

RecallLive: AI-Assisted Memory Support for Older Adults

Hojin Shin, Hamiltonsoutheastern High School, Fishers, IN, USA

Q1: Research Question/Engineering Objectives

PROBLEM

- Alzheimer's disease and age-related cognitive decline affect **50M+ older adults** worldwide
- Existing digital tools rely on passive engagement — reminders, static content, simple games
- No integrated system combines AI emotion detection, structured reminiscence, and caregiver insight

RESEARCH QUESTION

Can an AI-assisted mobile application integrating metadata-based clustering, real-time facial expression analysis, and language-model summarization be developed and evaluated for usability among older adults?

ENGINEERING GOALS

- Build metadata-driven photo clustering & memory video generation (RVC)
- Deploy on-device CNN for real-time facial expression recognition (RRA)
- Integrate LLM to generate interpretable caregiver engagement summaries (RRG)
- Evaluate system usability & accessibility with adults aged 65+

Q2: Project Design/Methodology

Personal Photo Input
User device storage

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Metadata Extraction & Clustering
EXIF timestamp · GPS · Temporal & spatial grouping

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Memory Video Generation RVC
Google Media3 API · Chronological ordering

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Real-Time Emotion Capture
Front-facing camera · Frame-by-frame

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CNN Emotion Classification RRA
TensorFlow Lite · 7 categories · On-device inference

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Emotion Timeline Construction
Temporal aggregation · Smoothing

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LLM Summary Generation RRG
Aggregated distributions → Natural language

↓

Caregiver Dashboard Display
Firebase real-time sync · Visual analytics

EVALUATION DESIGN

A two-phase sequential mixed-methods design was employed to capture both perception-based and direct interaction usability among adults aged 65+.

Phase 1 — Video-Based Usability Assessment

N = 202 | **Ages 63–84** | **~10 min** | **CloudResearch**

- Watched 4-min structured walkthrough video of RecallLive
- Completed 16-item usability & engagement survey (5-point Likert)
- Provided optional open-ended feedback

Measures: Ease of Use · Engagement · Design · Perceived Usefulness · Intention

Analysis: Descriptive stats · One-sample t-tests (H1) · Simple regression (H2) · Cronbach's α

Phase 2 — Hands-On Usability Assessment

n = 10 | **Ages 65–78** | **~30 min** | **Subset of P1**

- Installed RecallLive APK on personal Android device
- Interacted with all 4 core components using own photos
- Semi-structured post-use interview conducted via Zoom

Measures: Navigation · Feature clarity · Interaction flow · User comfort

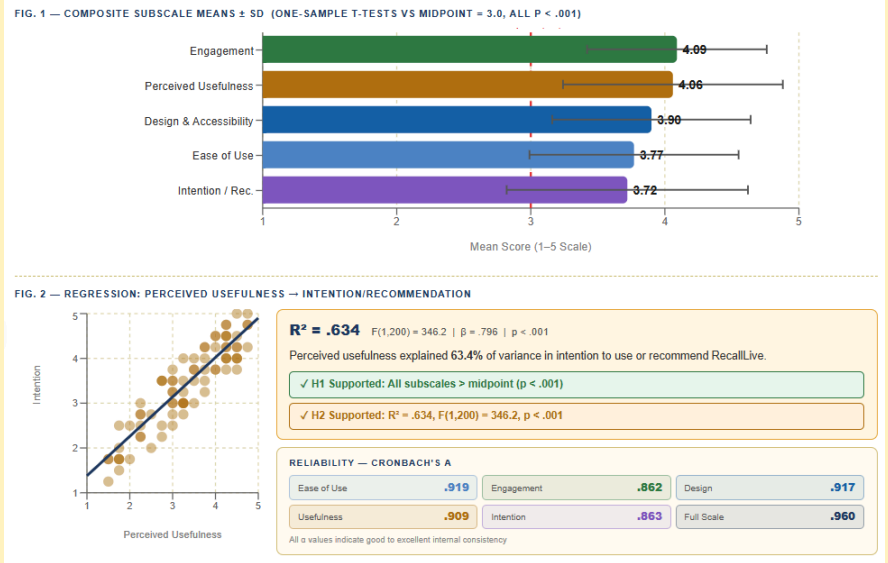
Analysis: Thematic analysis · Perception vs. experience alignment

APP COMPONENTS TESTED

Photo Clustering | **Video Generation** | **Emotion Detection**

Memory Quiz | **AI Summary**

Q3: Data Analysis & Results



Q4: Interpretation & Conclusions

NOVEL CONTRIBUTION

- First system integrating **on-device CNN emotion recognition + structured reminiscence + LLM caregiver reporting** in one mobile pipeline
- Privacy-preserving by design — no raw facial data stored or transmitted
- Bridges memory engagement and caregiver insight in real time
- Validated with **202 older adults (ages 63–84)** — competitive sample for high school ISEF

SOCIETAL IMPACT

- Supports **6.9M Americans** with Alzheimer's and their caregivers
- Scalable via personal photo libraries — no clinical setup required
- Addresses gap in AI tools that actively engage users in cognitive processes
- Phase 2 (n=10): All participants completed independently; navigation rated intuitive

KEY FINDINGS SUMMARY

4.09/5.00

Engagement

Highest rated subscale

4.06/5.00

Usefulness

Primary adoption driver

$\alpha = .86-.96$

Reliability

All scales excellent

R² = .634

Prediction

63.4% variance explained

LIMITATIONS & FUTURE WORK

Limitations

- Phase 1 based on video demo, not direct use
- Phase 2 sample (n=10) limits generalizability
- Short-term evaluation only

Future Directions

- Longitudinal deployment in memory care facilities
- Multimodal signals (voice + interaction patterns)
- Clinical validation with diagnosed populations