ScriptureLens AI - Comprehensive App Architecture & Workflow Analysis

App Overview

ScriptureLens AI is a Flutter-based biblical study and spiritual growth application that combines: - Privacy-first encrypted journaling - On-device AI (Qwen 2.5 0.5B) + Cloud AI (Claude/Anthropic) - Theological mentorship following Discovery Bible Study (DBS) methodology - Archaeological discoveries and historical context - Vector memory for personalized insights

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Architecture Overview

Clean Architecture Layers

The app follows a strict **Clean Architecture** pattern:

```
graph TD
    A[Presentation Layer] --> B[Domain Layer]
    B --> C[Data Layer]
    A -->|Uses| D[Services]
    D -->|Accesses| C

    style A fill:#4a9eff
    style B fill:#f39c12
    style C fill:#27ae60
    style D fill:#e74c3c
```

1. **Presentation Layer (`lib/features/*/presentation/`)**
   - Screens (UI)
   - Widgets (Reusable components)
   - State providers (Riverpod)

2. **Domain Layer (`lib/features/*/domain/`)**
   - Business logic
   - Models
   - Use cases

3. **Data Layer (`lib/features/*/data/`)**
   - Repositories
   - Data sources (local DB, API)

4. **Services (`lib/services/`)**
   - Cross-cutting concerns (AI, auth, caching)
   - Preloading services

Navigation Structure

The app uses a **bottom navigation bar** with `IndexedStack` to preserve state across tabs:

```
```mermaid
graph LR
    A[BibleReaderScreen] --> B[Home]
    A --> C[Discover]
```
```

```
    A --> D[Read]
    A --> E[Journal]
    A --> F[Mentor]
    A --> G[Me]

    style A fill:#2c3e50
    style B fill:#3498db
    style C fill:#9b59b6
    style D fill:#e67e22
    style E fill:#16a085
    style F fill:#e74c3c
    style G fill:#f39c12
```

<!-- slide -->

Tab Index	Screen	Purpose
0	**Home Dashboard**	Daily insights, AI follow-ups, stuck detection
1	**Discover**	Archaeological findings, biblical timeline, videos
2	**Read (Bible)**	Bible reader with AI mentor panel
3	**Journal**	Encrypted reflections with Look Forward notes
4	**Mentor Hub**	DBS sessions (Look Back/Up/Forward)
5	**Me (Profile)**	Soul Sphere, growth tracks, prayer altar

Feature Deep Dive

1. Home Screen

File: home_screen.dart

Components

Pulse Header

- Displays user's spiritual "pulse" (average emotion over last 7 days)
- Visual representation using color gradients

Daily Fact Card

- Curated biblical facts from discovery feed service

AI Follow-Up Card

- AI-generated empathetic question based on recent journal entries
- Uses **Qwen** (on-device) for instant response, falls back to Claude

Stuck Detector Card

- Monitors if user is "stuck" on a passage for 3+ days
- Offers context breakthroughs using AI

Daily Prayer Card

- Generates personalized prayers based on user's current emotional state
- Uses prayer service with theme-based prompts

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2. Discover Screen

File: discover_screen.dart

Features

Archaeological Discoveries Grid

- **Dead Sea Scrolls**, **Hezekiah's Tunnel**, **Pool of Siloam**, etc.
- Each discovery shows:
  - Image
  - Biblical connection
  - Era (with color-coding)
  - AI-generated context bridge

Chronological Context Slider

- Biblical timeline with visual eras:
  - Patriarchs (2000 BC)
  - Exodus (1400 BC)
  - Kingdom Era (1000 BC)
  - Exile (586 BC)
  - New Testament (0-100 AD)

DBS (Discovery Bible Study) Module

- Study method prompts:
  - "What did you notice?"
  - "What does this reveal about God?"
  - "How will you respond?"

Unifying Thread Visualizer

- Shows how OT shadows connect to NT fulfillment
- Interactive parallels (e.g., Passover Lamb → Jesus)

Video Content Feed

- Curated theological videos
- "LIVE" badge for trending content

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3. Bible Reader (Read Tab)

File: bible_content_widget.dart

Core Components

Bible Content Widget

- Book & Chapter selector with haptic feedback
- Verse-by-verse rendering with tap-to-select
- **Chronological slider** at bottom to show historical era

AI Mentor Panel **File**: ai_mentor_panel.dart

Three Tabs: Meaning, Apply, Related

```
sequenceDiagram
    participant User
    participant QwenAI
    participant ClaudeAI
    participant ThreadInjection

    User->>QwenAI: Tap verse
    QwenAI-->>User: Instant preview (200ms)
    QwenAI->>ThreadInjection: Check user's journal
    ThreadInjection-->>ClaudeAI: Send context
    ClaudeAI-->>User: Full insight (3 tabs)
```

Tab 1: Meaning

- **Natural Translation**: Original language nuances (Greek/Hebrew)
- **Original Context**: Historical/cultural background

Tab 2: Apply

- **So What?**: Modern life application
- **Scenario**: Practical example (work, relationships, mental health)

Tab 3: Related

- **Threads**: User's past journal entries related to this theme
- Personalized insight: "You felt [Emotion] on [Date]; this verse offers [Comfort/Challenge]"

Quick Reflection Input

- Inline journal entry creation
- Auto-attached to current verse

Bridge Toggle

- Switch between "Scholar Mode" (depth) and "Applied Mode" (practical)

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4. Journal Screen

File: journal_screen.dart

Features

Entry List

- Chronological feed of all journal entries
- Each card shows:
  - Emotion tag (with color-coded pulse)
  - Date & time
  - Content preview
  - Attached verse reference (if any)
  - Look Forward notes (expandable)

Look Forward Notes

- AI-generated follow-up question for next reflection
- JSON structure stored in database:

```
{
  "question": "How did this insight change your day?",
  "verses": ["John 3:16", "Romans 8:28"]
}
```

Spiritual Pulse Dashboard **Widget**: spiritual_pulse_dashboard.dart

- 7-day emotion timeline
- Average pulse visualization

Journal Entry Editor **Widget**: journal_entry_editor.dart

- **Privacy Toggle**: `ai_access_enabled` boolean
  - If `false`: Entry encrypted locally, no AI access
  - If `true`: Entry sent to vector memory (PII-scrubbed)

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5. Mentor Hub Screen

File: mentor_hub_screen.dart

Discovery Bible Study (DBS) Methodology The app implements **DBS** with three phases:

Look Back

- Review past journal reflections
- Identify recurring themes
- Show what verse/topic you explored before

Look Up

- Current Scripture study
- AI-generated thematic insights
- Verse suggestions based on user's chosen theme

Look Forward

- AI-generated reflection question
- Quick prayer generation
- Journal editor with pre-filled context

Mentorship Session Screen **File**: mentorship_session_screen.dart

Features: - **Theme Selection**: Choose a spiritual theme (faith, fear, love, etc.) - **Verse Discovery**: AI suggests 3-5 related verses - **Deep Dive**: Tap verse to see full context in modal - **Prayer Generator**: Creates personalized prayer based on theme

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6. Me Screen (Profile)

File: me_screen.dart

Visual Components

Soul Sphere Widget **File**: soul_sphere_widget.dart

- 3D rotating sphere representing spiritual state
- Color shifts based on current pulse:
  - **High (4-5)**: Glowing cyan/blue
  - **Mid (2.5-4)**: Purple/pink
  - **Low (1-2.5)**: Warm orange/amber

Memory Nodes Overlay **File**: memory_nodes_overlay.dart

- Floating bubbles representing journal entries
- Tap to revisit a memory

Growth Track Cards **File**: growth_track_card.dart

- Shows spiritual themes user is exploring
- Status: **Blooming** (3+ mentions), **Rooting** (2), **Pruning** (1)

Legacy Altar

- Count of answered prayers
- Displays as a monument-style card

Profile Header

- User name: "Friend"
- Streak counter with flame icon

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7. Search Screen

File: search_screen.dart

Smart Search Features

Fuzzy Verse Search

- Handles typos using wildcard OR conditions
- Database: `AppDatabase.searchVersesFuzzy()`

AI-Powered Keyword Extraction

- User enters feeling/phrase: "I feel anxious about work"
- AI extracts keywords: `["anxiety", "work", "stress", "worry"]`

Smart Suggestions

- Popular topics: "Faith in hard times", "Forgiveness"
- Popular feelings: "Anxious", "Grateful", "Lonely"

Journal Entry Search

- FTS5 (Full-Text Search) on journal content
- Privacy-aware: only searches locally encrypted data

Privacy & Security Architecture

Database Encryption

File: app_database.dart

SQLCipher Encryption

```
database.execute('PRAGMA key = "$key"')
```

- AES-256 encryption
- Key stored in `FlutterSecureStorage`
- Generated once per installation

Database Tables

Table	Purpose	Encryption
`journal_entries`	User reflections	Encrypted
`journal_entries_search`	FTS5 index	Encrypted
`ai_interactions`	AI conversation history	Encrypted
`sync_queue`	Pending sync tasks	Encrypted
`verses`	Bundled Bible text	Public data
`api_cache`	API response cache	Encrypted

Privacy Toggle Workflow

```
sequenceDiagram
    participant User
    participant UI
    participant DB
    participant Embedding
    participant Pinecone

    User->>UI: Create journal entry
    UI->>User: Show privacy toggle

    alt AI Access Disabled
        User->>UI: Toggle OFF
        UI->>DB: Save encrypted (local only)
        Note over DB: No cloud sync
    else AI Access Enabled
        User->>UI: Toggle ON
        UI->>User: Show consent modal
        User->>UI: Confirm
        UI->>Embedding: Generate vector (PII-scrubbed)
        Embedding->>Pinecone: Sync to vector DB
        Embedding->>DB: Save encrypted + metadata
    end
```

AI Integration Architecture

Dual AI Strategy: Qwen + Claude

On-Device AI: Qwen 2.5 0.5B Instruct **File**: qwen_service.dart

Use Cases: - **Instant Preview**: 200ms response for verse insights - **Intent Classification**: Detect user's mood/intent - **Simple Definitions**: Quick Greek/Hebrew word meanings - **Follow-Up Questions**: Home screen AI prompts

Model: `qwen2.5-0.5b-instruct-q4_k_m.gguf` - Quantization: Q4_K_M (500MB) - Platform: Flutter Gemma plugin - Offline: Works without internet

Cloud AI: Claude (Anthropic) **File**: ai_mentor_service.dart

Use Cases: - **Full Verse Insights**: 3-tab theological analysis - **Thread Injection**: Personalized insights using journal context - **Prayer Generation**: Contextual prayer creation - **Scholar Correction**: Validate user's understanding

Model: `claude-3-5-sonnet-20241022`

AI Mentor Service Methods

Method	Purpose	AI Engine	Latency
`getInstantPreview()`	Quick verse summary	Qwen	~200ms
`getVerseInsight()`	Full 3-tab insight	Claude	~3-5s
`getMentorFollowUp()`	Empathetic question	Qwen → Claude	~500ms
`extractSearchKeywords()`	Feeling→Keywords	Qwen	~300ms
`getSimpleDefinition()`	Word definition	Qwen → Claude	~400ms
`getDiscoveryContext()`	Archaeological bridge	Claude	~4s
`getScholarCorrection()`	Retelling validation	Claude	~5s

Thread Injection Service

File: thread_injection_service.dart

Purpose: Find relevant past journal entries to personalize AI insights

Workflow: 1. User taps a verse (e.g., John 3:16) 2. AI extracts verse themes: `["love", "salvation", "eternal life"]` 3. Service searches journal FTS5 index for those keywords 4. Returns top 3 matching entries 5. Injected into Claude prompt for "Related" tab

Example Output: > "You felt **anxious** on Jan 5th; this verse offers **assurance** because God's love is unconditional."

Key Workflows

Workflow 1: User Authentication

```
flowchart TD
    A[App Launch] --> B{Authenticated?}
    B -->|No| C[LoginScreen]
    B -->|Yes| D{Email Confirmed?}
    D -->|No| E[EmailVerificationScreen]
    D -->|Yes| F[BibleReaderScreen]

    C -->|Sign Up/Login| G[Supabase Auth]
    G -->|Send Email| E
    E -->|Deep Link| H[Check Confirmation]
    H -->|Confirmed| F

    style C fill:#e74c3c
    style E fill:#f39c12
    style F fill:#27ae60
```

Files: - login_screen.dart - email_verification_screen.dart

Deep Link Handling: - URL: `io.supabase.scripturelens://login-callback` - Handled in main.dart via `app_links` package

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Workflow 2: Verse Exploration

```
sequenceDiagram
    participant User
    participant BibleWidget
    participant QwenService
    participant AIMentorService
    participant ThreadInjection
    participant Database

    User->>BibleWidget: Tap verse
    BibleWidget->>QwenService: Request instant preview
    QwenService-->>BibleWidget: "God's love shown through sacrifice" (200ms)

    par Parallel AI Processing
        BibleWidget->>ThreadInjection: Find related journals
        ThreadInjection->>Database: FTS search
        Database-->>ThreadInjection: [Entry1, Entry2]
        ThreadInjection-->>AIMentorService: Inject context

        and Full Insight Generation
        AIMentorService->>AIMentorService: Build prompt
        AIMentorService->>Claude API: Request full insight
        Claude API-->>AIMentorService: XML response
    end

    AIMentorService-->>BibleWidget: VerseInsight (3 tabs)
    BibleWidget->>User: Display tabs
```

Key Components: - Optimistic UI: Shows Qwen preview immediately - Progressive enhancement: Claude fills in full detail - Thread injection enriches "Related" tab

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Workflow 3: Journal Entry Creation

```
flowchart TD
    A[User Opens Journal] --> B[Tap + Button]
    B --> C[Journal Entry Editor]
    C --> D{Privacy Toggle}

    D -->|AI Access OFF| E[Save Encrypted Locally]
    E --> F[Store in SQLCipher DB]

    D -->|AI Access ON| G[Show Consent Modal]
    G --> H{User Confirms?}
    H -->|No| E
    H -->|Yes| I[PII Scrubbing]
    I --> J[Generate Embedding]
    J --> K[Sync to Pinecone]
    K --> L[Save to DB with metadata]

    F --> M[Update Journal List]
    L --> M

    style E fill:#27ae60
    style L fill:#3498db
```

Privacy Guarantees: - **PII Scrubbing**: Regex removes names, emails, phone numbers - **Encryption**: AES-256

for all local storage - **Opt-In**: AI features require explicit consent

Database Model (`journal_entries` table): | Column | Type | Purpose | |——–|——|———| | `id` | INTEGER | Primary key | | `content` | TEXT | Encrypted entry | | `emotion_tag` | TEXT | Pulse value (1-5) | | `verse_reference` | TEXT | Linked verse | | `ai_access_enabled` | BOOLEAN | Privacy flag | | `look_forward_notes` | TEXT | JSON with AI question | | `created_at` | DATETIME | Timestamp |

Workflow 4: AI Insight Generation (Streaming)

File: ai_mentor_service.dart

```
Stream<VerseInsight> getVerseInsightStream({
  required String verseText,
  required String verseReference,
  List<String> userThreads = const [],
}) async* {
  // Step 1: Yield instant preview from Qwen
  yield VerseInsight(
    naturalMeaning: await getInstantPreview(...),
    // ... empty fields
  );

  // Step 2: Get threads in parallel
  final threads = await threadInjection.getRelevantThreads(...);

  // Step 3: Stream Claude response
  await for (final chunk in claude.createMessage(...)) {
    yield parseMentorResponseSync(chunk);
  }
}
```

UI Effect: 1. **0ms**: Tab shows “Loading...” 2. **200ms**: Qwen preview appears (typing effect) 3. **3-5s**: Claude replaces with full insight

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Workflow 5: DBS Session (Look Back → Look Up → Look Forward)

File: mentorship_session_screen.dart

Tab 1: Look Back

1. Query last 7 journal entries
2. Display as reflection cards
3. Show emotion tag + verse reference

Tab 2: Look Up

1. User selects theme (e.g., “Faith”)
2. AI generates theme insight using `getThemeInsight()`
3. AI suggests 3-5 verses via `getThemeVerses()`
4. User taps verse → Modal with full text

Tab 3: Look Forward

1. Generate “Look Forward” question via `prayer_service.dart`
2. Action cards:
   - **Quick Prayer**: AI-generates prayer for theme
   - **Journal Reflection**: Opens editor with pre-filled question

- **Bible Reader**: Navigates to suggested passage

Technical Implementation Details

State Management: Riverpod

Pattern: Provider-per-feature with code generation

Example (from journal_providers.dart):

```
@riverpod
Future<List<JournalEntry>> journalEntries(JournalEntriesRef ref) async {
  final db = ref.read(appDatabaseProvider);
  return await db.select(db.journalEntries).get();
}
```

Key Providers: - `navIndexProvider`: Bottom nav index - `journalEntriesProvider`: All journal entries - `verseInsightProvider`: Cached AI insights - `qwenPreviewProvider`: Streaming Qwen preview - `spiritualThemesProvider`: User's recurring themes

Preloading Services

File: bible_preloader_service.dart

Purpose: Load bundled Bible (WEB version) into SQLite on first launch

Workflow: 1. Check if verses table is empty 2. Read `assets/web_bible.json` 3. Batch insert 31,102 verses on background isolate 4. Takes ~2-3 seconds on first run

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File: model_preloader_service.dart

Purpose: Warm up Qwen model to reduce first-inference latency

Workflow: 1. Initialize Qwen on app start 2. Run dummy inference: `"Hello"` 3. Model stays in memory for 5 minutes of inactivity 4. Battery guard prevents usage below 20%

Battery & Performance Guards

File: battery_guard_service.dart

Rules: - Disable Qwen if battery $< 20\%$ - Allow Qwen if charging - Auto-unload Qwen after 5min inactivity

File: stuck_detector_service.dart

Purpose: Detect if user is "stuck" on a passage

Logic: - Track book/chapter visits - If same passage accessed 3+ times over 2+ days - Trigger context breakthrough card on Home screen

Offline Capabilities

Works Offline: - Bible reader (bundled WEB version) - Journal entry creation & reading - Qwen AI (on-device)

Requires Internet: - Claude API (full verse insights) - Supabase sync - Pinecone vector search - Archaeological discovery images

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UI Design Patterns

Glassmorphism

Standard Properties (from `.agent/rules/core_rules.md`):

```
BackdropFilter(
  filter: ImageFilter.blur(sigmaX: 15, sigmaY: 15),
  child: Container(
    decoration: BoxDecoration(
      color: Colors.white.withOpacity(0.1),
      borderRadius: BorderRadius.circular(20),
      border: Border.all(
        color: Colors.white.withOpacity(0.15),
        width: 1.5,
      ),
    ),
  ),
)
```

Typography

- **Bible Text**: `google_fonts` → **Lora** (classic serif)
- **UI/Labels**: `google_fonts` → **Inter** (modern sans-serif)

Icons

- Package: `lucide_icons`
- Style: Consistent minimalist line icons

Haptic Feedback

Every tap includes:

```
HapticFeedback.lightImpact(); // Button taps
HapticFeedback.selectionClick(); // Tab switches
```

Testing & Quality

Database Schema Version: `5`

Migrations: - v2: Added `ai_interactions` table - v3: Added `sync_queue` table - v4: Added `verses` + `api_cache` tables - v5: Added `look_forward_notes` column to `journal_entries`

Error Handling Patterns

Graceful Degradation

```
// Qwen initialization fails → Fall back to Claude
try {
  await FlutterGemma.initialize();
} catch (e) {
  print(' Qwen unavailable, using cloud AI only');
}
```

Offline Fallback

```
// No internet → Show cached insight or friendly message
if (!await _canConnect()) {
```

```
  return _getFallbackInsight(verseReference);
}
```

Key Dependencies

Package	Purpose
`flutter_riverpod`	State management
`drift`	Local database (SQLite)
`flutter_secure_storage`	Encryption key storage
`anthropic_sdk_dart`	Claude API
`flutter_gemma`	On-device Qwen AI
`google_fonts`	Typography
`lucide_icons`	Icon set
`supabase_flutter`	Backend + Auth
`app_links`	Deep linking

App Initialization Flow

File: main.dart

```
sequenceDiagram
    participant App
    participant Qwen
    participant Supabase
    participant BiblePreloader

    App->>Qwen: Initialize FlutterGemma
    Qwen-->>App: Success (or graceful fail)

    App->>Supabase: Initialize client
    Supabase-->>App: Ready

    App->>BiblePreloader: Preload bundled Bibles (async)
    Note over BiblePreloader: Runs on background isolate

    App->>App: runApp(MyApp)
```

Steps: 1. Initialize Qwen (non-blocking, ~1s) 2. Initialize Supabase 3. Start Bible preloader in background 4. Render app (immediate)

Data Models

VerseInsight

File: verse_insight.dart

```dart
class VerseInsight {
  final String naturalMeaning; // Tab 1: Simplified translation
  final String originalContext; // Tab 1: Historical context
  final String soWhat; // Tab 2: Modern application
  final String scenario; // Tab 2: Practical example
  final List<String> threads; // Tab 3: Related journal entries
}
```

ChapterPreview

```dart
class ChapterPreview {
  final String book;
  final int chapter;
  final String coreTheme; // AI-extracted theme
  final String provocativeQuestion; // DBS-style prompt
  final List<String> keyVerses; // 3-5 suggested verses
}
```

Sync Architecture (Future Enhancement)

File: sync_queue.dart

Purpose: Queue journal entries for vector sync to Pinecone

Not Yet Implemented: - Background sync worker - Conflict resolution - Retry logic

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Theological AI Persona

File: `.agent/rules/ai_persona.md`

The AI mentor follows these rules: 1. **No Hallucinations**: If Greek/Hebrew root unknown, state clearly 2. **Persona**: Never say "As an AI..." — maintain mentor character 3. **Safety**: Escalate self-harm mentions to human pastoral care 4. **Chain-of-Thought**: - Identify 1-2 keywords in original language - Connect to Grand Narrative - Retrieve user's emotional context from threads

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Performance Metrics

Target: 120fps (Impeller Rendering)

Optimizations: - Use `SizedBox` over `Container` for spacing - GPU shaders for glassmorphism - `IndexedStack` to preserve tab state - Async isolates for Bible loading

AI Response Times

Scenario	Target	Actual
Qwen instant preview	<250ms	~200ms
Claude full insight	<5s	~3-5s
Search keyword extraction	<500ms	~300ms

Security Summary

Implemented: - AES-256 SQLCipher encryption - Secure key storage (`FlutterSecureStorage`) - PII scrubbing before embedding - Privacy toggle on all journal entries - Local-first architecture

Considerations: - Supabase API key stored in `config.json` (should use env vars) - Anthropic API key in same file - No biometric lock (future enhancement)

Future Roadmap (Inferred)

Based on code structure: - **Quiz Feature**: Empty `lib/features/quiz/` directory - **Vector Memory Sync**: `sync_queue` table exists but unused - **Pinecone Integration**: Mentioned in privacy rules but not implemented - **Apple Sign-In**: Referenced in past conversations - **TestFlight Distribution**: iOS build pipeline exists

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Summary

ScriptureLens AI is a sophisticated biblical study app with: - **6 main screens** orchestrated via bottom navigation - **Dual AI strategy**: On-device Qwen for speed + Cloud Claude for depth - **Privacy-first**: SQLCipher encryption + user consent model - **Theological rigor**: DBS methodology + original language insights - **Personalization**: Thread injection connects past reflections to current study - **Modern UX**: Glassmorphic UI, haptics, 3D Soul Sphere, clean architecture

The app successfully balances **spiritual depth** with **technical excellence**, providing a premium Bible study experience while respecting user privacy.