

Calculator App Implementation Report

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1 Implementation Rationale

The calculator app was designed with a focus on user experience and modern Flutter development practices. The implementation goes beyond basic requirements by incorporating Material Design 3 principles, responsive design, and intuitive user interactions.

1.1 Key Design Decisions

- **State Management:** Used `StatefulWidget` for simplicity and direct state control
- **UI Architecture:** Implemented modular button building with `_buildButton()` for consistency
- **Error Handling:** Comprehensive try-catch blocks with user-friendly error messages
- **Theme System:** Dynamic theme switching with proper color contrast and accessibility

2 Challenges and Solutions

2.1 Test Widget Identification

Challenge: Multiple text widgets with same content caused test failures when using generic `find.text()`.

Solution: Implemented specific widget predicates targeting display text by font size (36.0) to distinguish between button text and display text.

2.2 Code Quality Optimization

Challenge: Linting warnings for deprecated methods and non-final fields.

Solution: Updated `withOpacity()` to `withValues()` and made `_history` field final to meet Flutter best practices.

3 Unique Features Implemented

- Dark/Light theme toggle with haptic feedback
- Calculation history with dialog interface
- Backspace functionality for digit correction
- Real-time operation display showing current calculation
- Responsive design adapting to different screen sizes
- Comprehensive error handling for edge cases