InnerVoice: Design Documentation

Project Overview

InnerVoice is an AI-powered journaling companion that transforms traditional journaling from a solitary writing exercise into an engaging conversation with an empathetic AI. The application addresses "blank page anxiety" and helps users maintain consistent journaling habits through intelligent prompts, real-time sentiment analysis, and meaningful insights.

Design Goals

1. Build a standard messaging app without AI and create a strong user experience
2. Break up frontend into smaller components
3. Set up and test endpoints with backend
4. Implement and utilize AI and use sample data to test
5. Create robust database schema that will to store journal entries
6. Polish for working demo

Technical Architecture

Frontend Stack

- Framework: SvelteKit 2.0
- Language: JavaScript with reactive components
- Styling: TailwindCSS and Custom CSS with modern glassmorphism design
- Voice Input: Web Speech API for browser-native speech recognition
- Charts: Custom SVG visualizations for sentiment dashboard
- Security: CryptoJS for Zero Trust Security

Backend Stack

- Framework: FastAPI (Python 3.11+)
- Database: SQLite with structured schema for journal entries
- AI Integration: OpenAI GPT-3.5-turbo for conversations, summaries, and insights

- Security: AES encryption for sensitive conversation data
- API Design: RESTful endpoints with clear separation of concerns

Key Technical Components

1. Conversation Engine

- GET /api/conversation/starter - Context-aware conversation starters
- GET /api/conversation/starters - Multiple prompt options
- POST /api/chat - Empathetic AI responses with memory integration

2. Journal Processing Pipeline

- POST /api/journal/generate - Real-time preview generation
- POST /api/journal/save-session - Commit conversations to permanent storage
- GET /api/journal/all - Retrieve historical entries with metadata

3. Sentiment Analysis System

- Real-time Processing: Analyzes user messages as they're sent
- Multi-dimensional Scoring: Sentiment scores (-1 to +1) plus thematic categorization
- Trend Visualization: 7/30/90-day emotional pattern tracking
- Journaling Streak: Gamification element to encourage consistency

4. Voice Integration

- Browser-native: Uses Web Speech API with continuous recognition
- Interim Results: Real-time transcription with immediate feedback
- Graceful Fallback: Clear error states for unsupported browsers or denied microphone access
- Accessibility: Full ARIA support and keyboard navigation compatibility

Data Architecture

Database Schema

```
journal_entries (
  id INTEGER PRIMARY KEY,
  date TEXT,
  title TEXT,
  summary TEXT,
  insights TEXT[], -- JSON array of AI-generated insights
  sentiment_score REAL,
  primary_theme TEXT,
  messages TEXT, -- JSON conversation history
  user_notes TEXT,
  mood TEXT
)
```

Security Implementation

- Conversation Encryption: AES-256 encryption for sensitive dialogue data
- Session Management: Temporary conversation storage with automatic cleanup
- API Security: Request validation and error handling for all endpoints
- Privacy by Design: No conversation data persists without explicit user save action

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AI Integration Strategy

Conversation AI (GPT-3.5-turbo)

- Empathetic Prompting: Custom system prompts for supportive, non-judgmental responses
- Context Awareness: Maintains conversation memory within sessions
- Dynamic Starters: Time-of-day and historical context influence initial prompts

Summary Generation

- First-Person Voice: Summaries written as personal reflections to make the user feel as they wrote the entry ("I noticed..." vs "The user...")
- Insight Extraction: AI identifies patterns and growth opportunities from conversations
- Theme Recognition: Categorizes journal entries into life domains (work, relationships, health)

Sentiment Analysis Pipeline

```
async def analyze_sentiment(text):
```

```
# Multi-model approach combining keyword analysis + AI classification
# Returns: sentiment_score (-1 to +1), primary_theme (string)
# 1: positive, -1: negative
```

Key Features & Implementation

1. Dynamic Conversation Starters

Problem Solved: Eliminates "blank page anxiety"
Implementation:

- Time-aware prompts (morning/evening greetings)
- Context from previous sessions
- Multiple options to prevent repetition

2. Voice-to-Text Integration

Problem Solved: Makes journaling accessible and natural
Implementation:

- Web Speech API integration
- Real-time transcription with cleanup
- Mobile-friendly voice input

3. Live Journal Preview

Problem Solved: Users see value before committing to save
Implementation:

- `/generate` endpoint creates previews without database writes
- `/save-session` handles permanent storage
- Prevents accidental data loss

4. Sentiment Dashboard

Problem Solved: Helps users identify emotional patterns
Implementation:

- Visual trend charts with 7/30/90-day views
- Mood distribution analytics

- Journaling streak gamification
- Theme extraction and categorization

5. Privacy-First Architecture

Problem Solved: Users trust the system with sensitive thoughts
Implementation:

- Client-side encryption options
- Explicit save confirmation
- Local processing emphasis

Performance & Scalability Considerations

Current Optimizations

- Debounced API calls to prevent excessive requests
- SVG-based charts for lightweight visualizations
- Session-based conversation storage to minimize database writes
- Efficient component updates using Svelte's reactivity

Future Scalability Enhancements

- Database migration to PostgreSQL or MongoDB for production use
- API rate limiting and user authentication
- Caching layer for frequently accessed journal data
- CDN deployment for static assets

Challenges & Solutions

1. Duplicate Save Prevention

Challenge: Multiple endpoints were creating duplicate journal entries
Solution: Separated preview generation (`/generate`) from permanent storage (`/save-session`)

2. Voice Input Implementation

Challenge: Balancing recognition accuracy with user experience
Solution: Implemented continuous recognition with interim results for real-time feedback while maintaining browser compatibility

3. Clinical-Sounding Summaries

Challenge: AI summaries felt like external analysis rather than personal reflection
Solution: Switched to first-person voice ("I noticed..." instead of "The user...")

4. Real-time Update Performance

Challenge: Frequent sentiment analysis calls created UI lag
Solution: Debounced updates with 200ms delays for smoother experience

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Future Enhancements

Short-term Improvements (1-3 months)

- Export functionality for journal data
- Search capabilities across historical entries
- Customizable themes and UI personalization
- Push notifications for journaling reminders

Medium-term Features (3-6 months)

- Multi-modal input: Image and video journal entries
- Advanced analytics: Correlation analysis between mood and activities
- Social features: Optional sharing with trusted contacts
- Integration APIs: Connect with fitness trackers, calendar apps

Long-term Vision (6+ months)

- Mobile companion app with offline capabilities
- Access to different models for user to experiment with
- Advanced AI models: Fine-tuned specifically for therapeutic conversations
- Professional integration: Optional sharing with therapists or coaches

- Community features: Anonymous group insights and challenges

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Technical Debt & Known Limitations

Current Limitations

- SQLite constraints: Not ideal for concurrent users
- Single-language support: Currently English-only speech recognition
- Browser dependency: Voice features require modern browser support and only available for certain browsers
- API rate limits: OpenAI usage costs scale with user adoption
- Text conversation generation is slightly too slow

Planned Technical Debt Resolution

- Database migration to PostgreSQL or MongoDB with proper indexing
- Authentication system with user management
- Comprehensive error handling with user-friendly messages
- Mobile app development for broader accessibility
- Optimize AI to reduce tokens while maintaining the same experience

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Success Metrics & Evaluation

User Engagement Metrics

- Daily active users maintaining journaling streaks
- Session completion rates (conversation → save)
- Feature adoption: Voice input usage, dashboard engagement
- Retention rates: Weekly and monthly active users

Technical Performance Metrics

- API response times under 500ms for chat endpoints
- Voice transcription accuracy above 90% for clear speech
- Database query performance under 100ms for journal retrieval

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Conclusion

InnerVoice successfully transforms the journaling experience by combining conversational AI, intuitive voice input, and meaningful analytics into a cohesive, privacy-respecting application. The technical architecture balances user experience with scalability, while the AI integration creates genuinely helpful and empathetic interactions.

The project demonstrates practical application of a responsible AI implementation to solve real user problems in the mental wellness space.

Total Development Time: ~18 hours over 48 hours
Lines of Code: ~4,200 (Frontend: 3,000, Backend: 1,200)
API Endpoints: 13 total across conversation, journal, and utility functions