., Rossetto, F., ... & Realdon, O. (2021). Digital interventions for psychological comorbidities in chronic diseases a systematic review. *Journal of Personalized Medicine*, 11(1), Article 30. https://doi.org/10.3390/jpm11010030

Paalimäki-Paakki, K., Virtanen, M., Henner, A., Nieminen, M. T., & Kääriäinen, M. (2022). Effectiveness of digital counseling environments on anxiety, depression, and adherence to treatment among patients who are chronically ill: Systematic review. *Journal of Medical Internet Research*, 24(1), Article e30077. https://doi.org/10.2196/30077

Rehman, F., & Sajjad, S. (2025). Bridging Technology and Therapy: Exploring AI in Mental Health Services through Counselors' and Students' Perspectives. *Online Media and Society*, *6*(1), 31-44.

Roca, S., Lozano, M. L., Garcia, J., & Alesanco, Á. (2021). Validation of a virtual assistant for improving medication adherence in patients with comorbid type 2 diabetes mellitus and depressive disorder. International Journal of Environmental Research and Public Health, 18(22), Article 12056. https://doi.org/10.3390/ijerph182212056

Saeidnia, H. R., Hashemi Fotami, S. G., & Lund, B. (2024). Ethical considerations in artificial intelligence interventions for mental health and well-being: Ensuring responsible implementation and impact. *Social Sciences*, 13(7), Article 381. https://doi.org/10.3390/socsci13070381

Sharma, A., Pruthi, M. & Sageena, G. (2022). Adoption of telehealth technologies: an approach to improving healthcare system. *Translational medicine communications* *7*(1), 20. https://doi.org/10.1186/s41231-022-00125-5

Sqalli, M. T., & Al-Thani, D. (2020). On how chronic conditions affect the patient-AI interaction: A literature review. *Healthcare*, 8(3), Article 313. https://doi.org/10.3390/healthcare8030313

Tao, T. J., Lim, T. K., Yeung, E. T. F., Liu, H., Shris, P. B., Ma, L. K. Y., ... & Hou, W. K. (2023). Internet-based and mobile-based cognitive behavioral therapy for chronic diseases: A systematic review and meta-analysis. *NPJ Digital Medicine*, 6(1), Article 59. https://doi.org/10.1038/s41746-023-00809-8

World Health Organization. (2025). *Noncommunicable diseases*. https://www.who.int/health-topics/noncommunicable-diseases#tab=tab_1

World Health Organization. (2025, September 25). *Noncommunicable diseases*. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

Yu, S., Wan, R., Bai, L., Zhao, B., Jiang, Q., Jiang, J., & Li, Y. (2023). Transformation of chronic disease management post-COVID. *Frontiers in Public Health*, 11, 1074364. https://doi.org/10.3389/fpubh.2023.1074364

Zhang, Z., Wang, J., & Liu, L. (2023). Redefining virtual assistants in health care: A systematic review. *Journal of Medical Internet Research*, 25, Article e53225. https://doi.org/10.2196/53225

Zhu, G., Zhou, Y., & Wei, H. (2024, March). Development of an Artificial Intelligence based Counseling Assistance Platform for College Students. In *2024 13th International Conference on Educational and Information Technology (ICEIT)* (pp. 45-50). IEEE.