MyOldFriend

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1 Abstract

We present a novel voice-based companion system designed to reduce loneliness among older adults by leveraging familiar telephone technology. Our system integrates OpenAI's real-time speech interaction API, Twilio's telephony services for proactive outreach, and a custom conversational memory layer for personalized, context-aware interactions. Preliminary evaluations (n=16) show promising results, with 81% of participants reporting high satisfaction with the telephone-based interface.

While pilot studies with younger adults and older adults in China demonstrate technical feasibility, they highlight the importance of validating our approach with the intended demographic: American, college-educated older adults. We investigate how the interaction medium (telephone), proactive outbound calling features, and conversational memory integration influence user engagement and satisfaction.

Our findings indicate that telephone-based AI companionship can significantly enhance user engagement compared to conventional digital interfaces, affirming a medium-centric approach to accessible AI interventions. By providing empirical evidence for the effectiveness of familiar technology in mitigating social isolation, this research advances the field toward scalable, user-centered solutions for supporting aging populations.

1.1 CCS Concepts

Human-centered computing → Accessibility technologies Social and professional topics → Seniors Computing methodologies → Natural language processing

1.2 Keywords

Elderly care, voice interfaces, AI companionship, accessibility, proactive engagement

2 Introduction

The global population is aging at an unprecedented rate, with projections indicating that by 2050, one in six people worldwide will be over the age of 65.[1] This demographic shift presents critical challenges, particularly in mitigating social isolation and loneliness—conditions that affect approximately 24% of adults aged 65 and older.[2] Although technological innovations hold promise as interventions, they often fail to reach those who need them most due to what can be described as an "adoption paradox." In other words, older adults who stand to benefit from digital solutions frequently encounter substantial barriers to using them.

Current companionship-oriented technologies, including smartphone applications, web platforms, and voice assistants, generally assume a level of digital literacy that many older adults do not possess. For example, while 61% of adults over 65 own smartphones, only 28% report feeling confident in performing tasks beyond basic calls and texts,[2] illustrating that mere access to devices does not translate into meaningful engagement or reduced loneliness. In addition, existing solutions often rely on users to initiate interactions, overlooking the reality that some older adults may exhibit decreased initiative in seeking social contact—even when experiencing loneliness. This "engagement barrier" further complicates adoption and sustained use.

Our overarching aim is to ultimately alleviate chronic loneliness, but as a foundational step, this initial study focuses on short-term measures of user engagement and satisfaction with a telephone-based AI interface. By first validating our technical implementation and medium-centric design approach, we lay the groundwork for subsequent longitudinal research that will assess the system's long-term psychological impact. Establishing immediate user acceptance and identifying interaction patterns are essential prerequisites for informing future efforts to reduce loneliness at scale.

To address these challenges, we propose a voice-based companion system that leverages the familiarity and accessibility of traditional telephone technology. By utilizing this well-understood medium, our system seeks to lower technological barriers and foster higher engagement among older adults who may struggle with more complex digital platforms. This medium-centric approach shifts the focus from feature-rich designs to more accessible, user-centered solutions—paving the way for scalable, impactful interventions that meet older adults where they are.

[1] Caplan, Z. (2023). 2020 Census: United States Older Population Grew. U.S. Census Bureau.

[2] Wilson SA, Byrne P, Rodgers SE, Maden M. A Systematic Review of Smartphone and Tablet Use by Older Adults With and Without Cognitive Impairment.

2.1 Research Questions

Our investigation addresses three fundamental questions:

- Medium Impact: In what ways does selecting the telephone as the primary interaction medium influence adoption rates and sustained engagement among older adults, compared to app-based alternatives?
- Proactive Engagement: Can AI-initiated calls through a familiar telephone channel effectively lower barriers to technology use and enhance user engagement over time?
- Memory Integration: How does incorporating a personalized memory layer into the conversational system affect the perceived quality of interactions and user satisfaction?

2.2 Contributions

This work offers the following contributions:

- Medium-Centric Framework: We propose a comprehensive framework that emphasizes medium selection as a critical design choice for AI-based companionship tools targeting older adults.
- Proactive Interaction Strategies: We demonstrate how proactive, AI-initiated engagements via a familiar communication channel can improve user involvement and reduce adoption barriers.
- Enhanced Personalization via Memory: We integrate a memory-enhanced conversational system to deliver personalized, context-rich interactions, ultimately improving user satisfaction and perceived value.

3 System Design And Implementation

Our research intersects four key domains: technology adoption patterns among older adults, AI companionship systems, memory integration in conversational agents, and existing elderly companionship technologies. By examining each area, we identify critical insights that inform a medium-centric approach to AI-driven companionship.

3.1 Older Adult Technology Adoption Patterns

Numerous studies emphasize that older adults' technology adoption hinges on interface familiarity and perceived ease of use. For example, Chen and Schulz (2016) found that adoption rates correlate strongly with prior experience using similar interfaces. Broader evidence suggests that Information and Communication Technologies (ICT) can reduce social isolation by enabling connections

to the outside world, fostering social support, and providing meaningful activities. However, systematic reviews of ICT interventions from 2002 to 2015 highlight that benefits often remain short-lived and inconsistently distributed. These findings underscore that while ICT has potential, its impact depends on designing solutions aligned with users' existing interaction paradigms, such as telephone-based interfaces.

Research on technology resistance among older adults challenges the assumption that age alone drives reluctance to adopt new tools. Mitzner et al. (2019) emphasize that resistance often stems from poor interface design rather than inherent age-related factors. This insight supports our approach of leveraging familiar modalities—like telephony—rather than attempting to push older users toward complex new platforms.

3.2 AI Companionship Systems

Early AI-driven conversation systems, such as ELIZA (Weizenbaum, 1966), demonstrated the potential for computational agents to engage users in meaningful dialogue. Modern implementations have expanded considerably, moving beyond simple text-based interactions. Fitzpatrick, Darcy, and Vierhile (2017) demonstrated that a fully automated conversational agent (Woebot) providing cognitive-behavioral therapy significantly reduced symptoms of depression in young adults, showcasing AI's potential as a scalable mental health support tool.

Advances in large language models (e.g., Brown et al., 2020) now allow AI systems to maintain contextually rich, coherent, and personalized conversations. Such enhancements present new opportunities for designing AI companions tailored to older adults' needs, as these models can adapt to individual preferences and communication styles, making them well-suited for empathy-driven companionship.

3.3 Memory Integration In Conversational Systems

The incorporation of memory layers within AI systems has shown promise in improving conversational quality and user satisfaction. Liu et al. (2021) highlight that retaining conversational history can foster rapport, encouraging sustained engagement among older users. Similarly, Li et al. (2021) introduced a personalized hybrid matching network that leverages user-specific dialogue history, significantly outperforming traditional multi-turn context-response matching. These findings confirm that memory-integrated conversational agents can deliver more personalized, context-aware interactions—an approach central to our system's design.

3.4 Older Adult Companionship Systems

Rodríguez-Martínez et al. (2024) identified effective communication strategies for chatbots aimed at alleviating loneliness in older adults. Their qualitative

analysis underscored the importance of empathy, emotional support, and ethical considerations like privacy and autonomy. Chou et al. (2024) further demonstrated that user-friendly chatbots tailored to older adults' mental health needs led to high utilization rates and significant reductions in loneliness. Iancu and Iancu (2023) similarly showed that perceived ease of use and usefulness strongly influence older adults' intentions to adopt chatbot companions, emphasizing the need for intuitive, accessible, and engaging interfaces.

3.5 Research Gap And Literature Gap Analysis

Prior research illustrates that while older adults can benefit from ICT and AI-based companions, existing solutions often overlook essential factors: the importance of a familiar medium, the value of proactive engagement, and the integration of personalized memory. Although studies have examined these elements separately, there is a notable lack of integrated systems that employ conventional telephone technology to deliver proactive, memory-enhanced companionship specifically tailored for older adults.

Our research addresses this gap by uniting these components—natural voice interaction, proactive calling features, and personalized memory management—within a telephone-based system. By building on established insights from prior work and focusing on a medium that aligns with older adults' existing habits, we aim to create a more accessible and effective AI-driven companionship solution.

4 System Design And Implementation

Our system combines three key components—OpenAI's Realtime API for natural voice interaction, Twilio for telephone integration, and mem0 for persistent memory management—to create an accessible and engaging voice companion for older adults. By leveraging a familiar communication medium (the telephone), we reduce barriers to adoption and deliver advanced AI-driven companionship in a format that feels both intuitive and supportive.

4.1 Voice Interface: OpenAI Realtime API

At the core of our voice interaction lies the OpenAI Realtime API (introduced in late October 2024), which supports low-latency, speech-to-speech dialogue akin to ChatGPT's Advanced Voice Mode. This approach eliminates the need for separate components like speech recognition, language processing, and speech synthesis pipelines. Instead, we rely on direct audio streaming with GPT-4o, resulting in faster, more natural interactions that preserve the emotional nuances of human conversation.

A key feature of this component is Voice Activity Detection (VAD), which accurately identifies when the user begins and ends speaking. By automatically detecting speech boundaries, the system facilitates a conversation flow that feels organic and responsive—an essential quality for older adults who may be less

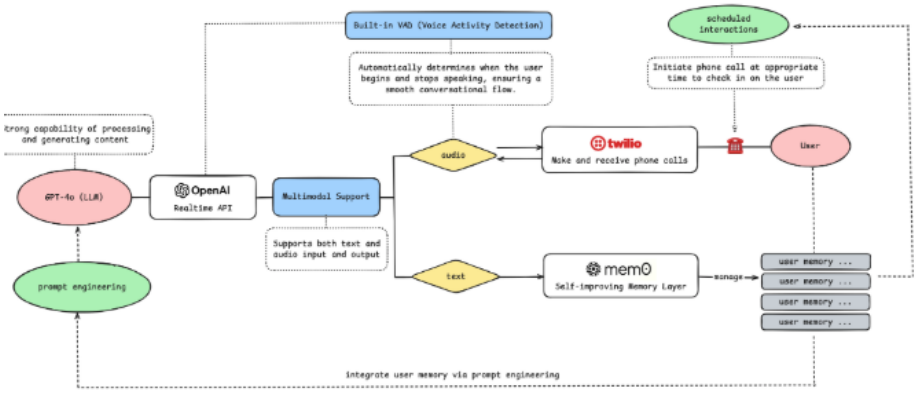

Figure 1: Figure 1: Overview of the system architecture integrating OpenAI's Realtime API, Twilio, and mem0.

comfortable with traditional computer interfaces. Additionally, we generate transcripts of both user and system utterances, enabling downstream processing for memory management and conversation quality analysis.

4.2 Telephone Integration: Twilio

Our decision to integrate Twilio's cloud communications platform reflects a commitment to accessibility. By anchoring the system in traditional telephone technology, we eliminate the need for smartphone ownership, application installations, or navigating unfamiliar interfaces. This choice speaks directly to research indicating that older adults often feel most at ease with familiar communication modes.

A key innovation is the system's ability to proactively initiate calls, reaching out to users much like a friend or family member might. This proactive approach addresses known engagement barriers by reducing the effort required from the user. Twilio handles incoming and outgoing calls, ensuring reliable audio quality and connection stability without burdening the user with technical complexities. The result is a system that encourages regular interaction while respecting users' comfort and technological preferences.

4.3 Memory System: mem0

The mem0 memory management system underpins our personalized approach. Instead of storing entire conversation histories, mem0 identifies and extracts "memory events"—key pieces of information that matter to the user. These events are stored as structured user memories, which can be efficiently retrieved and updated during subsequent interactions.

When a returning user's call is connected, the system references these stored memories to inform the conversation's direction. Through few-shot prompting techniques, mem0 can even capture user preferences, such as optimal call times, enabling the system to schedule future interactions that align with the user's routine. This personalization fosters rapport and continuity, allowing older adults to experience an evolving relationship with their AI companion.

4.4 Conversation Design

We have carefully crafted a persona named JOY to provide empathetic, engaging, and contextually appropriate interactions. JOY maintains a warm, supportive tone and adjusts her communication style to match the user's emotional state. The conversation logic integrates memory naturally, referencing historical information when available and gracefully prompting the user for missing details when needed.

Our conversation management approach ensures a seamless flow, employing follow-up questions, natural transitions, and planned conversation endings that set expectations for the next call. By balancing meaningful engagement with clear boundaries, the system creates a familiar, comforting environment for older adults seeking a reliable companion.

4.5 Rationale For Technology Choices

We chose the OpenAI Realtime API and GPT-4o for their ability to produce rich, low-latency voice interactions—a necessity for creating a human-like conversational experience. Twilio's telephony platform allows us to leverage a technology older adults already trust, reducing the cognitive load associated with new digital interfaces. The mem0 system provides scalable, efficient personalization, ensuring that each conversation feels increasingly tailored to the user's preferences and history. Together, these choices align with our overarching goal of delivering accessible, meaningful AI companionship through a medium-centric, user-focused design.

5 Evaluation Metrics And Technology

5.1 Evaluation Framework

Our evaluation framework focuses on short-term measures of system engagement and user satisfaction, deliberately preceding longer-term assessment of loneliness reduction. This staged approach allows us to first validate our technical implementation and interface design before conducting extended studies of psychological impact. While our ultimate goal is to reduce loneliness, this initial evaluation concentrates on establishing the feasibility and acceptability of our telephone-based approach.

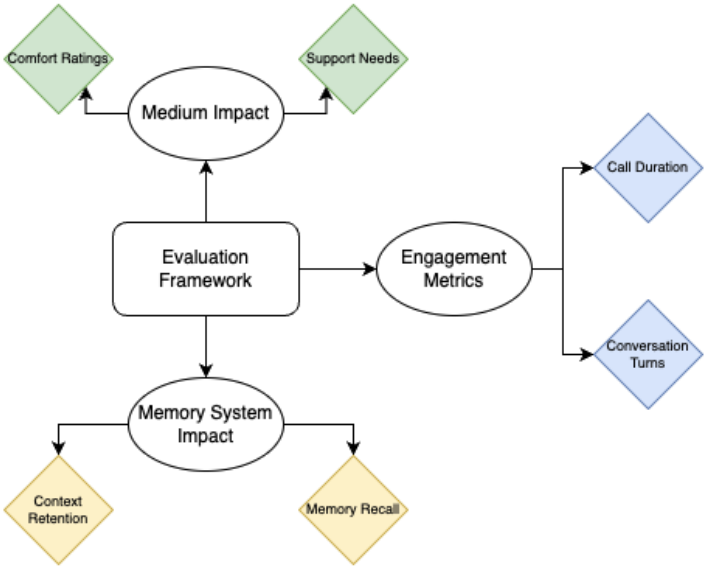

Figure 2: Figure 2: Overview of the evaluation framework integrating quantitative and qualitative metrics.

5.2 Integration Of Metrics

To rigorously evaluate our system's performance, we draw upon multiple data sources, including engagement analytics, session feedback, and periodic (longitudinal) feedback. By combining immediate and long-term perspectives with objective usage metrics, we can:

- Assess the immediate impact of individual interactions.
- Understand patterns of engagement over time. Compare the effectiveness of our telephone-based approach with existing solutions.
- Evaluate the success of key features such as memory integration and proactive calling.

5.3 Survey Questions

Session Feedback (1–5 scale; 1 = negative, 5 = positive):

- How well did the system understand your needs?
- How effective was the system in providing emotional support?
- How easy was it to use the system?

- How likely are you to continue using the system?
- How likely are you to continue using the system?

Long-Term Feedback (1–5 scale):

- How many times did you interact with the system this week?
- How satisfied are you with the system overall?
- Do you prefer phone calls over text-based interactions?
- How effective is the system in providing emotional support compared to text-based alternatives?
- How satisfied are you with the system's ability to remember previous conversations?
- Do you feel more personally connected through phone calls than text chats?

5.4 Multilingual Setup

To accommodate diverse user groups, our evaluation instruments underwent a three-step translation and validation process: (1) initial machine translation, (2) expert refinement for cultural and linguistic appropriateness, and (3) back-translation verification to ensure semantic equivalence. Although these measures were in place, practical constraints prevented the collection of Chinese-language survey responses.

6 Results

This section presents both quantitative metrics and qualitative feedback, shedding light on immediate user satisfaction as well as engagement over time.

6.1 Survey Insights

From the session feedback surveys (n=16):

- Average satisfaction: 4.19/5
- Chatbot understanding of needs: 3.94/5
- Emotional support: 4.06/5
- Usability: 4.19/5
- Likelihood of reuse: 3.94/5

In total, 81.25% of participants rated their interactions at 4 or 5, indicating high satisfaction with the system's usability and interaction design. Similarly, 75% of users rated the system's ability to understand their needs at 4 or higher. Although ease-of-use ratings were more varied (ranging from 1–5), 75% still scored it at 4 or above, confirming that most users found the interface approachable.

The period feedback survey (n=5), originally intended as a seven-day assessment but adjusted for variable trial lengths, provided insights into sustained engagement. All respondents expressed a strong preference for phone calls over text-based interfaces, and 80% rated the system's emotional support at 4 or higher. Memory integration features also performed well, with an average rating of 4/5 for the system's ability to recall past interactions.

6.2 Qualitative Feedback

Good Features

- *The phone call medium is much more accessible compared to the app*
- *Comforting voice was nice*
- *The tone and engagement, I liked how she lead the conversation for me to talk more*

Suggested Improvements

- *Better tone regulation - chatGPT has better tone*
- *Making it less latency*

Participants frequently praised the "comforting voice" and emphasized that using the telephone felt "natural and intuitive," reducing barriers often associated with new technologies. They also noted that the system's guided conversation style encouraged more extensive verbal engagement. Suggested improvements included refining tone modulation and reducing latency to enhance the realism and responsiveness of the interaction.

A notable limitation was the absence of survey responses from Chinese-speaking participants, despite trial attempts. This shortfall underscores the need for more robust multilingual evaluation frameworks to assess cross-cultural effectiveness in future iterations.

6.3 Addressing Research Questions

- Medium Impact: The strong preference for phone-based communication supports our medium-centric approach, demonstrating that leveraging familiar technology can improve accessibility and comfort for older adults.
- Proactive Engagement: High satisfaction and emotional support ratings indicate that proactively initiated calls effectively facilitate meaningful interactions and reduce engagement barriers.

- Memory Integration: Positive responses to the memory features suggest that personalized, context-aware conversations can enhance user satisfaction, fostering a more persistent sense of companionship over time.

6.4 Summary and Future Directions

While these findings are encouraging, they must be interpreted within the scope of a small sample size and a modified evaluation timeframe. Future work will focus on refining tone modulation, reducing latency, improving multilingual capabilities, and conducting larger-scale, cross-cultural studies. These steps will help ensure that the system evolves into a more inclusive, responsive, and globally adaptable AI companion for older adults.

7 Limitations And Ethical Considerations

Our work faces several limitations and raises important ethical considerations. Addressing these issues is essential for the responsible and effective deployment of AI-driven companionship for older adults.

7.1 Population Sampling

A key limitation arises from the discrepancy between our intended demographic—American older adults (65+) with college degrees—and our actual test participants. Our primary test group, composed of younger college students, provided useful technical feedback but does not represent the usability challenges, social needs, and emotional contexts of our target users.

Similarly, the secondary test group of Chinese older adults introduced cultural and linguistic differences that limit the generalizability of our findings. Variations in technology adoption, communication norms, and expectations for care across different cultures and languages affect both user engagement and system responsiveness. Future studies must include participants who closely match the intended demographic and cultural background to ensure that our design accurately addresses their needs.

7.2 Measurement Methodology

Our evaluation primarily relied on user satisfaction and subjective assessments of support rather than validated psychological measures. While these initial metrics are valuable for early-stage technical validation, they do not capture the full spectrum of emotional well-being or enable robust comparisons to other interventions. Standardized instruments such as the UCLA Loneliness Scale, Geriatric Depression Scale, or Hospital Anxiety and Depression Scale could provide a more comprehensive understanding of the system's long-term psychological impact. Future research will integrate these established measures to more rigorously assess emotional outcomes.

7.3 Temporal Scope

Our current focus on short-term engagement and satisfaction limits our ability to draw conclusions about the system's efficacy in alleviating chronic loneliness. Achieving sustained psychological benefits likely requires extended usage and longitudinal evaluation. Ongoing and future studies will incorporate longer-term assessment periods to determine whether our medium-centric approach fosters enduring improvements in social connectedness and emotional well-being.

7.4 Technical Limitations

Several technical challenges could hinder performance and user experience:

- Audio Quality: Low-fidelity telephone audio may pose difficulties for users with hearing impairments, potentially leading to frustration and reduced trust in the system.
- Voice Activity Detection (VAD): Our VAD system struggles to accurately determine when users start or stop speaking in noisy environments. This limitation can result in the AI either interrupting users prematurely or failing to respond promptly, degrading the natural flow of conversation.
- Environmental Sensitivity: Ambient noise and multiple speakers degrade system performance, leading to inconsistent user experiences.
- Network Dependencies: Reliance on stable internet and telephone networks introduces points of failure that may disrupt interactions.
- Temporal Reasoning and Scheduling: Handling time-related details and coordinating calls across multiple time zones can be error-prone, reducing the system's reliability in meeting user preferences.

Future iterations will refine audio processing, improve VAD accuracy, explore noise-cancellation techniques, and develop more robust fallback strategies for network issues. Enhanced temporal reasoning and clearer user prompts can help ensure accurate scheduling.

7.5 Ethical Considerations

The sensitive nature of providing companionship to older adults requires careful attention to ethical dimensions:

- Data Privacy: The system collects personal and conversational data, necessitating strict safeguards. We employ end-to-end encryption, comply with standards like GDPR and HIPAA, and obtain informed consent to ensure user privacy and security.

- Informed Consent and Autonomy: Users are fully briefed on the study's purpose, procedures, and potential risks. They can opt out at any time. Control over interaction frequency and timing respects user autonomy and comfort.

- Psychological Impact and Dependency: While AI companionship can mitigate loneliness, there is a risk of users developing dependency on the system. To mitigate this, our design encourages and complements real-world social connections rather than replacing them.

- Security Risks: The telephone medium may expose users to scams. We recommend implementing caller ID verification, user-specific PINs, or other authentication measures to ensure that each interaction is genuine and safe.

8 Next Steps

Our preliminary results suggest that a medium-centric approach to AI companionship is both feasible and promising. However, several key areas warrant further exploration: long-term impact assessment, better demographic alignment, and refined evaluation methodologies. Future studies will employ standardized measurement tools, such as the UCLA Loneliness Scale, to assess changes in participants' emotional well-being over extended periods, ensuring a more rigorous understanding of the system's effectiveness.

Additionally, by recruiting participants who closely resemble our target demographic—American, college-educated adults aged 65 and older—we aim to validate the system's accessibility and relevance to the intended user group.

8.1 Extended Demographic Studies

The most pressing need for future research involves conducting comprehensive studies with participants who accurately represent our target population—American adults aged 65 and older with college degrees. This expansion will allow us to validate our system's effectiveness with its intended users and understand their specific needs and preferences. Future research will:

- Longitudinal Studies: Conduct multi-month evaluations to observe how older adults integrate the system into their daily routines and whether benefits in engagement and emotional support persist over time.

- Socioeconomic Diversity: Investigate how educational backgrounds, varying socioeconomic statuses, and differing technological literacies influence system adoption, ultimately guiding more inclusive and adaptable system design.

8.2 Cross-Cultural Adaptation

Our initial experiences with Chinese older adults highlight the global potential of this approach. Future work will systematically explore how cultural differences shape the effectiveness of AI companions, leading to:

- Cultural Customization: Adapting conversational styles, language nuances, and interaction preferences to align with different cultural norms and values.
- Language Support: Expanding language capabilities to support multiple languages and dialects, ensuring accessibility for non-English speaking elderly populations.

8.3 Technical Enhancements

Refinements to the system's technical infrastructure will improve user experience and system reliability:

- Advanced Voice Synthesis: Integrating technologies like Hume's Empathetic Voice Interface to enhance the emotional expressiveness of the AI companion, creating more natural and emotionally resonant interactions.
- Improved VAD and Noise Cancellation: Incorporating advanced noise-cancellation algorithms and training VAD systems on diverse audio samples to enhance accuracy in various environments.
- Enhanced Security Measures: Developing robust authentication protocols and real-time threat detection systems to protect users from potential fraud and ensure secure interactions.

8.4 Improved Evaluation Framework

A more comprehensive, user-centered evaluation framework will inform both design and implementation:

- Age-Specific Usability Metrics: Developing metrics tailored to elderly users, such as cognitive load, physical interaction ease, and emotional well-being indicators.
- Cultural and Linguistic Factors: Assessing how cultural and linguistic differences impact user experience and system effectiveness.
- Long-Term Engagement Patterns: Tracking user engagement over extended periods to identify trends and factors influencing sustained use.
- Impact on Social Relationships: Evaluating how AI companionship affects users' existing social relationships and their overall social support networks.

- Physical and Cognitive Health Outcomes: Investigating the system's impact on users' physical health (e.g., medication adherence) and cognitive well-being (e.g., memory retention).

By pursuing these directions, we aim to refine the system's core capabilities, ensure that it effectively serves the intended user population, adapt it to diverse cultural contexts, and ultimately provide meaningful, enduring support to older adults experiencing social isolation.

9 Conclusion

This research presents a novel, medium-centric approach to AI companionship, focusing on older adults and leveraging the familiarity of telephone technology. By integrating OpenAI's Realtime API for natural voice interaction, Twilio's telephony services for accessible communication, and mem0's personalized memory management, we demonstrate how advanced AI capabilities can be delivered through an interface older adults already trust and understand.

Our design philosophy emphasizes that technological sophistication must align with user comfort and accessibility. Rather than expecting older adults to adapt to new interfaces, we adapt the technology to their existing communication habits. This represents a departure from more traditional AI solutions, which often place technical complexity above user-friendly design. Our proactive engagement features, allowing the system to initiate calls naturally, further differentiate our approach and foster a sense of continuity and emotional support.

9.1 Summary Of Key Findings

- Medium Impact: Users preferred phone-based interactions over text-based interfaces, validating our medium-centric strategy.
- Proactive Engagement: High satisfaction and emotional support ratings indicate that proactive, AI-initiated conversations effectively enhance user engagement.
- Memory Integration: Positive responses to the memory features support the value of personalized, context-aware interactions.
- User Experience: While overall feedback was positive, variations in ease-of-use scores highlight the need for iterative refinements to improve the interface further.

9.2 Broader Implications

As global populations age and concerns about social isolation persist, developing accessible AI companionship solutions becomes increasingly important. Our work shows that designing systems centered on the preferences and abilities

of older adults can lead to both effective and inclusive outcomes. The lessons learned extend beyond this target demographic: memory-enhanced, empathetic AI interactions and user-focused design principles can benefit a wide range of users.

By prioritizing familiarity, proactive engagement, and user comfort, we have not only addressed immediate challenges in older adult loneliness but also established a design framework that can inform the development of future AI-based support systems. Ultimately, our findings suggest that inclusive design practices do more than meet the needs of a specific group—they can elevate the user experience for all.

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