RECALLBRIDGE FRAMEWORK DOCUMENT

Problem Statement: Numerous elderly people suffer from dementia, which results in memory loss that causes problems with day-to-day activities and strains ties with family and carers. Names, faces, and previous conversations are frequently involved in these errors. This can cause frustration and a decrease in independence. Current digital assistants do not meet the cognitive needs of dementia patients. They also lack the ability to personalize memory recall. There is an urgent need for a voice-enabled assistant powered by AI that can help users remember people, events, and interactions. This assistant should use contextual clues from contacts, photos, and call logs. Such a solution could maintain dignity, lessen the burden on caregivers, and improve emotional well-being by providing everyday memory support suited to the user's life. India is expected to have 14 million dementia cases by 2050, making this an urgent public health issue.

Target Audience & Context: The main users are elderly people in the early to moderate stages of dementia. They often have memory lapses, especially with names, faces, and their personal history. The secondary users include caregivers and family members who help them every day. Caregivers often tire of repeating the same cues. Many people struggle to maintain their independence and dignity in the absence of memory aids. Voice interaction and a straightforward, user-friendly design are essential for comfort and acceptance in familiar settings, such as the home, where this solution is intended for use.

Use of Gen-AI: RecallBridge develops a custom memory aid for dementia patients using generative artificial intelligence. Large language models (LLMs) help understand natural language questions like "Who is Kumud's son?" They also pull together context from local data, such as contacts, images, call logs, and messages, to find relevant information. AI delivers emotionally-aware, human-like responses by figuring out relationships and timelines through a personal knowledge graph. Through multimodal prompts like "Show me his photo," which combine natural language processing (NLP) with image retrieval and captioning models, Gen-AI also supports visual recall. Context-aware dialogue models make the interaction feel like talking to a familiar friend, and voice integration allows for hands-free, senior-friendly use. Its ability to customize responses and handle incomplete or fragmented inputs mirrors how memory works.

Solution Framework: RecallBridge is a voice-enabled AI assistant designed to help dementia patients recall people, events, and interactions using everyday language. The solution integrates generative AI, multimodal context processing, and wearable IoT for seamless memory support.

1. Data Collection Layer: The app accesses on-device data such as contacts, messages, call logs, and photo metadata. Optionally, a wearable smart camera clips onto the user’s glasses to capture real-time visual context (e.g., people nearby).

2. Personal Knowledge Graph (PKG): Structured data is extracted using NLP, image recognition, and entity linking to build a PKG—a dynamic, personalized graph representing people, relationships, events, and communication timelines.

3. Query Processing & Generation: When a user speaks a query—e.g., “Who did I talk to yesterday?”—the app uses automatic speech recognition (ASR) and generative AI (LLM) to understand the intent. The system queries the PKG and responds with generated answers that feel natural and supportive.

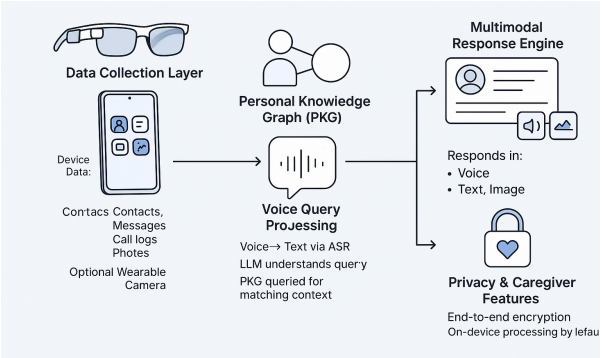

Fig 1. Illustration showing the solution framework

4. Multimodal Response Engine: The assistant can return results as voice, text, or images. For instance, "Show me Kumud's son" would retrieve the image with the person's name, last call timestamp, and relation context.

5. Privacy & Caregiver Integration: Data remains on-device or encrypted in a secure vault. Caregivers can optionally review/edit PKG entries or receive alerts if confusion or distress is detected.

Feasibility & Execution: RecallBridge can be practically implemented using Android's Accessibility API and user-granted access to contacts, call logs, SMS, and photos. Generative AI models like GPT-4 or Gemini can power natural language understanding and response generation. On-device whisper models enable offline voice interaction. A personal knowledge graph will be generated locally to protect privacy. Tools like React Native for the mobile app, Supabase for caregiver sync, and a TensorFlow Lite model for face matching enable smooth execution.

Scalability & Impact: The solution is scalable. It starts with Android devices and will expand to iOS and wearables like smart glasses. As more users interact, the AI improves its responses and adjusts to individual recall styles. Integration with caregiver dashboards boosts adoption in eldercare homes. With India expecting 14 million dementia cases by 2050, RecallBridge can significantly improve quality of life, lessen caregiver fatigue, and grow into a business that serves families, healthcare providers, and senior living centers worldwide. Monetization could include premium caregiver tools or partnerships with senior care centers.

Conclusion / Summary & Minimum Lovable Product: RecallBridge is a compassionate AI memory companion supporting dementia care through voice interaction, photo recall, and personalized memory graphs.

Our MLP will answer memory-based questions like "Who visited me yesterday?" using voice and face recognition, designed for real-world impact and early adoption in eldercare homes.

We plan to integrate a detachable smart camera and microphone with onboard processing for real-time recording, extracting, identifying, and securely storing relevant data. This allows contextual memory support without constant logging, respecting user privacy and convenience. RecallBridge lays the foundation for a scalable assistive tech business in elder care.

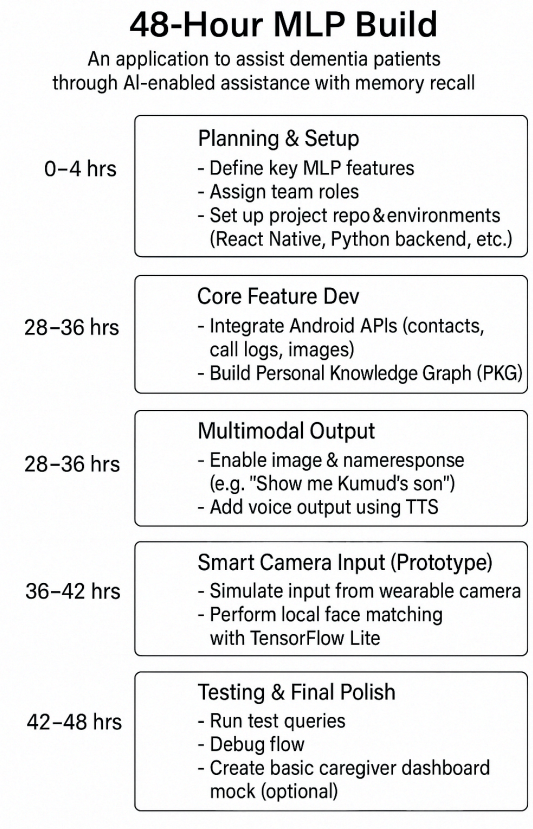

Fig 2. 48-hour development timeline for the RecallBridge